EUROMOD WORKING PAPER SERIES

EM 12/20

Did the UK policy response to Covid-19 protect household incomes?

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June 2020

Did the UK policy response to Covid-19 protect household incomes?*

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Abstract

We analyse the UK policy response to Covid-19 and its impact on household incomes, as of late April 2020, using microsimulation methods. We estimate that households will lose a substantial share of their net income (8% on average). The proportional losses are largest for higher-income families. However, the overall impact of the crisis on income inequality is small. Earnings subsidies (Coronavirus Job Retention Scheme) will protect household finances and provide the main insurance mechanism during the crisis. Besides subsidies, Covid-related benefit increases and tax-benefit automatic stabilisers will play an important role in mitigating the shocks, underlining the importance of tax-benefit design in protecting household incomes during economic downturns. Analysing how a near-decade of austerity has affected the UK safety net, we find that, even after the extra benefit spending, the ability of the 2020 system to provide insurance against the shocks would be similar to the 2011 pre-austerity system.

JEL: D31, E24, H24

Keywords: Covid-19; income distribution; earnings subsidies and tax-benefit policies

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* We are grateful to Holly Sutherland for insightful comments and suggestions. The results presented here are based on UKMOD version A1.5. UKMOD is maintained, developed and managed by the Institute for Social and Economic Research (ISER) at the University of Essex and we are indebted to Holly Sutherland, Paola De Agostini and the many others who have contributed to its development. The process of extending and updating UKMOD is financially supported by the Nuffield Foundation, based on the annual update of the UK component of EUROMOD funded by the European Union Programme for Employment and Social Innovation "EaSI" (2014-2020). We make use of micro-data from the Family Resources Survey made available by the Department of Work and Pensions and Understanding Society COVID-19 Study by ISER, University of Essex via the UK Data Service. The results and their interpretation are our own responsibility. This version of the paper is as of 16 June 2020.

1 Introduction

This paper studies the fiscal and distributional impact of Covid-19 in late April 2020 in the UK. We assess how much income protection is provided by the new earnings subsidies (the Coronavirus Job Retention Scheme) and Covid-related increases to benefits, as well as looking at how effective are the tax-benefit automatic stabilisers in protecting household finances during recessions. We also analyse how austerity over the last decade has affected the UK safety net.

In more detail, our baseline is the income distribution before Covid-19. Then, using individual-level data from the Understanding Society COVID-19 Study on employment and earnings changes by sex, age and industry, we simulate similarly-sized employment and earnings shocks on the sample of workers from the Family Resources Survey 2017/18. Workers affected by the shocks become unemployed or furloughed, or stay employed (not furloughed) but their hours and earnings fall. Furloughed workers receive earnings subsidies from the Job Retention Scheme. Using the tax-benefit model UKMOD, we then calculate household income tax liabilities and benefit entitlements before and after the employment and earnings shocks. The changes in income taxes and state benefits due to the shocks capture the automatic stabilisation response of the tax-benefit system before the Covid-related benefit increases (Auerbach and Feenberg 2000). Finally, we estimate the effect of Covid-related increases to state benefits on household incomes, keeping fixed the earnings distribution. The analysis provides an estimate of the distributional impact of Covid-19 in April 2020 (before subsidies from the self-employment grant were paid out).

We find that households will lose a substantial proportion of their income, of 8% on average, due to Covid-related employment and earnings shocks. The earnings subsidies for furloughed workers will protect household finances from the shocks, accounting for 13% of baseline net income. They will support households across the entire income distribution and will provide the main insurance mechanism against the negative income shocks. Net of the subsidies, the loss in earnings from both employment and self-employment will amount to a substantial 14% of net income.

Besides the earnings subsidies, the Covid-related benefit increases and tax-benefit automatic stabilisers will also have an important role in mitigating income losses. Comparing the impact of the benefit increases and automatic stabilisers on net incomes, it is the latter that will have the bigger effect on net incomes, underlining the importance of tax-benefit designs in protecting household incomes during economic downturn. On the other hand, different parts of the distribution rely on different types of policy for mitigating income shocks, stressing the importance of both automatic stabilisers and governments' responses to crises in determining the amount

of income protection.

Income from social security benefits – both the system that was in place before the crisis, and the Covid-related increases – contribute to income gains mostly at the bottom of the distribution. Households will benefit mainly from means-tested benefits such as Universal Credit (UC), but the unemployment benefit (Jobseeker's Allowance) will also contribute to small income gains across all parts of the distribution, highlighting the importance of provision and access to social insurance benefits.

Assessing the impact of a near-decade of austerity on the UK safety net, we show that, compared to the 2011 policies, the 2020 *pre-Covid* tax-benefit policies would have been less effective in providing insurance against the shocks for most parts of the distribution. In particular the 2011 system would have raised net income by additional 3.5% compared to the 2020 *pre-Covid* system. The extra Covid benefit spending will strengthen the UK safety net, so the 2020 *post-Covid* and 2011 systems would provide similar levels of income protection. But although the Covid-related benefit increases strengthen the safety net, these measures are due to last only during the current financial year.

This paper relates to several strands of literature. It relates to the now fast-growing literature on the economic and distributional impact of Covid-19. Using the Understanding Society COVID-19 data, Benzeval et al. (2020) analyse the economic impact of the pandemic in the UK on employment and earnings, and the ways different household types mitigate the negative shocks. Adams-Prassl et al. (2020) assess differences in the labour market impact of Covid-19 in the UK, Germany and US. Brewer and Gardiner (forthcoming) analyse the design and beneficiaries of the UK policy response to the pandemic, focusing in particular on low-income households. By simulating employment shocks and using a tax-benefit model, Figari and Fiorio (2020), Beirne et al. (2020) and Bronka et al. (2020) assess the distributional impact of Covid-19 in Italy, Ireland and the UK, respectively. There has been also growing evidence on the impact of the crisis on the US labour market (Coibion et al. 2020b; Cajner et al. 2020) and private spending (Baker et al. 2020; Coibion et al. 2020a).

The current paper builds on and contributes to the existing literature in several ways. First, as survey micro-data on household incomes during the pandemic will only become available with a few years' lag, the present paper addresses this data limitation by combining different data sources and a tax-benefit model to predict household circumstances during Covid-19. Second, the paper brings new insights into the importance of different types of policy in mitigating income losses along the income distribution. It also examines empirically how policy reforms over the last decade have reduced the ability of the UK safety net to cushion negative eco-

nomic shocks. As such, it also contributes to the evidence on the mitigating role of tax-benefit policies during recessions. Income taxes and unemployment insurance benefits have been found to be particularly important in providing income protection and income and consumption smoothing during recessions (Larrimore et al. 2015; Fernández Salgado et al. 2014; Dolls et al. 2012; Kniesner and Ziliak 2002a,b; Auerbach and Feenberg 2000). Furthermore, means-tested benefits have been shown to be effective in providing a much-needed safety net for households during economic downturns (Bitler et al. 2017; Bitler and Hoynes 2016). Recent analysis has also highlighted the importance of tax and benefit automatic stabilisers for income redistribution (Paulus and Tasseva 2020).

The rest of the paper is structured as follows: Section 2 describes the UK policy response to Covid-19 and the tax-benefit policies that will play a role in protecting household incomes from the negative income shocks. Section 3 discusses the decomposition approach to identify the effect of earnings subsidies, tax-benefit automatic stabilisers and Covid-related benefit increases; the data and the simulation of employment and earnings shocks; and the tax-benefit model UKMOD. Section 4 discusses the results and section 5 concludes.

2 The UK policy response to Covid-19 and tax-benefit policies

During the Covid-crisis, access to unemployment and income-related benefits as well as income taxes and national insurance contributions will provide insurance against the economic shocks. In addition, the UK government introduced a package of policy measures in response to Covid-19. These include income protection schemes for workers and increases to state benefits. This section describes the Covid-related policy measures, as well as discussing which tax-benefit policies will play a role in stabilising household incomes during the crisis.

To support businesses and workers, the Coronavirus Job Retention Scheme (JRS) was introduced to subsidise the earnings of furloughed employees. This allows companies to reduce the hours of workers to zero without laying them off, removing the costs of searching and re-hiring workers later on. The JRS pays 80% of gross earnings up to a maximum of £2,500 per month. Initially the scheme was set for 4 months but on May 12, 2020 it was extended until the end of October. The Office for Budget Responsibility estimates the cost of the scheme to £60 billion for the 8-months duration of the scheme (OBR, 2020). Similarly, a Self-employment Income Support Scheme (SEISS) was introduced to provide subsidies for self-employed. The scheme was opened for claims on May 12 and will pay subsidies of up to £7,500.

Information about who has received the SEISS payments is not yet available, and so this version of this paper, which analyses the distributional impact of Covid-19 in April 2020, does not look at the scheme. OBR estimates the scheme to cost £15 billion (OBR, 2020).

In addition to the earnings subsidies, families affected by the economic shocks can access a range of state benefits to compensate for the losses in earned income. The main ones are the unemployment benefit, Jobseeker's Allowance (JSA), and the means-tested benefit Universal Credit (UC). The contribution-based Jobseeker's Allowance (JSA) is a flat-rate unemployment benefit paid up to 6 months while looking for a job. The benefit is available to those who have paid employees' national insurance contributions. It has two rates: for those aged under 25 (£58.9 per week) and a more generous rate for those aged 25+ (£74.35 per week). UC is an income-tested benefit for working-age people on low-incomes or who are unemployed. It was introduced in 2014 with the aim to gradually replace a range of income-related benefits and tax credits, by combining them into a single state transfer. The benefit consists of a basic 'standard allowance' and extra payments which depend on the person's and their family's circumstances, including additional amounts in respect of children, and to those who are renting. UC is withdrawn in line with the joint earnings of the family, and overall entitlement is subject to a maximum ceiling known as a benefit cap.[1] Prior to Covid-19, the UC rate for singles aged 25+ was the same as JSA, £323 per month, while the rate for couples was about 1.6 times higher, £507 per month.

In response to the crisis, the UK Government increased the level of UC for all family types by £20 a week. In relative terms, this is a substantial increase of 28% for singles aged 25+ and 17% for couples. Access to UC for the self-employed was also improved by suspending the Minimum Income Floor: this reduced UC entitlement for those earning less than the equivalent of a certain number of hours at the minimum wage rate. Other Covid-related changes included increases to Housing Benefit (HB) and the UC component which support low-income families with paying their rent. The maximum benefit amount is determined by the so-called Local Housing Allowance (LHA) rates, which have been generally lagging behind price growth since 2012. In response to Covid-19, the LHA rates were increased and re-aligned to the 30th percentile of the distribution of private market rents. Finally, the amount of earnings disregarded in calculating the entitlements to HB and Council Tax Reduction (a benefit that supports families with paying property tax) was also increased (from £17.1 to £37.1 per week). As with UC, the standard allowance

[1]If due to the change in their circumstances families become subject to the benefit cap, they can be exempt from it by the 39 weeks "grace period". However, the cap will bite if already prior to the shock families were not exempt from it.

rates for Working Tax Credit – an in-work benefit and one of the benefits that UC is replacing – also went up by £20 a week. At the time of writing, these changes were due to expire in April 2021. OBR estimates the costs for the benefit increases to £8 billion (OBR, 2020).

One contribution of this paper is to identify how the tax and benefit system automatically responds to cushion the impact of labour market shocks. As well as the means-tested benefit system, income tax and national insurance contributions (NIC) also have an important role to play in mitigating income losses. The income tax schedule in the UK is progressive, as are NIC for most parts of the distribution. Thus, as earnings drop due to the economic shocks, income tax payments and NIC also decrease, so that after-tax income drops by less than pre-tax income.

3 Data and Methodology

3.1 Estimating the distributional impact of the crisis

Our aim is to estimate the impact of the crisis on the income distribution using the methodology from Paulus and Tasseva (2020) and Bargain and Callan (2010) who combine household micro-data with tax-benefit microsimulation techniques. We also decompose the changes in the income distribution to identify separately the distributional impact of: earnings losses; earnings subsidies; tax-benefit policies before the Covid-related benefit increases (which we refer to as the automatic stabilisation response of policies); and the Covid benefit increases.

