
Article:
Brewer, Mike, Dang, Thang and Tominey, Emma orcid.org/0000-0002-0287-3935 (2024) Universal Credit:Welfare Reform and Mental Health. Journal of Health Economics. 102940. ISSN 0167-6296

https://doi.org/10.1016/j.jhealeco.2024.102940

Universal Credit: Welfare Reform and Mental Health

Mike Brewer

Resolution Foundation

Thang Dang

INVEST Research Flagship Centre, University of Turku; University of Economics Ho Chi Minh City

Emma Tominey

Department of Economics, University of York; HCEO; IZA

October 24, 2024

Abstract

The UK Universal Credit (UC) welfare reform simplified the benefits system whilst strongly incentivising a return to sustainable employment. Exploiting a staggered roll-out, we estimate the differential effect of unemployment under UC versus the former system on mental health. Groups with fewer insurance possibilities - single adults and lone parents – experience a mental health deterioration of 8.4-13.9% standard deviations which persists into the subsequent year. For couples, UC partially or fully mitigates mental health consequences of unemployment. Exploring mechanisms, for single adults and lone parents, reduced benefit income and strict job search requirements dominate any positive welfare effects of the reduced administrative burden of claiming benefits.

Keywords: Welfare reform; Mental health; Mediation; Universal Credit

JEL codes: D61; I10; I14; I38

Statements and Declarations:
Funding: This research is funded by University of Economics Ho Chi Minh City, Vietnam (Thang Dang). **Conflict of interest:** The authors declare no competing interests. **Other declarations:** Studies in humans and animals: none. Declaration of generative AI in scientific writing: none. Declaration of generative AI and AI-assisted technologies in the writing process: none. **Data availability:** The analysis is drawn on restricted versions of the UK Household Longitudinal Study (UKHLS) datasets provided by the UK Data Service. The authors have signed an agreement with the UK Data Service to not disclose the data publicly. However, the authors are happy to make a description available of how data access can be obtained and to make the software codes and programs available.

Corresponding author: Thang Dang, INVEST Research Flagship Centre, University of Turku, Finland; University of Economics Ho Chi Minh City, Vietnam (email: thang.dang@thangdang.org).

1 Introduction

Governments spend a lot of money on welfare payments to individuals and families. Accounting for around 20% of all public expenditure in the OECD, UK and US[1], it is not surprising that efficient delivery of the welfare state is a common goal of governments across the world. The objectives of a well functioning welfare state is to raise welfare of recipients, providing a safety net which mitigates for any negative consequences of losing a job or the loss of income, whilst incentivizing self-sufficiency through work (Hartley et al. 2022). Failure to strike the correct balance can result in unintended consequences such as mental health issues, illness or criminal activities of claimants (Blank 1997; Blank 2002).

In this paper we evaluate a major overhaul of the welfare state in the UK - Universal Credit (UC) - on the mental health of unemployed individuals. As UC was rolled out across the UK, benefit claimants would become eligible for UC if they experienced a change in their circumstances, such as a change in employment status. There is a long-established relationship between unemployment and mental health (see for example Björklund 1985; Hamilton et al. 1997; Tefft 2011) and our paper analyses the differential effect of unemployment under UC relative to the former welfare system.[2]

Using the UK Household Longitudinal Study (UKHLS) combined with detailed administrative data on the UC roll-out, we make three main contributions to the literature. First, we evaluate the effect of UC on mental health of unemployed individuals. As many countries across the world aim to simplify their benefits system, the analysis will shed light on whether it is possible to move to a universal system, whilst protecting claimants' mental health. Wickham et al. (2020), also study the mental health effect of UC, estimating a different parameter to ours.

Our second contribution is to identify the mechanisms for the treatment effect on mental health. In particular UC was implemented along with sub-policies which individually may result in either positive or negative mental health consequences of the reform. A first objective of UC was to reduce the administrative burden of the current welfare state by combining application processes and payments of up to six existing benefits, including income support,

[1] In the UK, this is represents around 11% of national income (Office for Budget Responsibility 2017).

[2] In the paper we refer to the treatment effect as this differential effect of unemployment under UC compared to the former system called "legacy".

housing and child benefits into one, which is likely to improve mental health consequences of unemployment and claiming benefits.[3] The second aim was to strongly incentivise claimants into self-sufficiency, through policy rules including changes in benefit income (Brewer et al. 2012) and compulsory intensive job search of up to 30 hours per week for unemployed or low income claimants. Whilst the simplified application process may raise mental health of claimants, the movement to stricter restrictions is likely to have the opposite effect.[4]

We can measure directly or proxy for these policy rules. Specifically we identify the causal parameter of the differential effect of unemployment under UC versus legacy on six mediators - the administrative burden of receiving benefits, benefit income, household income, problems paying bills, satisfaction with leisure time and an indicator for exiting the welfare system whilst unemployed.