Impact of the crisis

Let us denote with y gross (pre-tax) market income; with $t(y)$ income tax and NIC, which are a function of y; and with $b(t, y)$ state benefits which are a function of t and y. Household net income B (for *baseline*) is then:

$$B = y - t(y) + b(t, y) \tag{1}$$

An economic shock occurs which raises unemployment and lowers gross earnings. The UK Government responded by introducing earnings subsidies and increases to state benefits, so that gross market income after the shock (y_k) plus subsidies (k) is y'; income tax liabilities and NIC after earnings changes are $t(y')$; and state benefits after earnings and benefit changes are $b''(t, y')$. Household net income after the shock can be shown to be:

$$D = y' - t(y') + b''(t, y') \tag{2}$$

and the difference between D and B gives the impact of the crisis on household incomes.

Decomposing changes in the income distribution

We can introduce an intermediate counterfactual scenario C after the shock and earnings subsidies, but before the crisis-related benefit increases. This allows us to decompose the change in income Δ:

$$\begin{gathered}\Delta = D - B = \\ \underbrace{D - C}_{\text{benefit policy changes}} + \underbrace{C - B}_{\text{earnings changes+automatic stabilisers}} = \\ \underbrace{y' - t(y') + b''(t, y') - (y' - t(y') + b(t, y'))}_{\text{benefit policy changes}} \\ + \underbrace{y' - t(y') + b(t, y') - (y - t(y) + b(t, y))}_{\text{earnings changes+automatic stabilisers}}\end{gathered} \tag{3}$$

where the difference between D and C gives the effect of benefit increases (P), keeping fixed the distribution of gross market incomes, tax liabilities and NIC. The difference between C and B gives the total effect of earnings changes plus automatic changes to income tax, NIC and benefits, keeping fixed the tax-benefit rules at their pre-crisis levels (i.e. effect of automatic stabilisers).

Let us now denote as I a functional of income. If I is additively decomposable by income source, e.g. mean net income, we can break down the difference between C and B further into earnings losses (E), earnings subsidies (K), income tax and NIC as automatic stabilisers (S^t) and benefits as automatic stabilisers (S^b):

$$\begin{aligned} E &= I[y_k] - I[y] \\ K &= I[y'] - I[y_k] \\ S^t &= I[t(y)] - I[t(y')] \\ S^b &= I[b(t, y')] - I[b(t, y)] \end{aligned} \tag{4}$$

If I is not additively decomposable by income source, e.g. an inequality indicator such as the Gini coefficient, we approximate the contribution of automatic stabilisers

by taking the difference in I based on different income concepts:

$$\begin{gathered} E + K = I[y'] - I[y] \\ S^t = I[y' - t'(y)] - I[y - t(y)] - (E + K) \\ S^b = I[y' - t'(y) + b(t, y')] - I[y - t(y) + b(t, y)] - (I[y' - t'(y)] - I[y - t(y)]) = \\ I[C] - I[B] - S^t - (E + K) \end{gathered} \tag{5}$$

where $I[y' - t'(y)]/I[y - t(y)]$ is estimated based on gross market income net of taxes and NIC.[2]

3.2 The data and simulation of shocks

We use the Family Resources Survey (FRS) micro-data for 2017/18 (DWP, 2019), combined with information on employment and earnings shocks from the Understanding Society (UK Household Longitudinal Study-UKHLS) COVID-19 Study (University of Essex, 2020a). The FRS 2017/18 are the latest FRS data available at the time of writing. The FRS can be considered as the benchmark for household incomes data in the UK. They are used for official income statistics by the Department for Work and Pensions, and by the Institute for Fiscal Studies in their annual reports on income trends. We then use information on the labour market situation and earnings of individuals in April 2020 from the UKHLS COVID-19 Study to simulate similarly-sized employment and earnings shocks in the FRS.

In more detail: we uprate financial values in the FRS income data to (pre-Covid-19) 2020 prices to account for growth in average earnings and statutory indexation for disability benefits, public pensions, statutory maternity pay, maternity allowance and the statutory sickness pay (we do not directly simulate changes in the labour market and population structure since 2017-18). These are the data used in the *baseline*, i.e. before the employment and earnings shocks, and so they are our simulation of what the UK population would have looked like in April 2020 had there been no coronavirus crisis.

Next, we use the UKHLS COVID-19 Study as our source of data on what sort of employment and earnings shocks have been caused by the crisis. Our aim is to simulate similar-in-size shocks on the FRS sample of workers such that the FRS data with simulated shocks form the underlying data for scenarios C and D.

The UKHLS is a long-running annual household panel study, and the UKHLS

[2]We can rewrite the effect of earnings changes and automatic stabilisaters as: $I[y' - t(y') + b(t, y')] - I[y - t(y) + b(t, y)] = I[y'] - I[t(y')] + I[b(t, y')] - (I[y] - I[t(y)] + I[b(t, y)]) + \eta$, where η is a residual term. For additively decomposable measures, such as mean income, η is zero but it is non-zero for measures which are not additively decomposable by income source, such as Gini. Hence, when we decompose the change in inequality indicators, our estimate for the contribution of automatic stabilisers contains a residual.

COVID-19 data, which were collected through an on-line and phone survey in April 2020, were an addition to the usual annual waves that collected information on the labour market situation and earnings of individuals in April 2020 and how these had changed since February 2020 (i.e. before the crisis had affected the labour market in the UK). We estimate two multinomial logit models on the UKHLS data, one on a sample of employed adults and one on a sample of self-employed adults, both restricted to those who had positive earnings in February 2020 (before Covid-19). For the sample of formerly employed workers, the dependent variable is employment status in April 2020 and has four outcomes: i) still employed and with no drop in earnings, ii) still employed (not furloughed) but with reduced working hours and earnings, iii) furloughed, and iv) not employed.[3] The control variables include sex, age and industry (13 categories) and their interactions; household type; baseline earnings quintile; and number of baseline working hours in bands by sex. For the sample of formerly self-employed workers, the dependent variable is self-employment status in April 2020 with the following three outcomes: a) still self-employed and with no drop in earnings, b) still self-employed but with reduced hours and earnings, and c) no longer engaged in self-employment. The control variables include sex, age, industry, household type, baseline earnings quintile, and number of baseline working hours in bands by sex. Results from the multinomial logit are reported in Table A.1 (for the employed) and Table A.2 (for the self-employed).[4]

We then use the estimated coefficients from the multinomial logit to predict the probability of each outcome for each individual in the FRS sample of workers with positive earnings. We than randomly assign each individual to one of the outcomes, respecting these predicted probabilities. In total, a 928,000 workers in the FRS are simulated to be newly unemployed (having applied the grossing weights), 7.1 million workers to be furloughed and 3.5 million workers to experience a drop in working hours and earnings (but not furloughed). Thus, the majority of workers affected by the coronavirus shock will experience a drop in earnings rather than a complete loss in earned income.

Self-employed simulated to become unemployed (outcome c) do not receive earnings subsidies.[5] Employees who are predicted to be furloughed (outcome iii) receive the JRS subsidy. To calculate how much workers are entitled to under the scheme, we use information on (baseline) total gross earnings from employment (FRS variable *inearns*). Finally, employed and self-employed in the FRS with hours and

[3] *No drop in earnings* constitutes a drop of no more than £5 per week. *Reduced hours and earnings* implies a fall of more than £5 in earnings and at least 1 working hour per week.

[4] Industry was collected at Wave 9 (2017-18) of Understanding Society (University of Essex, 2020b).

[5] As discussed earlier, the self-employed can apply for subsidies from the SEISS, which were paid in late May or June. But they had no access to the scheme in April 2020, which is the reference period of this analysis.

earnings reduction (outcomes ii and b, respectively) experience a drop in earnings and hours which we simulate as the mean relative drop in earnings by sex in the UKHLS COVID-19 sample amongst those reporting a drop. For employed, the drop is 35% for men and 43% for women. For self-employed, the drop is 75% for both men and women.

Table 1 shows the characteristics of workers in the FRS by employment status after the simulated shocks. There is a clear age, education and income gradient among the workers affected by the shocks. A larger share of the newly unemployed are aged 20-29 or 60+ compared to the other age groups. The newly unemployed are also more likely to come from the lowest earnings quintile. Furloughed workers are more likely to be young, male, lower educated, and to be from the bottom and middle of the earnings distribution. In comparison, those with reduced working hours and earnings (but not furloughed) are more likely to be older, male, and in the bottom earnings quintile. Those with no drop in their earnings ('no change') are more likely to be older, female, higher educated, and from the upper part of the earnings distribution.

Table 1: Characteristics of workers by employment status

	Unemployed	Furloughed	Reduced hours & earnings	No change
Age group:				
20-29	5.0	33.4	9.6	52.0
30-39	2.9	25.4	12.5	59.2
40-49	2.9	23.4	13.2	60.6
50-59	2.8	21.6	14.1	61.5
60+	3.6	21.3	13.7	61.4
Men	3.3	28.0	14.5	54.2
Women	3.4	22.6	10.2	63.7
In a household with:				
children	3.6	26.1	12.6	57.7
1 earner	3.0	24.3	13.9	58.7
2+ earners	3.5	25.9	12.0	58.7
Completed education aged:				
16 or less	3.5	30.6	13.2	52.7
17-19	3.4	27.2	11.7	57.7
20+	3.2	19.3	12.5	65.0
Earnings quintile:				
1	5.5	34.2	19.3	41.1
2	2.1	33.4	13.7	50.8
3	3.6	28.4	10.3	57.8
4	3.4	22.1	9.1	65.4
5	2.4	11.0	11.0	75.5
Number of (in thousand):				
employed	722	7,062	1,174	15,034
self-employed	206	0	2,289	1,221
all	928	7,062	3,463	16,256

Notes: The table shows the share of workers (in %) by different characteristics simulated to be newly unemployed, furloughed, with reduced hours and earnings (not furloughed) and with no drop to earnings (no change). The sample includes individuals with positive earnings from employment and/or self-employment and aged 20-63. Employed with earnings from employment only. Self-employed with earnings from self-employment (and employment).
Source: Own calculations with FRS 2017/18 and Understanding Society COVID-19 data.

Table 2 and Table 3 show the distribution of workers in the FRS by industry and

occupation, respectively, by employment status after the simulated shocks. Workers in accommodation and food services, construction and real estate, and the arts, entertainment and recreation are most likely to become unemployed, furloughed or have their earnings and hours reduced, as are workers in elementary and skilled trades occupations.

Table 2: Share of workers (in %) by industry

	Unemployed	Furloughed	Reduced hours & earnings	No change
Agriculture, Mining, Manufacture, Utilities	4.1	33.0	7.2	55.7
Construction and Real Estate	3.7	35.0	28.8	32.5
Wholesale and Retail Trade	3.7	36.1	7.6	52.6
Transportation and Storage	1.9	31.1	16.4	50.6
Accommodation and Food	4.1	66.4	13.3	16.2
Information and Communication	4.0	8.0	12.2	75.8
Financial and Insurance Activities	3.1	10.6	5.8	80.5
Professional, Scientific and Technical Activities	1.1	17.7	14.6	66.6
Administrative and Support Service	3.6	26.6	18.6	51.2
Public Administration and Defence	1.5	7.6	4.3	86.6
Education	3.7	15.3	9.3	71.6
Human Health and Social Work	3.8	11.3	9.2	75.7
Arts, Entertainment, Recreation and Other	2.9	30.7	27.7	38.8

Notes: The table shows, for a given sector, the share of workers (in %) simulated to be newly unemployed, furloughed, with reduced hours and earnings (not furloughed) and with no drop to earnings (no change). The sample includes individuals with positive earnings from employment and/or self-employment and aged 20-63.

Source: Own calculations with the FRS 2017/18 and Understanding Society COVID-19 data.

Table 3: Share of workers (in %) by occupation

	Unemployed	Furloughed	Reduced hours & earnings	No change
missing	.0	6.8	23.2	69.9
Managers, Directors and Senior Officials	3.2	23.8	13.5	59.5
Professional Occupations	2.6	12.5	9.9	75.0
Associate Prof. and Technical Occupations	3.3	18.2	12.7	65.8
Admin and Secretarial Occupations	3.6	25.2	5.9	65.3
Skilled Trades Occupations	3.8	34.1	25.0	37.1
Caring, Leisure and Other Service Occupations	4.1	21.2	12.0	62.7
Sales and Customer Service	4.0	40.2	6.1	49.7
Process, Plant and Machine Operatives	2.6	32.5	16.3	48.7
Elementary Occupations	3.8	43.5	11.3	41.4

Notes: The table shows, for a given occupation, the share of workers (in %) simulated to be newly unemployed, furloughed, with reduced hours and earnings (not furloughed) and with no drop to earnings (no change). The sample includes individuals with positive earnings from employment and/or self-employment and aged 20-63.