Our third contribution is to allow for treatment effect heterogeneity across household composition. The UC welfare reform may lead to a heterogeneous treatment effect on mental health for households with just one adult compared to households with couples due to different insurance possibilities. An unemployed individual living with a partner can potentially protect against changes in benefit income or stress from stricter job search through changes in the spouse's labour supply or offering of support (see for example Tominey 2016). However single adult households may be more vulnerable to the welfare reform. Estimating differential treatment effects across household composition is particularly important for policies aiming to minimise the negative unintended consequences from welfare reform.

To identify the treatment effect of UC on the mental health of participants, we exploit a staggered roll-out across areas of the UK between 2013–2018 which started in the North of the UK and slowly moved across the whole country. So as not to overwhelm the roll-out, not all benefit claimants within a roll-out area were eligible for UC, but rather those changing their employment or housing status whilst satisfying eligibility rules (explained in Section 2.3).[5] Given this, our identification strategy estimates a panel data model with fixed effects

[3]The legacy system is similar to the welfare systems in many countries, offering a set of benefits depending on different needs. The six legacy benefits combined into UC include Income Support, Income Based Jobseeker's Allowance, Income-Related Employment Support Allowance, Housing Benefit, Child Tax Credit and Working Tax Credit.

[4]See Section 2 for full details on the policy rules.

[5]In this paper we focus on eligibility through a change in unemployment status, given the strong and established relationship between unemployment and claimant outcomes and leave the investigation of the mental health effects of UC for those moving house to future research.

at the individual, region and time level. The regional and time fixed effects ensure that we can compare the effect of unemployment of two individuals within the same region but in a different time period, exploiting the roll-out of UC across time. Including the individual fixed effects means that the variation we exploit in the effect of unemployment will come from those changing employment state. Whilst the effects of unemployment or benefit eligibility are potentially endogenous, the focus is on the differential effect of unemployment under the two systems. This parameter is causally identified if the roll-out is exogenous and if the common trends assumption holds and there is no treatment effect heterogeneity across the timing of roll-out. We show that our strategy is robust to tests of these assumptions.

Our results suggest that compared to the former legacy system, UC exacerbates mental health problems among the unemployed for groups with fewer insurance possibilities - including single adults and lone parents. The treatment effect is a reduction in mental health of 8.4% and 13.9% of a standard deviation for single adults and lone parents, respectively. These effects persist into the year following the period of unemployment. While we do not find a significant treatment effect for couples without children, we find a large improvement in mental health for couples with children from unemployment under the UC system by 25.4% of a standard deviation. This heterogeneity of treatment effects on mental health are explained through estimation of the treatment effect on the set of mediators related to sub-policy rules of UC. For single adults and lone parents, although the reform was successful in simplifying the benefit application system and thus reducing mental health problems among those unemployed, its negative consequences on other channels including reduced income, increased difficulties paying bills, reduced leisure satisfaction and increase exit from the welfare system generate a net negative effect on mental health.

In contrast, we find that the reform is favourable to the mental health for couples without or with children, through an improvement in income, a reduction in administrative burden of applying for benefits and a reduction in problems paying bill (for couples with children). Evidence shows that the partners of a treated individual react to the treatment by raising their own work hours. As a consequence, the net treatment effects on mental health are zero or positive for couples.

Our paper is relevant to several strands of the economics literature. First, a large literature has linked the design of unemployment compensation programmes to labour mar-

ket outcomes including employment trajectories (Nickell 1979; Narendranathan et al. 1985; Atkinson and Micklewright 1991), the duration of the unemployment spells among benefit recipients (Katz and Meyer 1990; Card and Levine 2000; Nicholson and Needels 2006; Lalive 2007; Lopes 2022) and job search effort (Marinescu and Skandalis 2021). Going beyond labor market effects, Wanberg et al. (2020) has estimated the psychological well-being effect of unemployment compensation programmes. Our paper relates to this line of research by showing that key changes in benefit levels along with the conditions for receiving these benefits such as tightening job search requirements drive claimant's mental health.

Second, the paper speaks to the central question of the consequences of welfare reforms (Blank 2002). Previous studies on this research topic has initially focused on employment which is typically the direct target of welfare reforms (Brewer and Hoynes 2019). Accordingly, welfare reforms are helpful in raising labour supply for the affected working age population including lone parents' labour supply (Brewer et al. 2006; Francesconi and Van der Klaauw 2007; and Gregg et al. 2009) and immigrant labour participation (Borjas 2003). The literature has been extended to consider broader human capital outcomes, such as improving subjective well-being for single mothers (Herbst 2013), parental behaviours (Kalil et al. 2022) and lifelong child human capital (Bailey et al. 2020) as well as other unintended consequences including disparities in political outcomes (Fetzer 2019) and increasing criminal activities (Giulietti and McConnell 2020; Tuttle 2019; and Watson et al. 2020).