Source: Own calculations with the FRS 2017/18 and Understanding Society COVID-19 data.

3.3 The tax-benefit model UKMOD

The measure of household net income in this paper is cash income and is the sum of gross market incomes, state pensions, national insurance and means-tested benefits minus income tax and NIC liabilities. To account for household composition and economies of scale, household net incomes are equivalised using the modified OECD equivalence scale (with a value of 1 for a couple without children).

To calculate income tax liabilities, NIC and entitlements to benefits, we use the tax-benefit model UKMOD, a spin-off model of the UK component in the EU-wide tax-benefit model EUROMOD (see Sutherland and Figari (2013) and Figari et al. (2015) for information on EUROMOD and De Agostini and Chatsiou (2019) for information on UKMOD). UKMOD simulates for each individual and household in the FRS their taxes and benefits based on their gross earnings, other sources of income, their individual and household characteristics, and the tax-benefit measures that were in place at a given time period. UKMOD calculations account for non-take-up of income-related benefits (see Appendix C).

In the baseline and scenario C, UKMOD calculates net incomes based on the tax-benefit rules that would have applied in April 2020 in a world where the Covid-19 did not happen, that is, using the policies that were confirmed in the government Budget on 11 March 2020. The amount of income tax and NIC paid and state benefits received by households differ between the baseline and scenario C because of the simulated shocks in C. By comparing the baseline and scenario C, we can estimate the fiscal and distributional impact of the earnings subsidies and assess the effectiveness of the pre-Covid tax-benefit system in cushioning economic shocks. We refer to this as the automatic stabilisation effect of policies (see Paulus and Tasseva 2020, Dolls et al. 2012).

In scenario D, UKMOD re-calculates net incomes accounting for the benefit increases that the UK government introduced in response to the crisis. Thus, although the earnings data are the same in scenarios C and D, the amount of state benefits received by households differ because scenario D includes the Covid-related increases in benefit levels (there are no changes in taxes paid by households between scenarios C and D).

4 Results

This section assesses the impact of the crisis, and of the UK policy response to Covid-19, on the fiscal budget and the household income distribution. It also looks in more detail at the impact of the increase to state benefits announced by the government when the crisis hit, as well as at how effective the tax-benefit system would have been in responding to the economic shocks without these measures. Finally, it analyses the impact of a near-decade austerity on the UK safety net by assessing how the tax and benefit system of 2011-12 would have protected households from the Covid shock.

4.1 Changes to earnings and the fiscal budget

Table 4 reports the level and changes to total employee and self-employed monthly earnings, subsidies from JRS, government revenues from income tax and NIC, and government spending on state benefits. Column 2 shows the levels in the baseline (before Covid-19). Column 3 shows the impact of the Covid employment and earnings shocks and the full UK policy response (i.e. scenario *D* versus the baseline) in million £. Table 5 shows the baseline number and the change to the number of earners, taxpayers and state benefit recipients.

Earnings and JRS subsidies

The labour market shock means that total employee and self-employed earnings will fall by £6.8 billion (10%) and £4.2 billion (42.8%), respectively. This will be mainly due to workers experiencing a cut to their earnings rather than losing their job. Subsidies from the JRS will amount to a substantial £10 billion, or 14.9% of total employee earnings in the baseline. The government will get about 16% of the spending on JRS back in the form of income tax and NI contributions.

The shock is simulated to reduce the number of employed and self-employed workers by 722,000 and 206,000, respectively, while 7.1 million workers are simulated to be furloughed and on the JRS. This compares to an estimated 6.3 million jobs that had been furloughed by 3 May.[6]

Income tax and NIC

As earnings fall, revenues from income tax will also fall by a substantial £2.4 billion (17.1%) per month, and revenues from NIC by £1 billion (13.6%). This translates to 2.3 million people being fully exempt from paying income tax and NIC as their income falls below the Personal Allowance and the NIC Primary Threshold.

Benefit spending

Benefit spending will go up substantially. This will be mainly due to the spending expansion of the main means-tested benefit, Universal Credit (UC), as well as the contributory unemployment benefit, Jobseeker's Allowance (JSA). There will be also increased spending on the Working Tax Credit (WTC), Housing Benefit (HB), Council Tax Reduction (CTR) and Child Benefit (CB).

Spending on UC will expand substantially by £1 billion (36.6%) and the number of UC claimants is simulated to rise by 1.4 million (33.8%). Thus, UC will provide important safety net during this crisis. For comparison, based on figures published

[6] https://www.gov.uk/government/collections/hmrc-coronavirus-Covid-19-statistics#Coronavirus-Job-Retention-Scheme-Management-information

by the Department for Work and Pensions, the record number of claims led to 1.2 million starts to UC in the period 13 March 2020 to 9 April 2020.[7] The savings made due to the benefit cap applied on UC are noteworthy, and are simulated to be worth £319 per affected family per month, on average (although they make up a small proportion of the total spend on UC).

Spending on JSA will also increase substantially by £194 million, and the number of JSA claims is simulated to rise by 623,000 due to the sharp rise in the number of unemployed, highlighting the effectiveness of unemployment benefits in providing insurance during economic downturn (Dolls et al. 2012; Auerbach and Feenberg 2000). We simulate that 54,000 families will lose their WTC entitlement as they become unemployed and instead gain entitlement to UC or JSA.[8] Spending on HB (for non-working age families) and CTR will also rise, providing additional income protection for families. The number of families simulated to be entitled to CB increases, as 171,000 families with a higher earner see their earnings fall sufficiently so that they do not see their CB entitlement withdrawn.

Looking at the combined change in income tax and NI revenues less spending on state benefits, we simulate the shock in April to have reduced the net fiscal balance by £14.9 billion per month. About 68% of this will be due to subsidies through JRS, 23% due to losses in income tax and NIC revenues, and 9% due to increased benefit spending.

[7] https://www.gov.uk/government/publications/universal-credit-29-april-2013-to-9-april-2020/universal-credit-29-april-2013-to-9-april-2020#starts-on-uc-header

[8] In reality, WTC recipients whose hours are temporarily reduced or who are placed on furlough will be treated by HMRC as if their hours of work had not changed. We do not account for this in our modelling.

Table 4: Change in total earnings, revenues and spending (in million £ and per month)

	Baseline (in levels)	**Impact of crisis** (change to baseline)
Employee earnings	68,390	-6,813
Self-employed earnings	9,894	-4,237
Earnings subsidies from JRS	0	10,204
Revenues from income tax + NIC	21,392	-3,386
Income tax	13,911	-2,372
Employee NIC	7,008	-762
Self-employed NIC	473	-252
Spending on benefits	6,043	1,342
Universal Credit (UC)	2,721	996
Savings from UC benefit cap	26	15
Jobseeker's Allowance (JSA)	14	194
Working Tax Credit (WTC)	94	27
Housing Benefit (HB)	715	21
Child Benefit (CB)	943	25
Council Tax Reduction (CTR)	392	50
Other means-tested benefits	1,164	29
Revenues–spending	15,349	-14,931

Notes: Other means-tested benefits include the Child Tax Credit, Income support, income-related Employment and Support Allowance, income-based JSA, Pension Credit, Scottish benefits (Sure Start Maternity Grant and Best Start Grant). No simulations to Statutory Sickness Pay.

Source: Own calculations with UKMOD and FRS 2017/18.

Table 5: Change in number of earners, tax payers and state benefit recipients (in thousand)

	Baseline (in levels)	**Impact of crisis** (change to baseline)
Employed	26,299	-722
Self-employed	4,245	-206
Furloughed workers on JRS	0	7,062
Income tax + NIC payers	32,387	-2,272
Income tax	29,557	-2,761
Employee NIC	23,418	-1,020
Self-employed NIC	3,269	-1,398
Benefit recipients	13,431	1,636
Universal Credit (UC)	4,026	1,360
Affected by UC benefit cap	90	37
Jobseeker's Allowance (JSA)	44	623
Working Tax Credit (WTC)	374	-54
Housing Benefit (HB)	2,007	4
Child Benefit (CB)	7,103	171
Council Tax Reduction (CTR)	5,376	520
Other means-tested benefits	3,405	36

Notes: Other means-tested benefits include the Child Tax Credit, Income support, income-related Employment and Support Allowance, income-based JSA, Pension Credit, Scottish benefits (Sure Start Maternity Grant and Best Start Grant). No simulations to Statutory Sickness Pay.

Source: Own calculations with UKMOD and FRS 2017/18.

4.2 The impact of the crisis on the distribution of income

The distributional impact of the shock to earnings, and of the tax-benefit response

Figure 1 shows the distributional impact of the shock to earnings and the tax-benefit response by showing the difference in mean equivalised household net income between the baseline and scenario D, where households are ranked based on their net income before Covid-19, for each decile group (1-10), and for the whole population (All). As well as showing the change in net income (black circle), we also show the change due to employee earnings and self-employed earnings; subsidies from JRS (where someone is put on the JRS, this is treated as if they lost all their earnings and then gained a new source of income, JRS payments); income tax + NIC; and all benefits. A negative change means a fall in net income.

In summary, households will lose a large proportion of their income due to the pandemic, with losses higher in the middle and top of the distribution than at the bottom. Subsidies from JRS will play a crucial role in supporting household finances across the entire distribution. They will provide the main insurance mechanism during the crisis. Reductions in income taxes and NIC will provide additional income protection for households at the top, while increases to benefit entitlements will protect households at the bottom of the distribution.

In more detail, we estimate that the average loss in net income will be 7.9%. Breaking down the change by income source shows that earnings subsidies from the JRS will account for a large share of the average baseline income, i.e. 12.8%. Net of subsidies, the loss in earnings from both employment and self-employment will amount to a substantial 13.9% of mean net baseline income. Automatic reductions in income taxes and NIC will also help mitigate income losses, contributing to an average gain in net income of 4.3%. A smaller gain of 1.7% will come from state benefits.

Across the income distribution, all decile groups will lose out, on average, with losses proportionally larger in the middle and top of the distribution than at the bottom. The fact that the losses in earned income are skewed towards high-income families mostly reflects the way that earners are distributed across the household income distribution: there are substantially more no-earner and fewer two-earner households at the bottom than in the middle or top of the distribution (see Table A.4). If we only focus on households with one earner, then the losses in earned income, as a proportion of baseline net income, are largest at the bottom of the distribution (see Figure B.1). The losses in earned income for households with two-and-more earners are somewhat more equally distributed (see Figure B.2).

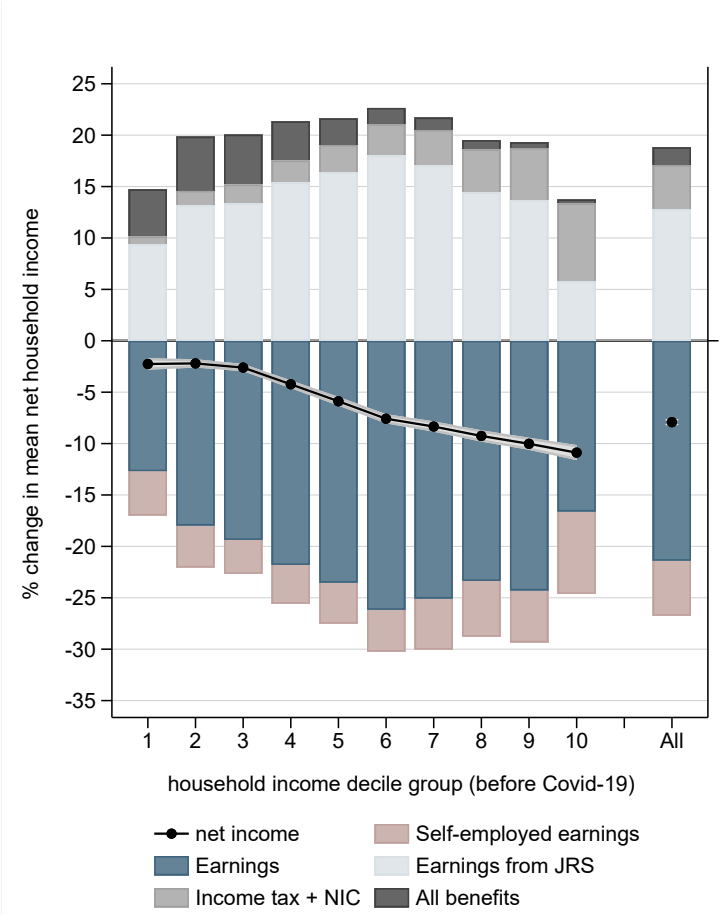
Earnings subsidies provide a very important safety net across all deciles, amount-

ing to 9.4% of the baseline net income in the poorest decile up to 18% in the sixth decile. In the richest decile, the cap on the JRS subsidy will make the scheme less effective in insuring household incomes against the shocks.

After the earnings subsidies, reductions in income tax and NIC will also help mitigate income losses. They will absorb a higher proportion of the losses the higher the decile group, due to the progressive nature of the income tax and NIC schedule. In other words, income tax and NIC will shield higher-earners more than lower-earners (in fact, in the richest 10th decile, they will mitigate an even larger share of the income loss than the JRS subsidy).

At the bottom of the distribution, state benefits will play an important role in alleviating pressure on the households budgets. In the bottom three deciles, state benefits will contribute to sizeable income gains of 4-5%.

Figure 1: Change in mean net income by decile



Notes: The figure shows the distributional impact of the employment and earnings shocks and the UK policy response, i.e. the *baseline* versus scenario *D*. Changes in income based on equivalised household net income.
Source: Own calculations using UKMOD and FRS 2017/18.

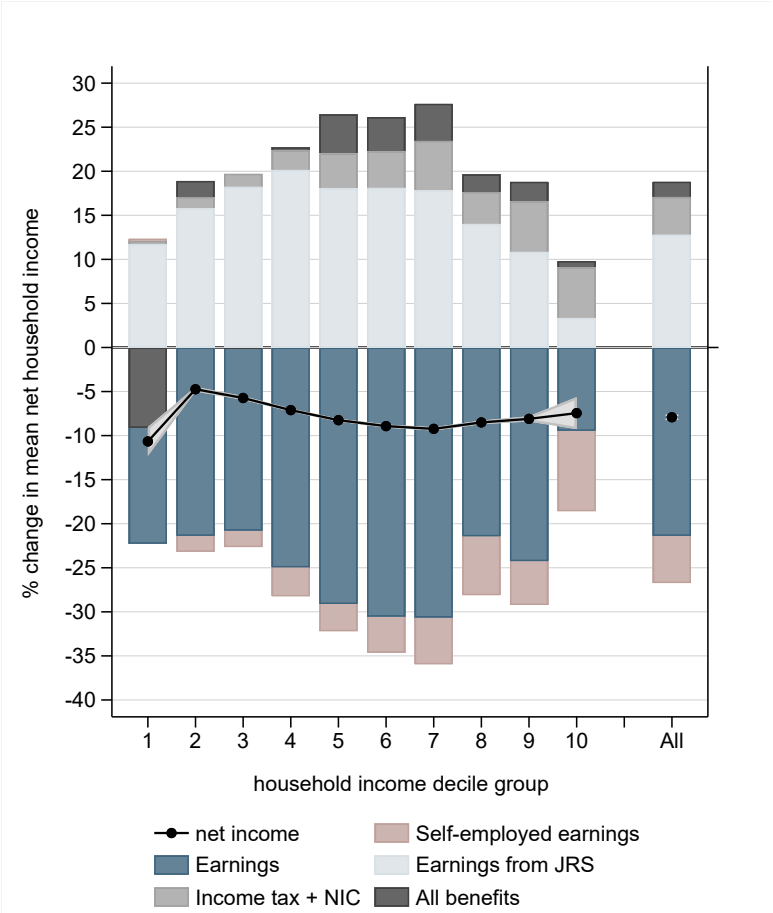
Changes in the distribution of income

Figure 2 presents these results in a different way, by comparing the level and composition of household net incomes in the baseline and scenario D, and doing this within each decile group having re-ranked households. The pattern of income changes is rather different from that shown in Figure 1 because the re-ranking effect is so large. Figure 2 shows that the crisis is simulated to lead to a considerable rise in the number of adults with very low disposable income (caused by those who lose all their earnings as a result of the crisis), such that the greatest fall is seen among the bottom decile. The pattern of changes in income in decile groups 2 to 7 is consistent with a reduction in inequality (because the fall in income is greater, in percentage terms, the higher is the income decile), but the pattern of changes in decile groups 1, and 8 to 10 is consistent with an increase in inequality.

Figure 3 shows the impact of Covid-19 on income inequality based on the Gini coefficient, coefficient of variation (CV), mean log deviation (MLD) and the Theil index (TI). The total change in inequality (black dot) is decomposed into the contribution of earnings changes (i.e. earnings losses net of subsidies) and of tax-benefit policies. In line with Figure 2, we find that net income inequality will remain broadly unchanged. Breaking down the change in net income inequality shows that earnings changes and the effect of tax-benefit policies will offset each other. Disparities in earnings will increase: For example, the Gini coefficient based on net income will go up by 0.018 and the CV by 0.052 due to higher earnings inequality. However, tax-benefit policies will mitigate the increased inequality in earned income. We return to the distributional impact of tax-benefit policies in the next section.

Looking at changes in income poverty and using a fixed poverty line at 60% of the median baseline income, we estimate that the poverty rate and poverty gap will increase substantially due to Covid-19 (see Table A.4 and Table A.5, respectively). For the overall population, the poverty rate will increase from 17.4% to 19.8%.

Figure 2: Change in mean net income by decile
(households ranking not fixed)



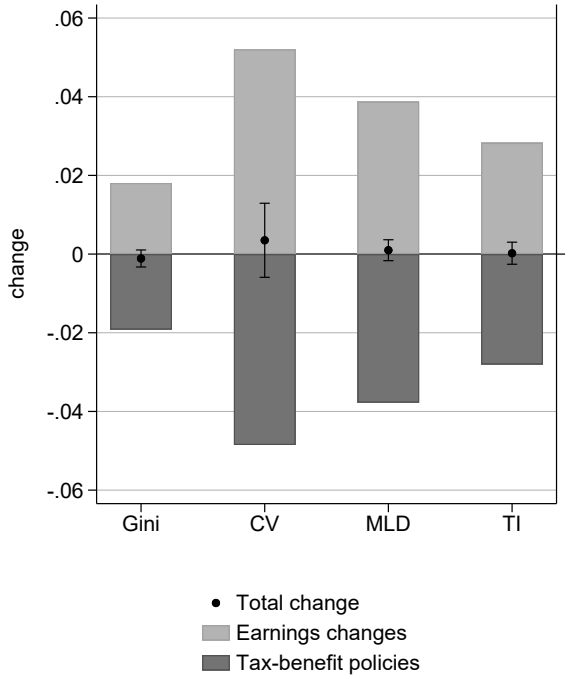
Notes: The figure shows the distributional impact of the employment and earnings shocks and the UK policy response, i.e. the *baseline* versus scenario *D*. Changes in income based on equivalised household net income. Households ranking based on the respective (baseline or post-Covid) income distribution.
Source: Own calculations using UKMOD and the Family Resources Survey.

4.3 The distributional impact of the Covid-19 increases to state benefits and tax-benefit stabilisers

In this section, we analyse separately the contribution of the state benefit increases announced in response to Covid-19 and the contribution of the tax-benefit system that we would have had in their absence (i.e. the one confirmed in the government's March 2020 Budget): we refer to this latter one as the automatic stabilisers.

Figure 4 repeats the change in net income due to state benefit entitlements, and income tax and NIC liabilities that was shown in Figure 1, but now shows in the left plot, the impact of the automatic stabilisers and in the right plot, the impact of Covid-related benefit increases (for the estimation of the effect of benefit increases and automatic stabilisers, see equations 3 and 4, respectively). Comparing the total impact of the automatic stabilisers versus the total effect of Covid-related benefit increases on mean net incomes, it is clear that the former has the most impact on

Figure 3: Changes in income inequality



Notes: The figure shows the impact on inequality of the employment and earnings shocks and the UK policy response, i.e. the *baseline* versus scenario *D*. CV=coefficient of variation; MLD=mean log deviation; TI=Theil index. Changes in income inequality based on equivalised household net income.
Source: Own calculations using UKMOD and FRS 2017/18.

net incomes, on average. This underlines the importance of tax-benefit designs in protecting household incomes during economic downturn. On the other hand, different parts of the distribution rely on different types of policy for mitigating income shocks, stressing the importance of both automatic stabilisers and governments' responses to crises for providing income protection (see e.g. Paulus and Tasseva 2020).

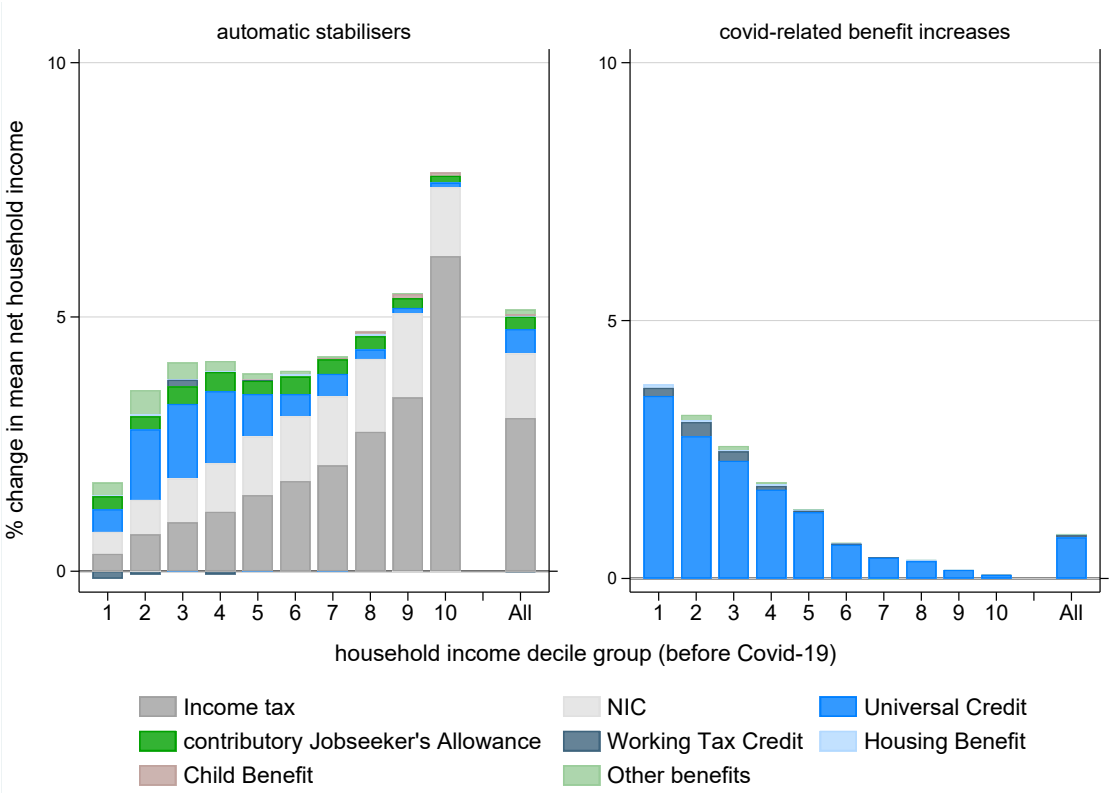
In more detail, looking at the plot on the left, income taxes and NIC will have the most sizeable effect on mean net income. Furthermore, they compensate most for income losses at the upper end of the distribution, due to the progressivity of the system. In the richest top decile, income tax and NIC will contribute to a gain of 6.2% and 1.4%, respectively. In other words, after the drop in earnings, the top decile will retain in total 7.6% of its baseline income due to lower tax liabilities and NIC. This emphasises the role of income taxes and NIC as an important source for income insurance (Kniesner and Ziliak 2002a,b).