Finally, there is a small literature relating specifically to the effect of universal credit. Wickham et al. (2020) estimate the difference-in-difference effect of being unemployed versus employed, on mental health, measured across the years of roll-out. Our contributions relative to Wickham et al. (2020) are i) to implement a triple difference model to identify more clearly the eligibility to UC, which switches on not just from living in a rollout area but also requiring changing employment status; ii) all of our analysis allows for heterogeneous treatment effect by household composition which turns out to be very important for the results which evidences intrahousehold insurance against negative mental health effects of the treatment; iii) we causally identify the treatment effect on a set of mediators to understand how welfare reform which simplifies the benefit system such as UC can do so whilst protecting mental health of the claimants. In addition, d'Este and Harvey (2024) estimate the effect

of UC on criminal activities, showing an increase in local crimes including burglaries and vehicle crimes.

The UC welfare reform has been recognised as the most radical social security reform for over 60 years (Dwyer and Wright 2014). The reform is estimated to cost £15 billion to implement and the early roll-out had a positive albeit very modest effect on employment of claimants.[6] A full evaluation of the reform requires to identify the mental health costs or benefits, which is the focus of our paper.

2 Welfare system in the UK

The UK Welfare Reform Act of 2012 legislated for Universal Credit (UC), a major reform aimed at simplifying the welfare system by replacing six means-tested benefits and in-work tax credits into one benefit. This reduced the administrative burden to applicants and welfare offices. Whilst previously benefit applicants would have to navigate different government departments and apply for benefits via telephone or paper forms, under UC claimants make one online application.

2.1 Legacy

UC replaced the former benefit system known as the legacy system. The legacy system is common in most OECD countries, whereby a set of benefits exist for different purposes. Individuals claim separately for each benefit they are eligible for including housing benefit, income-based jobseeker's allowance (JSA), income-related employment and support allowance (ESA), income support (including support for mortgage interest), child tax credit and working tax credit.[7] See Appendix Section 2.1 for details. In general a benefit payment under the legacy system was made every 1-2 weeks to the individual claimant, except in the case of housing benefit which was paid to the landlord.

[6] Department for Work and Pensions (2014) found that 69% of UC claimants found a job between making their claim six months later compared to 65% of legacy claimants.

[7] Other benefits not included in the reform include disability living allowance, contribution-based JSA, contribution-based ESA, carer's allowance and child benefit.

2.2 UC Roll-out

The implementation of UC roll-out is managed by the Department of Work and Pensions (DWP). The welfare reform required substantial changes in the technology of processing welfare payments and as such UC was rolled out across local authorities slowly across time.

Figure 1 demonstrates the national expansion of the UC roll-out coverage between April 2013 and December 2018. The figure shows that by April 2013 the "Pathfinder" areas had incorporated UC into their welfare systems. There followed a quick expansion across 2015 and by the end of 2018 all local authorities in the UK had rolled out UC.

2.3 UC Eligibility

Whilst the roll-out of UC took place between 2013–2018, individuals living in a UC roll-out local authority would become eligible for UC only if their housing or employment circumstances changed and they satisfied eligibility criteria.[8] From the initial roll-out, individuals have to satisfy the following 'gateway' conditions. Individuals were eligible to claim UC if they resided in a roll-out area, had a change to their employment or housing circumstances, were single with no partner or children and were aged 18–60, with no or low income (under £270 (or £330) per month if under (or older than) 25 years old), not self-employed, not in education or homeless, had savings no higher than £16,000 and if they accepted a 'claimant commitment' to work-related requirements.[9]

These conditions were changed in the following years to expand the coverage of UC whereby couples without children became eligible from July 2014 and households with children from January 2016. In our analysis, we exploit the regional roll-out variation for our identification, comparing two individuals with the same characteristics but unemployed under two different policy regimes. Analysis is run separately across household composition and consequently for identification, we exploit the geographical variation in roll-out rather than the policy variation related to individuals' traits.

[8]This strict condition allowed DWP to prevent a rush of applicants transferring from the legacy system to UC within a local authority.

[9]See Section 2.4 for the detailed information.

As of July 2019, the UK government planned a "managed migration" where all benefit claimants would be moved to UC. A pilot was initiated in Harrogate, Yorkshire, postponed in March 2020 due to COVID but re-started in June 2022. The current plan is to have UC as the only welfare system in the UK by 2024.

2.4 UC rules as potential mechanisms

Whilst the overall objective of UC was to align six benefits into one, in practice UC was implemented along with several other individual policy changes, which will feature in our analysis estimating the mechanisms for the treatment effect on mental health.