However, income taxes and NIC will have less impact at the bottom of the distribution where, on average, they account for a much smaller share of baseline income (for example, someone earning £16,800 per year, i.e. working 37 hours a week at the National Living Wage level, would pay 5% of gross income in income

tax, compared to 15% if earning £50,000 per year).

What protects most households at the bottom of the distribution during recessions are state benefits: in the case of the current crisis it is mainly the means-tested benefit UC. As a stabiliser (left plot), UC will provide a safety-net mainly for the bottom five deciles. The Covid-related increases to UC (right plot) contribute to additional income gains targeted at the bottom of the distribution. For the poorest decile, this would amount to an average gain in equivalised net income of 3.5%. The stabilisation effect of UC and the UC stimulus package will benefit most households with children, lone mothers, one-earner families and those in privately rented or social housing (Figure B.6). After UC, the unemployment benefit JSA (left plot) will also contribute to small income gains across all parts of the distribution highlighting the importance of provision and access to social insurance benefits. For households with two-and-more earners the gains from JSA will be quite sizeable, especially in the bottom four deciles (Figure B.4). The increases to WTC (right plot) will have a small positive effect on net incomes.

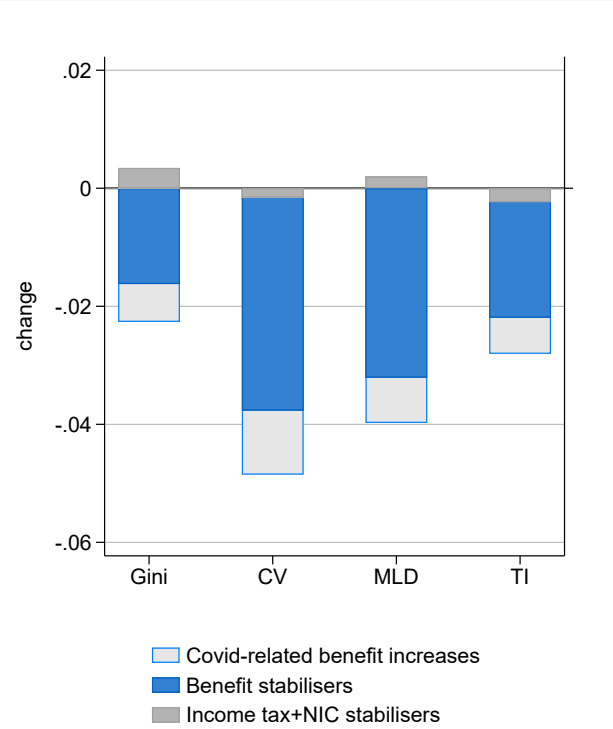
Figure 4: Change in mean net income by decile and tax-benefit policy



Notes: Left plot shows impact of automatic stabilisers, i.e. the *baseline* versus scenario *C*. Right plot shows impact of Covid-related benefit increases, i.e. scenario *C* versus *D*. Changes in total net income and the contribution of earnings changes and JRS subsidies are omitted. Changes in income based on equivalised household net income. Other benefits include the Council Tax Reduction, Child Tax Credit, Income support, income-related Employment and Support Allowance, income-based JSA, Pension Credit, Scottish benefits (Sure Start Maternity Grant and Best Start Grant). No simulations to Statutory Sickness Pay.
Source: Own calculations using UKMOD and FRS 2017/18.

Next, we look at the impact of tax-benefit policies on income inequality measured by Gini, CV, MLD and TI. Figure 5 shows the separate contribution of benefits (breaking down their contribution into stabilisers and Covid-related benefit increases) and tax+NIC stabilisers to the total change in inequality. The total change in inequality and contribution of earnings changes are omitted. Table A.6 includes all estimates for the baseline level and changes in inequality. The key result is that benefits (both automatic stabilisers and Covid-related benefit increases) will entirely offset the increase in earnings inequality, highlighting their importance for redistribution; while income tax and NIC will have little impact on inequality. Overall, benefits will reduce the Gini coefficient by 0.022, CV by 0.047, MLD by 0.04 and TI by 0.026.

Figure 5: Decomposing the change in income inequality by tax-benefit policy



Notes: CV=coefficient of variation; MLD=mean log deviation; TI=Theil index. Changes in income inequality based on equivalised household net income. Total change in inequality and contribution of earnings changes are omitted.
Source: Own calculations using UKMOD and FRS 2017/18.

4.4 The impact of austerity on the UK safety net

In this section, we explore the impact of a near-decade of austerity on the effectiveness of tax-benefit policies in providing income protection. In the last decade, there have been various cuts made to eligibility, or freezes made to the nominal entitlements (De Agostini et al. 2018; Bourquin et al. 2019). On the tax side, the top marginal tax rate was reduced from 50% to 45% and the zero tax band (Personal

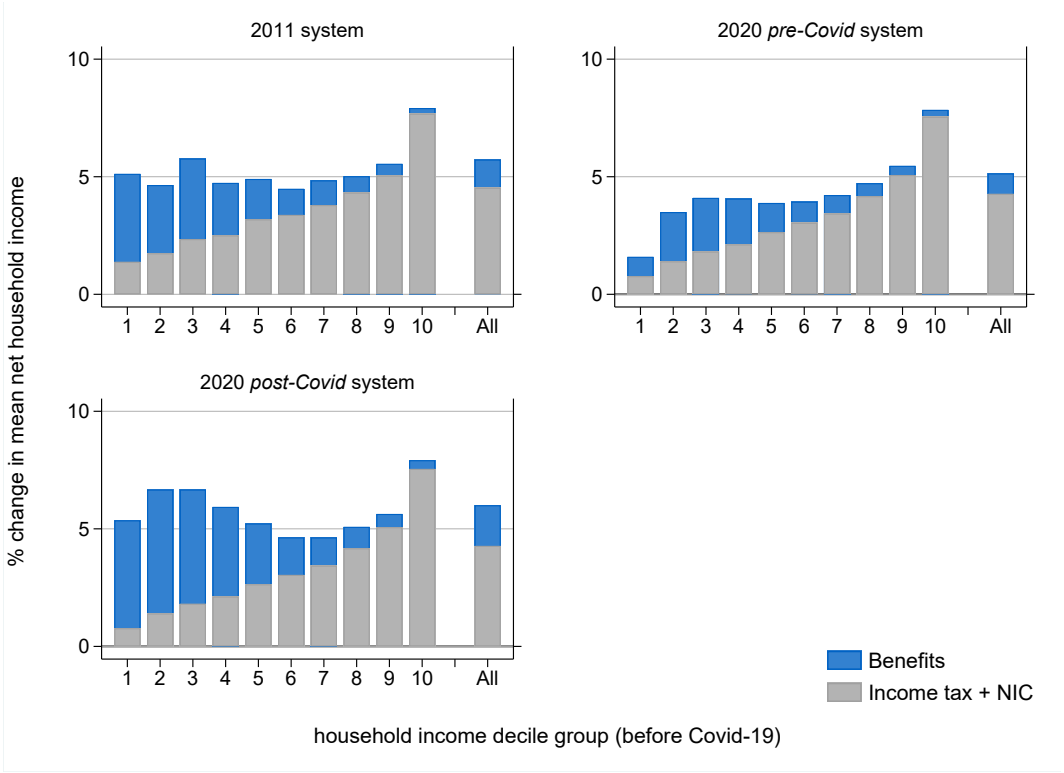
Allowance) has grown faster than prices, but the higher income tax thresholds and the point at which the Personal Allowance is tapered away have deteriorated in real terms.

To assess the impact of austerity on the UK safety net, we compare the distributional impact of tax and benefit policies had the 2011 system been in place today (indexed by CPI) versus the 2020 *pre-Covid* and the 2020 *post-Covid* systems (Figure 6). To estimate the impact of the 2011 policies, we use the tax-benefit model UKMOD to apply the indexed 2011 tax-benefit policies on the household micro-data a) before Covid-19 and b) after the simulation of employment and earnings shocks.

Comparing the distributional impact of the 2011 with the 2020 *pre-Covid* system shows that, due to austerity measures, for most parts of the distribution the 2020 *pre-Covid* system would have been less effective in providing insurance against shocks. In particular in the poorest decile, the 2011 tax-benefit policies would have raised net income by an additional 3.5% compared to the 2020 *pre-Covid* policies.

The emergency benefit package in response to the pandemic will strengthen the UK safety net and, compared to 2011, the 2020 *post-Covid* system will provide more insurance in deciles 2 to 4 and about the same in the rest of the distribution. Nevertheless, although the Covid-related benefit increases provide additional income insurance, these protections are temporary measures and do not undo the impact of austerity measures over the years.

Figure 6: The impact of the 2011 versus the 2020 pre-/post-Covid tax-benefit systems on household net incomes



Notes: 2020 *pre-Covid* and 2020 *post-Covid* systems based on scenarios C and D, respectively. 2011 tax-benefit parameters in 2020 prices and applied on the earnings distribution before and after Covid-19 to estimate effect of automatic stabilisers.
Source: Own calculations using UKMOD and FRS 2017/18.

5 Conclusions

Governments across the globe have taken drastic measures to address the economic costs of Covid-19. The UK government introduced income protection in the form of earnings subsidies for workers, and raised the level of means-tested state benefits. Families experiencing income losses due to Covid-19 can rely on state support through these measures as well as through the built-in automatic stabilisation response of the tax-benefit system.

Combining different sources of household micro-data and a tax-benefit model, we estimate the fiscal and distributional impact of Covid-19 as of April 2020. We assess separately the impact of earnings losses, government's earnings subsidies (the Coronavirus Job Retention Scheme), state benefit increases and tax-benefit automatic stabilisers. We do not consider the impact of the Self-Employment Income Support Scheme, as payments were not made until late May 2020.

We simulate that UK households will, on average, sustain income losses in net income due to Covid-19 of 8%. Earned income falls by a substantial 14% of baseline

net income. Earnings subsidies for furloughed workers will play a major role in protecting household incomes, accounting for 13% of baseline net income. They will support households across the entire income distribution and will provide the main insurance mechanism against the negative income shocks.

Besides the earnings subsidies, tax-benefit policies will provide needed income protection for families. At the bottom of the distribution, UC as a stabiliser will help families cope with the shocks. Covid-related increases to UC payments will be especially targeted at the poorest decile, contributing to a net income gain of 4%. The unemployment benefit JSA will also help mitigate income losses, providing insurance against the shocks across the entire distribution. But the tax system itself also cushions the shock, and automatic reductions in income tax and national insurance contributions are worth 4%, on average, of the pre-Covid baseline income, with the middle and top of the distribution benefiting mostly from income tax and NIC stabilisers due to the progressivity of the tax schedule and NIC.

Finally, we look at the impact of a near-decade of austerity measures on the UK safety net. Compared to the 2011 system, we show that the 2020 *pre-Covid* tax-benefit system would have been less effective in providing insurance against the shocks for most parts of the distribution. The extra Covid benefit spending will strengthen the safety net, so the 2011 and 2020 *post-Covid* system would provide similar level of income protection. But although the Covid-related benefit increases strengthen the safety net, these protections are temporary measures and do not undo the impact of austerity over the years.

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Appendix

A Tables

Table A.1: Multinomial logit of employment status in Apr 2020 (base outcome = no drop in earnings)

	Reduced hours & earnings	Furloughed	Unemployed
Constant	-1.429	.099	-6.579**
	(2.751)	(.864)	(3.022)
Men	.350	-.665	6.884*
	(2.917)	(1.153)	(3.652)
Age	-.002	.010	.085
	(.060)	(.018)	(.053)
Men x Age	.012	-.000	-.107
	(.063)	(.022)	(.066)
Household type:			
Single adult, no children	.141	-.115	.144
	(.298)	(.171)	(.457)
Single adult living with children	.113	-.215	-.311
	(.305)	(.180)	(.534)
Multiple adults, no children	.050	-.024	.255
	(.319)	(.182)	(.456)
Multiple adults living with children	-.143	.109	.409
	(.358)	(.191)	(.552)
Earnings quintile:			
q1	ref	ref	ref
q2	-.234	-.365**	-1.660***
	(.251)	(.162)	(.496)
q3	-.538*	-.785***	-1.035**
	(.295)	(.179)	(.519)
q4	-.656**	-1.107***	-.951*
	(.313)	(.189)	(.524)
q5	-.162	-1.747***	-1.631***
	(.317)	(.210)	(.584)
Sex x Hours in work:			
Women x less than 20	ref	ref	ref
Women x 20-34	-.651**	-.234	-.442
	(.270)	(.195)	(.441)
Men x 20-34	-.175	1.088**	-.736
	(.581)	(.492)	(.799)
Women x 35+	-1.137***	-.455**	-.454

	(.314)	(.224)	(.594)
Men x 35+	-1.394***	.756*	-1.040
	(.500)	(.447)	(.844)
Sector:			
Agriculture, Mining, Manufacture, Utilities	ref	ref	ref
Construction and Real Estate	-6.802*	.027	2.516
	(3.548)	(1.439)	(3.237)
Wholesale and Retail Trade	-2.300	-.646	5.942*
	(2.919)	(.949)	(3.169)
Transportation and Storage	1.242	1.199	-1.896
	(5.370)	(1.958)	(3.820)
Accommodation and Food	-.185	.528	6.283*
	(2.929)	(1.130)	(3.302)
Information and Communication	3.846	-1.066	5.169
	(3.365)	(2.321)	(3.664)
Financial and Insurance Activities	-.699	-.207	16.409***
	(3.100)	(1.921)	(5.390)
Professional, Scientific and Technical Activities	.950	.451	8.937**
	(3.254)	(1.230)	(3.824)
Administrative and Support Service	-4.954	-.221	-9.117***
	(3.407)	(1.460)	(3.108)
Public Administration and Defence	-1.778	-1.022	1.616
	(4.050)	(1.778)	(5.902)
Education	1.134	-.843	4.164
	(2.756)	(.996)	(3.413)
Human Health and Social Work	.045	-.207	1.147
	(2.849)	(.997)	(3.317)
Arts, Entertainment, Recreation and Other	2.650	2.785**	7.073**
	(3.330)	(1.311)	(3.466)
Sex x Sector:			
Women x Agriculture, Mining, Manufacture, Utilities	ref	ref	ref
Men x Construction and Real Estate	9.606**	2.993	-5.755
	(3.954)	(2.005)	(4.458)
Men x Wholesale and Retail Trade	1.023	1.475	-6.195
	(3.257)	(1.308)	(4.129)
Men x Transportation and Storage	-.039	1.551	-1.762
	(5.817)	(2.247)	(5.503)
Men x Accommodation and Food	3.283	3.418**	-6.268
	(3.499)	(1.655)	(4.656)
Men x Information and Communication	-4.358	.507	-9.167**
	(4.221)	(3.217)	(4.227)
Men x Financial and Insurance Activities	.474	.443	-30.724**
	(4.532)	(2.724)	(13.221)
Men x Professional, Scientific and Technical Activities	.861	-1.646	-19.284***
	(3.867)	(1.762)	(4.519)
Men x Administrative and Support Service	7.587**	1.163	4.769
	(3.768)	(2.037)	(3.867)
Men x Public Administration and Defence	2.635	1.826	-7.080
	(4.952)	(2.481)	(6.631)
Men x Education	-.009	-1.379	-4.954
	(3.139)	(1.735)	(4.200)
Men x Human Health and Social Work	-1.658	.352	22.750
	(3.347)	(1.756)	(15.363)
Men x Arts, Entertainment, Recreation and Other	-1.489	-.822	-21.670***
	(3.711)	(1.795)	(4.052)
Age x Sector:			
Age x Agriculture, Mining, Manufacture, Utilities	ref	ref	ref
Age x Construction and Real Estate	.128*	-.006	-.053
	(.072)	(.031)	(.056)

Age x Wholesale and Retail Trade	.043	.005	-.114*
	(.064)	(.020)	(.060)
Age x Transportation and Storage	-.020	-.036	.023
	(.114)	(.043)	(.070)
Age x Accommodation and Food	.032	.009	-.097
	(.064)	(.026)	(.063)
Age x Information and Communication	-.072	.015	-.065
	(.079)	(.050)	(.068)
Age x Financial and Insurance Activities	.004	-.022	-.463***
	(.069)	(.041)	(.158)
Age x Professional, Scientific and Technical Activities	-.030	-.016	-.208**
	(.071)	(.026)	(.083)
Age x Administrative and Support Service	.095	.004	-.078
	(.072)	(.032)	(.057)
Age x Public Administration and Defence	.028	-.026	-.036
	(.084)	(.038)	(.112)
Age x Education	-.030	-.004	-.076
	(.060)	(.021)	(.063)
Age x Human Health and Social Work	-.000	-.030	-.029
	(.062)	(.021)	(.061)
Age x Arts, Entertainment, Recreation and Other	-.043	-.046*	-.128**
	(.073)	(.027)	(.063)
Sex x Age x Sector:			
Women x Age x Agriculture, Mining, Manufacture, U	ref	ref	ref
Men x Age x Construction and Real Estate	-.187**	-.042	.116
	(.079)	(.043)	(.081)
Men x Age x Wholesale and Retail Trade	-.032	-.025	.105
	(.070)	(.028)	(.081)
Men x Age x Transportation and Storage	-.006	-.025	.051
	(.123)	(.048)	(.106)
Men x Age x Accommodation and Food	-.062	-.063*	.087
	(.079)	(.038)	(.103)
Men x Age x Information and Communication	.067	-.051	.040
	(.095)	(.070)	(.080)
Men x Age x Financial and Insurance Activities	-.015	-.034	.714***
	(.100)	(.060)	(.265)
Men x Age x Professional, Scientific and Technical Activities	-.017	.027	.373***
	(.084)	(.037)	(.098)
Men x Age x Administrative and Support Service	-.140*	-.041	.144*
	(.083)	(.045)	(.075)
Men x Age x Public Administration and Defence	-.082	-.031	.125
	(.104)	(.054)	(.125)
Men x Age x Education	-.022	.014	.068
	(.068)	(.034)	(.081)
Men x Age x Human Health and Social Work	-.003	-.026	-.853
	(.071)	(.038)	(.560)
Men x Age x Arts, Entertainment, Recreation and Other	-.013	-.006	.140*
	(.077)	(.038)	(.077)
N	6122		

Notes: The dependent variable is employment status in Apr 2020. The model is estimated on the sample of employees, aged 20-63, with positive earnings from employment only in Feb 2020. The base outcome is *no drop in earnings*, i.e. of no more than £5 per week. The outcome *reduced hours and earnings* implies a fall of more than £5 in earnings and 1 working hour per week. Standard errors at a confidence level of 95% are shown in parenthesis. Significance levels indicated as * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Source: Own calculations with Understanding Society COVID-19 data.

Table A.2: Multinomial logit of self-employment status in Apr 2020 (base outcome = no drop in earnings)

	Reduced hours & earnings	Unemployed
Constant	-.567	-1.742
	(.746)	(1.806)
Men	.141	-1.043
	(.372)	(.915)
Age	-.011	-.023
	(.010)	(.024)
Household type:		
Single adult, no children	.214	-.528
	(.315)	(.668)
Single adult living with children	.215	-1.067
	(.332)	(.760)
Multiple adults, no children	.467	-1.334*
	(.312)	(.768)
Multiple adults living with children	.293	-.064
	(.380)	(.784)
Earnings quintile:		
q1	ref	ref
q2	.209	.961
	(.329)	(.737)
q3	.648*	-.077
	(.331)	(.914)
q4	.079	.507
	(.311)	(.838)
q5	-.150	1.424*
	(.298)	(.756)
Sex x Hours in work:		
Women x less than 20	ref	ref
Men x less than 20	-.319	-1.765
	(.509)	(1.191)
Women x 20-34	.400	-1.103
	(.371)	(.941)
Men x 20-34	.123	.687
	(.393)	(.744)
Women x 35+	.295	.045
	(.398)	(1.067)
Sector:		
Agriculture, Mining, Manufacture, Utilities	ref	ref
Construction and Real Estate	1.655***	2.425**
	(.486)	(1.097)
Wholesale and Retail Trade	.938**	-.131
	(.457)	(1.501)
Transportation and Storage	.985*	-3.834***
	(.521)	(1.473)
Accommodation and Food	3.530***	3.861**
	(1.102)	(1.751)
Information and Communication	.974*	2.434**
	(.560)	(1.138)
Financial and Insurance Activities	-.700	-13.414***
	(.914)	(1.138)
Professional, Scientific and Technical Activities	.314	-.611
	(.440)	(1.427)
Administrative and Support Service	1.489***	3.145***
	(.510)	(1.122)
Public Administration and Defence	1.072*	-12.124***

	(.636)	(1.091)
Education	.669	.529
	(.431)	(1.320)
Human Health and Social Work	.717*	-1.094
	(.433)	(1.486)
Arts, Entertainment, Recreation and Other	1.623***	1.028
	(.457)	(1.181)
N	1365	

Notes: The dependent variable is self-employment status in Apr 2020. The model is estimated on the sample of self-employed, aged 20-63, with positive earnings from self-employment in Feb 2020. The base outcome is *no drop in earnings*, i.e. of no more than £5 per week. The outcome *reduced hours and earnings* implies a fall of more than £5 in earnings and 1 working hour per week. Significance levels indicated as * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Source: Own calculations with Understanding Society COVID-19 data.

Table A.3: Household composition in the income distribution

	no earner	1 earner	2+ earners	with children	with 3+ children	with disability	with elderly	lone mother
decile								
1	22.4	9.7	1.5	10.3	22.1	8.0	11.5	16.1
2	15.4	11.9	2.7	12.8	24.2	9.7	11.8	22.2
3	15.4	12.0	4.5	12.4	14.2	15.1	14.5	21.9
4	12.8	11.8	6.7	12.0	11.1	18.9	13.5	15.4
5	10.3	10.9	9.1	10.9	7.1	17.4	11.6	9.0
6	7.7	10.6	11.9	9.5	4.9	13.3	10.1	6.8
7	5.4	9.5	13.9	9.0	5.6	7.7	8.0	2.8
8	4.0	8.0	15.1	8.4	3.4	4.8	6.9	3.7
9	3.3	7.6	17.0	7.8	3.5	2.6	6.2	1.2
10	3.4	7.9	17.6	6.9	3.8	2.4	6.0	1.0
n households	9,647,460	7,966,661	10,008,789	7,841,651	1,182,077	3,662,404	8,498,519	1,666,359

(table continued)

	single-person hh: women	single-person hh: men	accommodation own	private rent	social rent/other
decile					
1	19.5	17.5	8.9	10.9	19.1
2	13.4	10.0	7.4	10.2	17.5
3	14.4	11.6	7.6	10.4	20.3
4	13.0	11.3	8.8	11.3	14.5
5	10.2	10.4	9.9	10.8	9.7
6	9.3	10.6	10.3	11.3	8.0
7	6.6	8.4	10.7	11.4	4.5
8	5.6	6.1	10.9	8.8	3.5
9	4.3	6.8	12.3	7.7	1.8
10	3.6	7.3	13.2	7.1	1.1
n households	4,250,753	3,741,577	17,476,426	5,062,829	5,083,655

Notes: The table shows, for a given household type, what proportion (in %) of households are situated in each decile group. Income decile groups based on household equivalised net income before Covid-19. Each column refers to a household with certain characteristics. Household types for presence of earners are based on employment status before Covid-19. Household types can be overlapping.

Source: Own calculations with UKMOD and FRS 2017/18.

Table A.4: Change in the poverty rate in % points

	Baseline (in %)	**Impact of crisis** (change to baseline)
All	17.372***	2.367***
	(.353)	(.209)
Women	18.119***	2.297***
	(.392)	(.229)
Men	16.604***	2.439***
	(.400)	(.231)
Children	23.875***	2.691***
	(.759)	(.426)

Notes: The table shows the impact on the poverty rate of the employment and earnings shocks and the UK policy response, i.e. the *baseline* versus scenario D. The poverty rate is the % of people with household equivalised net income below the poverty line. The poverty line is 60% of the median household equivalised net income in the baseline. Standard errors at a confidence level of 95% are shown in parenthesis. Bootstrapped standard errors after 200 replications. Significance levels indicated as * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Source: Own calculations with UKMOD and FRS 2017/18.