A first mediator measures the extent to which UC reduced the administrative burden of applying for benefits - a primary aim of UC. The greater the number of benefits an individual is entitled to, the larger the potential improvement in mental health from moving to UC versus legacy.

Second, UC aimed at strengthening incentives to work and a movement out of the benefit system in part through a change in benefit income. The overall expectations were that the total benefits paid out would increase through UC as more individuals claim for their full benefit entitlement with one benefit application compared to several applications under the legacy system. Yet, there were distributional changes in benefit income received by different groups of individuals, designed to strengthen incentives to work where these were previously weakest, including low income households (Brewer and Hoynes 2019). For example, employed couples received the greatest increase in benefits and single parents received the greatest loss. In practice therefore, for some UC claimants, benefits would fall under UC compared to legacy system whilst for others would rise.

Third, there is a possibility that UC created financial difficulties in paying bills due to three sub-policy rules. There is a wait of at least five weeks between the UC application and receipt of the benefit which compares to 1-2 weeks under legacy. From the initial pilot, DWP learnt that the delay in benefit payments led claimants to struggle to pay their bills and so from April 2014, claimants could apply for a loan (known as a UC advance) to cover their bills or living expenditures until their first payment was received. The advance is paid off across the subsequent 12 months, taken directly from the welfare payment. A further

change under UC was payment of housing benefits to the claimants rather than under legacy straight to the landlord. A consequence of these rules of UC was an increase in financial debt. According to Windle and Martin (2019) "76% of claimants on Universal Credit are behind on their rent payments, with just 24% not in some form of rent arrears" whilst Reeves and Loopstra (2021) found a correlation between universal credit uptake and food bank usage. An unintended consequence of the UC reform therefore was an increased financial difficulty which may induce mental health problems.

Fourth, the "claimant commitment" under UC stipulated an intense job search criteria for either claimants out of work, receiving a low income or working just a few hours. To claim UC, individuals including non parents or single parents of a child aged three or over (or five or over for before April 2017) were expected to meet the *full work-related requirements* which consist of actively spending 30 hours per week on job search. Upon being offered a job, claimants were obliged to accept if they were unemployed, or the job increased their work hours and earnings for those already working. These activities were supported and monitored by an assigned work counsellor.[10] Failure to adequately meet this work-related commitment without acceptable reasons resulted in benefit sanctions (non-payment) - although note that the specific policy of sanctions applied across both the legacy and UC systems (see Williams 2021). The severity of the sanctions varied across the work requirement missed. The lowest level of sanction would prohibit benefits until a missed work-related meeting with the work counsellor had taken place; whilst a highest level stopped benefits for 3 months, for example if a job offer was not taken up.

Finally we measure whether UC induced individuals who were unemployed to exit the welfare system without claiming any benefits. There are three possible reasons why welfare exit may increase under UC compared to legacy. UC digitalised the benefit application process which caused problems firstly if claimants did not have a smartphone or computer but also due to the common IT issues which delayed a new claimant's application. In a survey of UC claimants, 30% of participants had made more than 10 calls to the helpline to

[10]Several UC claimants with specific conditions can be exempted from the *full work-related requirements* if they have one of the following conditions: no sufficient ability for work or work-related activities, eligible for pension credit, pregnant and within 11 weeks of the due date, caring responsibility for a severely disabled individual or an under-one year old child, students who are aged under 21 without parental support and have a student loan or grant which will be deducted from the benefit payment, students who are in a couple and have a student loan or grant which will be deducted from the benefit payment, or a victim of domestic violence (would be given a 13-week duration of work-related requirement exemption).

solve problems such as a delay or reduction in their payment, an error in their payment or difficulty navigating the system (Foley 2016). Second, the strict rules associated with the work commitment may mean that some individuals who were not able to fulfil the job search intensity requirements would face sanctions in the short-run and choose to exit. Finally, individuals were eligible for UC only if their household savings were below a threshold of £16,000 which may cut off the benefit system to more wealthy individuals. This criteria was absent in many of the legacy benefits where, for example eligibility for Job Seekers Allowance states that household savings will not affect the claim.

The policy rules of the administrative burden of being unemployed, income, problems with bills, leisure satisfaction and welfare exit will be three mediators through which the treatment effect (unemployed whilst eligible for UC versus legacy) may affect mental health of claimants.

3 Data

The main data source is the UK Household Longitudinal Study (UKHLS), matched with detailed administrative data on the roll-out of UC. The UKHLS is a large and nationally representative panel survey which replaced the former British Household Panel Survey (BHPS). Our study uses a panel sample of UKHLS including waves 1 (2009–2011), wave 2 (2010–2012), wave 3 (2011–2013), wave 4 (2012–2014), wave 5 (2013–2015), wave 6 (2014–2016), wave 7 (2015–2017), wave 8 (2016–2018) and wave 9 (2017–2019). This survey design is suitable for evaluating the effect of UC, which rolled out between 2013–2018. Each UKHLS wave contains information including socio-economic and demographic status, health, employment and social benefits of about 40,000 households across the United Kingdom.

Because the strict age condition for claiming UC is between 18 and 60, our main sample is constructed based on an unbalanced panel sample of working-age individuals aged 18–60. To investigate if the treatment effect of being eligible for UC on mental health among newly unemployed individuals is heterogenous across household composition, we separate our total sample into different subgroups for the analysis: single adults, lone parents, couples without children and couples with children in each survey wave.

Our total sample consists of 199,563 individual-year observations aged 18–60 in which there are 49,571 individuals and on average one individual appears in 6 UKHLS waves. Other subsamples include 54,326, 15,457, 72,733, 57,047 individual-year observations for single adults, lone parents, couples without children and couples with children. Table 1 presents summary statistics of key variables for the total sample (column (1)-(2)), for the sub-samples defined by household composition (columns (3)-(6)). In the following sub-sections, we report details construction of key variables in the analysis.

3.1 Eligibility for UC

Across time eligibility to UC varied across region and across a set of criteria linked to individual traits. An indicator for living in a UC roll-out area is constructed from administrative data containing the year and month of UC roll-out across the local authority districts based on the information released by the Department for Work and Pensions and the UK Parliament (see Department for Work and Pensions 2018; House of Commons Library 2018). This data is merged into the UKHLS sample based on indicators for the local authority district along with the interview month to define eligibility in the specific month that we observe individuals.

Individuals are eligible for UC if they live in a roll-out area and satisfy some gateway conditions. Initially only non-cohabiting adults with no children were eligible but from July 2014 (January 2016) couples without children (couples with children) were also eligible, if they had no or low income, were not self-employed, in education or homeless and if their savings were below £16,000. Given this, eligibility for UC takes the value of 1 if an individual satisfies the following conditions and 0 otherwise:

- April 2013–June 2014: aged 18–60, living in an UC area, single with no children in the household, not self-employed or a fulltime student;
- July 2014–December 2015: aged 18–60, living in an UC area, single with no children or couples without children in the household, not self-employed or a fulltime student;
- January 2016–May 2019: aged 18–60, living in an UC area, not self-employed or a fulltime student.

Note that we implicitly include the remaining criteria of having "no" income in our analysis. Our parameter of interest is the interaction between unemployment and UC eligibility and the unemployed report zero labour market income. Whilst savings are not directly observed in the dataset, the eligibility criteria linked to savings does enter our mediator analysis where we estimate the treatment effect on welfare exit - whereby individuals are unemployed but not in receipt of benefits. In this analysis we discuss that welfare exit may occur for reasons including because their savings are too high.

We combine the eligibility variable with an indicator for unemployment in a panel data model across individuals, to identify the effect of unemployment whilst satisfying the eligibility criteria for UC in the same month of the survey.

Table 2 shows the status of UC eligibility across the years in our sample. The proportion of individuals eligible for UC is zero for the years prior to the welfare reform in 2013. The UC roll-out started in 2013 and 2014 in several pilot areas, reflecting low eligibility of 0.1% in 2013 and 1.5% in 2014 for the total sample and 0.3% in 2013 and 2.3% in 2014 for single adults and 2% in 2014 for couples without children. Across time, the UC criteria expanded to include households with children and reached more areas, such that eligibility for UC increased to 80% in the total sample by 2019. For the latter group of couples with children, almost all areas were rolled out to UC at the same time. For this reason, we will not identify the policy effect through a staggered roll-out but by a policy being switched from off - to on.

3.2 Mental health

The UKHLS 12–item General Health Questionnaire (GHQ–12) is used to construct the score of mental health (Jackson, 2007). The GHQ–12 provides short self-reported measures of mental ability in a non-clinical setting with several scores given to specify the severity of symptoms of anxiety, mental illnesses and depression. The measures have been used in economics research (for example Baird et al. 2013) and validation studies have shown that the GHQ generates measures of psychological distress which has a large association with mental disorders (Jackson, 2007).

In the UKHLS data, the GHQ–12 asks the participants experience of the following 12 conditions: *lack of concentration; loss of sleep; playing a useful role in life; being capable*

of making decisions; constantly under strain; problem overcoming difficulties; enjoy day-to-day activities; ability to face problems; unhappy or depressed; losing confidence; believe worthless; and general happiness. For each component, the respondents respond with a four-point Likert-scale from 1 to 4, in which a higher number represents a poorer status of that mental health component.