Table A.5: Change in the poverty gap in % points

	Baseline (in %)	**Impact of crisis** (change to baseline)
All	4.267***	1.049***
	(.124)	(.068)
Women	4.356***	1.016***
	(.134)	(.072)
Men	4.176***	1.083***
	(.157)	(.076)
Children	5.184***	1.463***
	(.236)	(.122)

Notes: The table shows the impact on the poverty gap of the employment and earnings shocks and the UK policy response, i.e. the *baseline* versus scenario D. The poverty gap is the mean shortfall of the total population from the poverty line (counting the non-poor as having zero shortfall), expressed in % of the poverty line. The poverty line is 60% of the median household equivalised net income in the baseline. Standard errors at a confidence level of 95% are shown in parenthesis. Bootstrapped standard errors after 200 replications. Significance levels indicated as * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Source: Own calculations with UKMOD and FRS 2017/18.

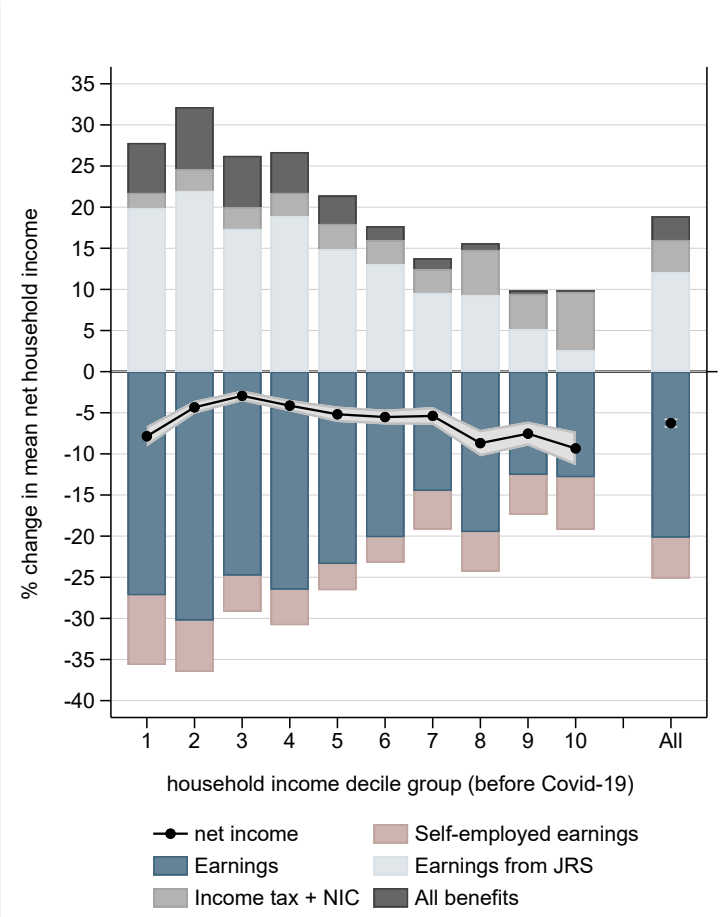
Table A.6: Decomposing changes in income inequality

	Baseline	**Impact of crisis** (change to baseline)				
	(in levels)	$E+K$	S_t	S_b	P	Δ
Gini	.306***	.018***	.003***	-.016***	-.006***	-.001
	(.002)	(.001)	(.000)	(.001)	(.000)	(.001)
CV	.646***	.052***	-.002	-.036***	-.011***	.004
	(.015)	(.009)	(.003)	(.001)	(.000)	(.005)
MLD	.162***	.039***	.002	-.032***	-.008***	.001
	(.003)	(.004)	(.003)	(.003)	(.000)	(.001)
TI	.162***	.028***	-.002**	-.020***	-.006***	.000
	(.003)	(.003)	(.001)	(.001)	(.000)	(.001)

Notes: Inequality estimates based on equivalised household income. The total change Δ is decomposed into: the contribution of earnings changes ($E+K$), tax/NIC and benefit automatic stabilisers (S_t and S_b), and Covid-related benefit increases (P). Standard errors at a confidence level of 95% are shown in parenthesis. Bootstrapped standard errors after 200 replications. Significance levels indicated as * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.
Source: Own calculations with UKMOD and FRS 2017/18.

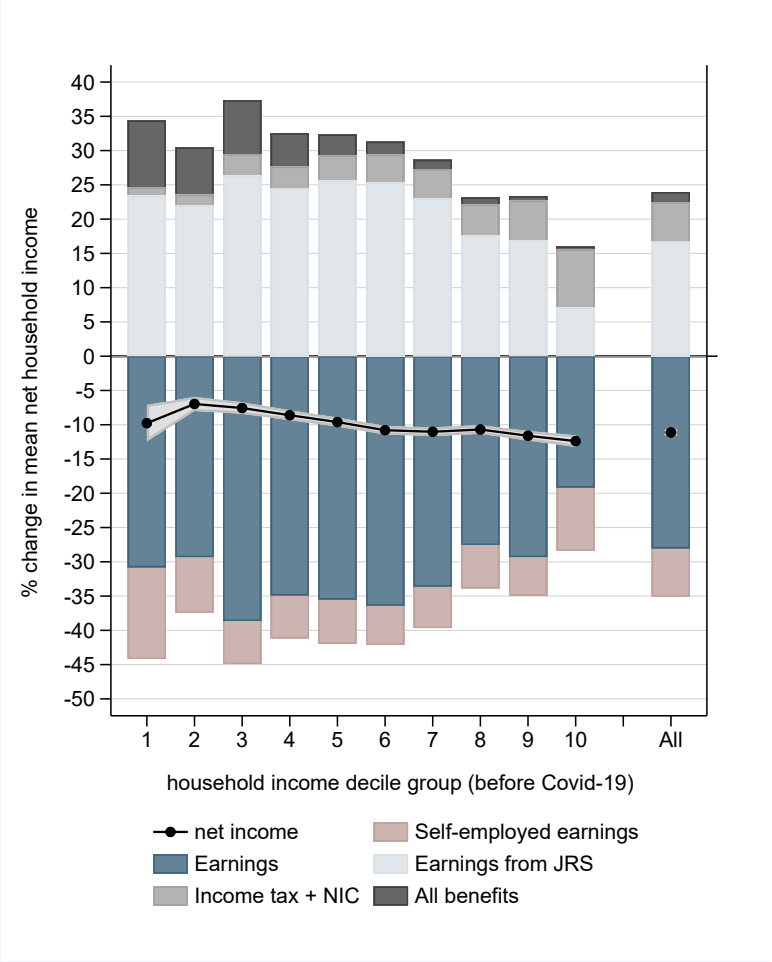
B Figures

Figure B.1: Change in mean net income by decile: **households with 1 earner**



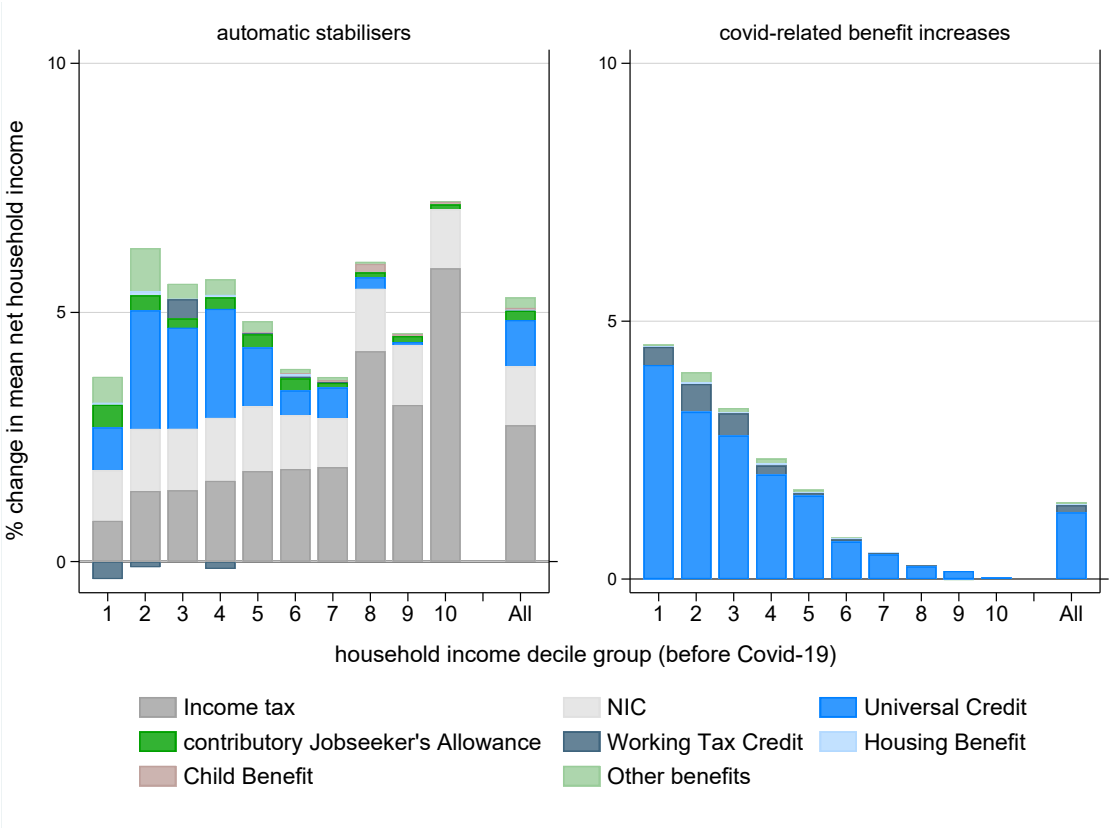
Notes: The figure shows the distributional impact of the employment and earnings shocks and the UK policy response, i.e. the *baseline* versus scenario *D*. Changes in income based on equivalised household net income. All-population deciles.
Source: Own calculations using UKMOD and the Family Resources Survey.

Figure B.2: Change in mean net income by decile: **households with 2+ earners**



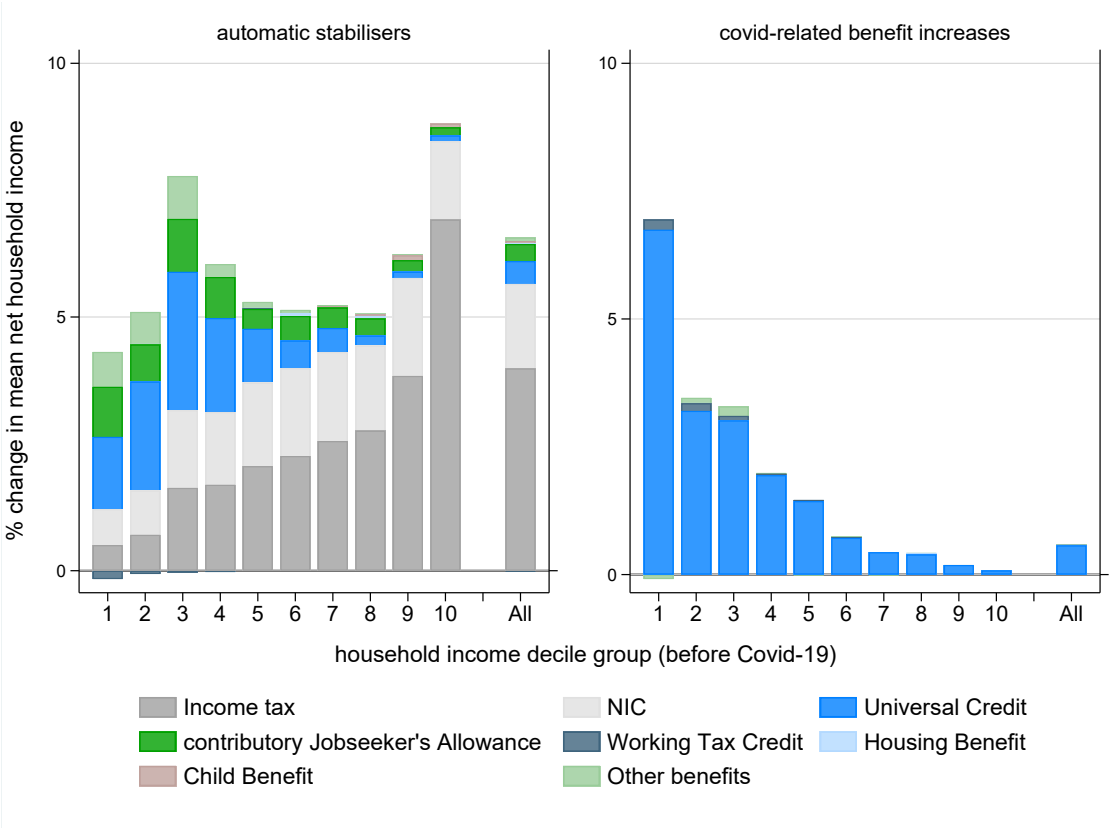
Notes: The figure shows the distributional impact of the employment and earnings shocks and the UK policy response, i.e. the *baseline* versus scenario *D*. Changes in income based on equivalised household net income. All-population deciles.
Source: Own calculations using UKMOD and the Family Resources Survey.