For example, the question which is used to measure the mental ability of the *concentration* component is: *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*. Meanwhile, the question used to elicit the information about *loss of sleep* is: *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*. See Appendix Table A.1 for details on the four possible answers for each component.

We use factor analysis to construct a continuous score for mental health.[11]. Using factor analysis allows us estimate a latent variable for mental health by combining information on each of the 12 scores which each measure mental health with error. Section A.2 provides details on the factor analysis and Table A.2 reports the factor loadings of the 12 mental health measures. The reference loading is based on *concentration* with a fixed score of 1. Among estimated coefficients, *unhappy and depression* has the highest loading with a score of 2.18 whilst *capable of making decisions* has the lowest factor loading of 0.83.

A higher mental health score represents better mental health and in the analysis the score is standardised to have a mean of zero and a standard deviation of one. Table 1 reports the mean mental health score in the full sample of 0, single adults and lone parents have a negative score (-0.079 and -0.169) and couples without or with children have a positive score for mental health (0.057 and 0.048).

A second measure of mental health is a binary variable which measures psychiatric problems including severe depression or anxiety. Tseliou et al. (2018) suggest coding each of the 12 answers to the GHQ-12 to take the value of 0 for an answer indicating the condition was experienced not at all or the same as usual and 1 otherwise. The study showed that a score

[11]Aggregating the score by summing across components creates measurement error (Brown et al. 2018; Hausman et al. 1998).

of 4 or higher across the 12 conditions was highly related to prescription data for stress, anxiety or depression. Table 1 reports that 18% of the total sample experience poor mental health, with higher values for single adults or lone parents at 21-24% compared to couples.

3.3 Unemployment

To construct a measure of unemployment, we rely on the following question asking the UKHLS respondents about their current economic activity.

Which of these best describes your current employment situation? (1) Self employed; (2) In paid employment (full or part-time); (3) Unemployed; (4) Retired; (5) On maternity leave; (6) Looking after family or home; (7) Full-time student; (8) Long-term sick or disabled; (9) On a government training scheme; (10) Unpaid worker in family business: (11) Working in an apprenticeship; (97) Doing something else.

An indicator for unemployment takes a value of 1 if the answer for the above question is *(3) Unemployed* and 0 otherwise. From Table 1, 6.5% of the total sample are unemployed. The rates of unemployment are larger among single adults and lone parents (10.2-12.7%) than couples without or with children (4.1-4.3%).

Figure 2 illustrates the evolution of mental health for unemployed and employed across 2009 to 2018, plotted along with the rate of UC roll-out. For the whole period, the employed have better mental health than the unemployed. While the mental health scores for the employed are highly stable, there is a decline in the mental health of the unemployed across the whole period. Estimating the slope coefficient of mental health across time suggests the decline in mental health for the unemployed group is stronger in the post-UC period of 2013-2018 (at -0.499) compared to the pre-UC period of 2009-2012 (where the coefficient is -0.334). Descriptively, this suggests a mental health deterioration of unemployed individuals associated with the UC roll-out.[12] In the paper, we examine the causal effect of the UC roll-out on mental health of unemployed individuals.

[12]Figure A.1 contains the corresponding graphs for subgroups and show similar patterns except for couples with children - for whom there is an improvement in mental health of unemployed.

3.4 Mechanisms

We consider six potential mechanisms for the differential effect of UC versus legacy on the mental health of unemployed individuals. The potential mediators through which eligibility to UC exacerbated or mitigated the mental health effects of becoming unemployed are given by the different policy rules explained in Section 2.

Administrative burden. UC simplified the benefit application process by aggregating applications for up to six legacy benefits into one UC claim. A variable for the number of benefits claimed is calculated as a proxy for the administrative burden, by summing up all benefits the respondents take at the survey time. This includes UC and legacy benefits as well as additional benefits including disability allowance and carers allowance.

Benefit income. UKHLS participants report monthly income received across the full set of UK benefits. Because benefits under UC were calculated at the household level, benefit income is measured as the log of the full set of household benefits. These are measured in GB 2010 prices.

Household income. Compared to the former system, UC changed the claimants' household income directly and through changes in benefit income including from increased deductions from any earnings. Household income is measured as the contemporaneous monthly net income from the labour market and all other sources taking away any taxes, deductions and benefits. Log household income is measured in GB 2010 prices.

Problems paying bills. UC has been shown to create financial difficulties for claimants due to policies including payment of housing benefits to the claimant rather than the landlord and offering a loan whilst waiting for the first benefit payment, which was taken from subsequent benefit payments. An indicator for problems paying bills is taken from the following question.

Sometimes people are not able to pay every household bill when it falls due. May we ask, are you up to date with all your household bills such as electricity, gas, water rates, telephone and other bills or are you behind with any of them?. The potential answers included *(1) up to date with all bills; (2) behind with some bills; (3) behind with all bills.* We construct an

indicator for problems paying bills which takes the value of 1 if the answer for the above question is (2) or (3) and 0 otherwise.

Leisure satisfaction. To claim UC, unemployed individuals had to engage in intensive job search of 30 hours per week. We proxy for this increased time constraint with a measure for satisfaction with leisure time taken from the following question.

Describe the satisfaction with the amount of leisure time you have: (1) Completely dissatisfied; (2) Mostly dissatisfied; (3) Somewhat dissatisfied; (4) Neither satisfied nor dissatisfied; (5) Somewhat satisfied; (6) Mostly satisfied; (7) Completely satisfied. An indicator for leisure satisfaction takes the value of 1 if the answer for the above question is (5), (6) or (7) and 0 otherwise.

Welfare exit. As described above, UC claimants may be more likely to exit the welfare system when unemployed either because they found the application process and strict criteria hard to manage, or because their savings were too high to be eligible. We define welfare exit as an indicator which takes the value of 1 if an individual is unemployed but not claiming any benefits and 0 otherwise.

Table 1 reports summary statistics for mediators for the total sample and sub-samples by household composition. Monthly benefit and household income is £404 and £3143 in the total sample and on average individuals claim 0.651 benefits. 7.3% (37.2%) of the total sample experience bill problems (are satisfied with their leisure time) respectively. Finally 2.6% of the total sample are unemployed and not claiming benefits - our definition of exiting the welfare system.

3.5 Control variables

Our research question estimates the differential effect of being unemployed on mental health, across the UC versus legacy benefit system. The benchmark controls are linked to the time-varying eligibility criteria of UC. We include as controls age, age squared, an indicator for cohabiting with (at least one) other adult, an indicator for having a child, an indicator for being a full-time student and for being self-employed.

In sensitivity analysis, we add two more controls. The first additional control is an indicator for having a previous mental disorder which is constructed using a question asking whether the individual had a depression problem in the past from the UKLHS data.

Second, highest educational qualifications are classified into several categories which are used for constructing dummies for the highest educational levels including higher degree (any degree beyond a bachelor's degree), first degree (an undergraduate degree), higher diploma (a level 2 qualification on the Regulated Qualifications Framework), A-level (Advanced-level set of qualifications which are typically taken at age 18) and GCSE/O-level (the GCSE level is the General Certification of Secondary Education which is a higher level set of qualifications which are typically taken at age 16 and the O-level is the Ordinary level is a subject-based qualification conferred as a component of the General Certificate of Education).

The average age of the individuals across all waves of our sample is nearly 40 years old. Whilst 65% of the total sample are cohabiting, 36% have a child, 5.9% are full-time students and 8.8% of the sample are self-employed.

4 Methodology

4.1 Estimation of the treatment effect

UC was exogenously rolled out across regions and time. Within roll-out regions individuals claiming benefits were eligible for UC only if their circumstances - such as employment status - changed. We estimate whether the mental health effects of unemployment are different for individuals living in a UC versus a legacy region to understand whether UC exacerbates or mitigates mental health problems associated with being unemployed. Our panel data model will include fixed effects for region and time to exploit the exogenous roll-out of UC; and individual fixed effects to identify individuals changing their unemployment status across time.

For mental health outcome Y_{idt} of individual i, living in local authority district d and observed in year t, we run the regression

$$Y_{idt} = \alpha_0 + \alpha_1 U_{idt} + \alpha_2 D_{idt} + \alpha_3 U_{idt} \times D_{idt} + \boldsymbol{\alpha}_4 \boldsymbol{X}'_{idt} + \phi_i + \phi_d + \phi_t + \epsilon_{idt} \quad (1)$$

where U_{idt} is a dummy variable indicating whether the individual is unemployed and D_{idt} is a dummy variable which takes the value 1 if the individual meets the eligibility criteria of UC and 0 otherwise.[13]

Welfare programmes should in principle reduce mental health effects of becoming unemployed by providing income support and job search assistance. To understand whether UC mitigates or exacerbates the mental health effect of being unemployed, we include an interaction term between being unemployed and eligibility for UC denoted $U_{idt} \times D_{idt}$. The coefficient α_3 - our parameter of interest - is the differential effect of unemployment under UC compared to the legacy benefit system on the individual's mental health.

In the estimation model, we include fixed effects for the individual, local authority district and year, denoted by ϕ_i, ϕ_d and ϕ_t, respectively. This leads interpretation of the coefficient on the interaction between D_{idt} and U_{idt} to be within-individuals, within-district and across time. This means that the variation for identification in a triple difference setup is interpreted as comparing two individuals who are unemployed within the same region but at a different period, so that in the one case the individual is eligible for UC and in the other region they are eligible for legacy.