Figure B.3: Change in mean net income by decile and tax-benefit policy: **households with 1 earner**



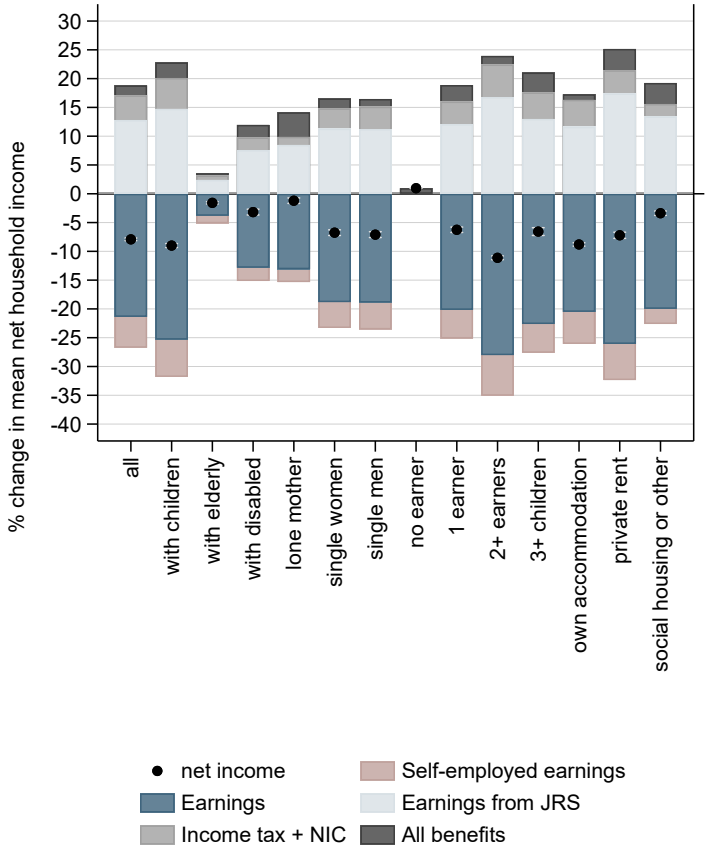
Notes: Left plot shows impact of automatic stabilisers, i.e. the *baseline* versus scenario *C*. Right plot shows impact of Covid-related benefit increases, i.e. scenario *C* versus *D*. Changes in total net income and the contribution of earnings changes and JRS subsidies are omitted. Changes in income based on equivalised household net income. Other benefits include the Council Tax Reduction, Child Tax Credit, Income support, income-related Employment and Support Allowance, income-based JSA, Pension Credit, Scottish benefits (Sure Start Maternity Grant and Best Start Grant). No simulations to Statutory Sickness Pay.
Source: Own calculations using UKMOD and FRS 2017/18.

Figure B.4: Change in mean net income by decile and tax-benefit policy: **households with 2+ earners**



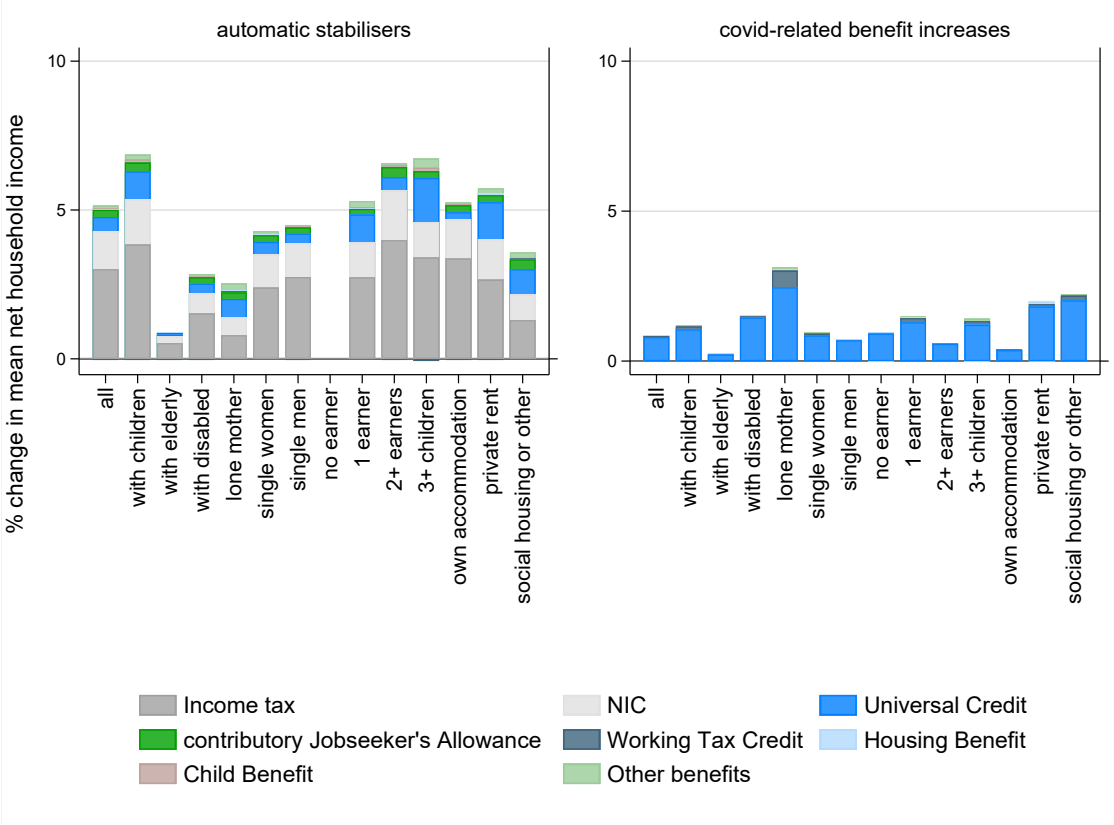
Notes: Left plot shows impact of automatic stabilisers, i.e. the *baseline* versus scenario *C*. Right plot shows impact of Covid-related benefit increases, i.e. scenario *C* versus *D*. Changes in total net income and the contribution of earnings changes and JRS subsidies are omitted. Changes in income based on equivalised household net income. Other benefits include the Council Tax Reduction, Child Tax Credit, Income support, income-related Employment and Support Allowance, income-based JSA, Pension Credit, Scottish benefits (Sure Start Maternity Grant and Best Start Grant). No simulations to Statutory Sickness Pay.
Source: Own calculations using UKMOD and FRS 2017/18.

Figure B.5: Change in mean net income by household type



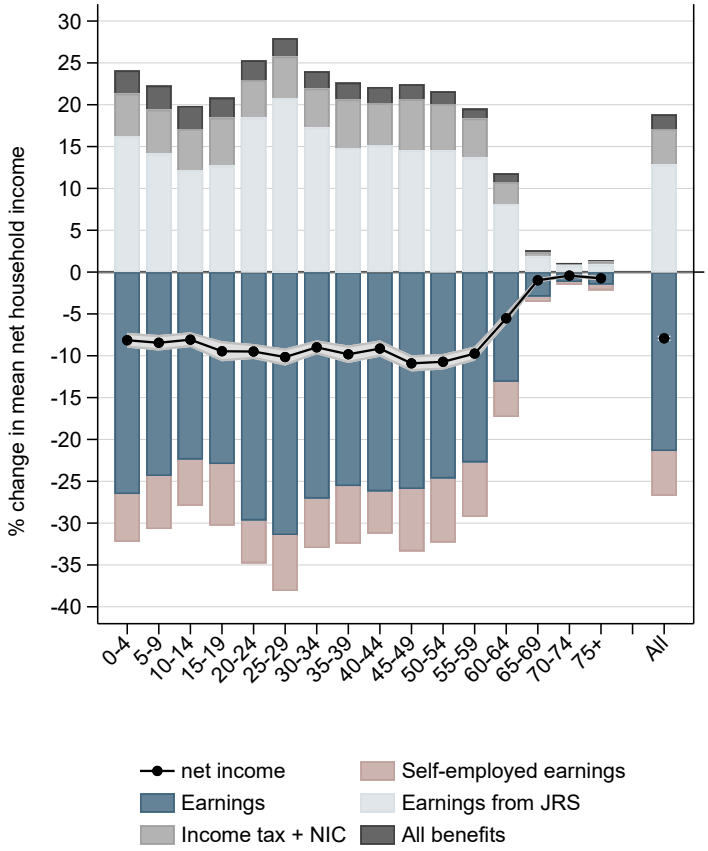
Notes: The figure shows the distributional impact of the employment and earnings shocks and the UK policy response, i.e. the *baseline* versus scenario *D*. Changes in income based on equivalised household net income. Household types for presence of earners are based on employment status before Covid-19.
Source: Own calculations using UKMOD and the Family Resources Survey.

Figure B.6: Change in mean net income by household type and tax-benefit policy



Notes: Left plot shows impact of automatic stabilisers, i.e. the *baseline* versus scenario *C*. Right plot shows impact of Covid-related benefit increases, i.e. scenario *C* versus *D*. Changes in total net income and the contribution of earnings changes and JRS subsidies are omitted. Changes in income based on equivalised household net income. Household types for presence of earners are based on employment status before Covid-19. Other benefits include the Council Tax Reduction, Child Tax Credit, Income support, income-related Employment and Support Allowance, income-based JSA, Pension Credit, Scottish benefits (Sure Start Maternity Grant and Best Start Grant). No simulations to Statutory Sickness Pay.
Source: Own calculations using UKMOD and FRS 2017/18.

Figure B.7: Change in mean net income by age group



Notes: The figure shows the distributional impact of the employment and earnings shocks and the UK policy response, i.e. the *baseline* versus scenario *D*. Changes in income based on equivalised household net income.
Source: Own calculations using UKMOD and the Family Resources Survey.

C Benefit take-up

The calculations of means-tested benefits and tax credits in UKMOD account for non-take-up. Take-up rates are based on the 2017 mid-point estimates on a caseload basis by the Department for Work and Pensions and HM Revenue and Customs.[9] Households from the FRS sample are randomly selected to take-up their simulated entitlements so that the number of takers is in line with the official take-up rates. For UC, there is no evidence yet for the extent of non-take-up. However, due to the means-tested nature of the benefit, it is plausible that, like the benefits UC is replacing, UC does not reach all entitled families. A take-up rate of 87% is assumed for UC (as the take-up rate estimated for the Income Support benefit for families

[9]DWP 2017/18 take-up estimates for income-related benefits available here: https://www.gov.uk/government/statistics/income-related-benefits-estimates-of-take-up-financial-year-2017-to-2018. HMRC 2017/18 take-up estimates for tax credits available here: https://www.gov.uk/government/statistics/child-benefit-child-tax-credit-ctc-and-working-tax-credit-wtc-take-up-rates-2017-to-2018

without children). For more information on the take-up assumptions in UKMOD, see De Agostini and Chatsiou (2019).

In scenarios C and D, we assume that families affected by the shocks do not take up UC if they were entitled to and did not take up UC prior to the shock. That is their take-up behaviour remains the same even after the change in their circumstances. In the case of affected families who become newly entitled to UC after the shock, the majority takes up UC but a small proportion of eligible families (as with Income Support) do not receive UC (e.g. due to errors in assessing their eligibility).