$\boldsymbol{X}'_{idt}$ denotes the set of covariates in our model, including age, age squared, indicators for cohabitation, presence of child, full-time education and self-employment status. These controls reflect the time-changing eligibility criteria of UC.[14] ϵ_{idt} is an error term assumed to have conditional mean zero. We cluster the standard errors at the local authority district level - the level of the treatment variation.

The coefficient of unemployment (α_1) estimates the change in mental health from unemployment, but is not likely to be causal given the possibility of entering unemployment due to reasons related to their mental health. Therefore, in our analysis we will interpret α_1 descriptively. Instead, the purpose of our analysis is to estimate whether the UC welfare reform can affect the mental health effect from unemployment. Even if the cause of unemployment is endogenous, the exposure to UC versus legacy is not, due to the staggered roll-out of UC

[13]Eligibility for UC is defined in Section 3.1 and takes the value of 1 if the individual lives in a roll-out region and meets the eligibility criteria in that time period.

[14]Because we estimate the differential effect of unemployment across the welfare systems, individual characteristics should not bias our result if the roll-out of UC was exogenous. To reassure that this is the case, we include further controls in a sensitivity analysis of section 4.1.1 including gender, prior mental health problems and education; and a further sensitivity analysis drops all controls X.

across time and local authority districts as discussed in Section 2.2 and validated in Section 4.1.1. Hence we can interpret the differential mental health effect across the welfare systems as a causal treatment effect.

We allow the treatment effect to vary across household type defined as single adults; lone parents; cohabiting couples without children and cohabiting couples with children. This is important for two reasons. Firstly the differences in policy rules under UC versus legacy varied across household type where for example single adults or married couples may expect a benefit income cut or increase respectively. Second, for any change in policy rules from the welfare reform, the insurance possibilities within households to protect mental health will vary according to the presence of another adult and/or children within the households, leading to potentially heterogeneous effects on mental health.

4.1.1 Validity of identification strategy

Our identification strategy assumes that the staggered roll-out across local authority districts is exogenous. To show that the timing of roll-out is not related to local characteristics, Table A.3 reports results from a regression of district level characteristics against the month and year of the local authority roll-out. Local characteristics from the 2011 UK censuses include demographic information on ethnicity, labour market attachment, marital status and health of the local population and local labour market conditions.[15] These measures are aggregated at the local authority district level. Table A.3 shows that the date of UC roll-out is not correlated to these local characteristics. In column 10, when we regress the UC roll-out date on all of these characteristics in one specification, we find that all coefficients for these characteristics are individually statistically insignificant and we reject joint significance of the variables. These findings support our hypothesis that the timing of UC roll-out is exogenous to local socio-demographic characteristics which may be linked to the mental health of local people.

One further possible threat facing our research design is selection into or out of unemployment as a consequence of UC roll-out. For example if individuals felt that the UC

[15]We use local job density as a proxy for local labor market conditions. This variable is measured as the number of available jobs per working-age resident, based on official statistics within a local authority district. For example, a job density of 1.0 indicates one job for every working-age resident. A higher job density suggests better conditions in a district's local labor market.

benefit system was more draconian they may have taken steps to avoid unemployment. We test whether this is true in Table A.4, by regressing a dummy variable for living in a UC roll-out area and the benchmark control variables on an indicator for being unemployed. If individuals selected out of unemployment as a consequence of UC, we would find a positive coefficient on the variable "Living in UC area", however instead our results show that there is no link between living in UC roll-out area and unemployment for the entire sample as well as various subgroups (single adults, lone parents, and couples without or with children). To further check whether there is any structural shift in the household compositions of unemployed individuals across UC roll-out, for example if lone parents whose benefit income on average fell under UC had stronger incentives to remain employed, whilst couples with children would receive higher benefit income under UC, we consider how the composition of unemployed individuals across the different groups reacts to UC roll-out. Figure A.2 confirms a stable representation of the single adults, lone parents and couples without and with children amongst the unemployed, comparing the post-UC years (year 0 and 1) relative to the pre-UC years (year -3,...,-1).

Recent research has highlighted a potential bias in estimating treatment effects from a staggered roll-out by using a two-way fixed effect model (see Borusyak et al. 2024; Callaway and Sant'Anna 2021; De Chaisemartin and d'Haultfoeuille 2020; Goodman-Bacon 2021; and Sun and Abraham 2021). A bias is possible as the DinD estimator estimates the weighted sum of the average treatment effects for each region and year and these weights may be negative.

In our case, across time different groups of individuals were eligible for UC - starting with single adults from the pilot study and extended first to couples with no children and finally to households with children. We undertake our analysis separately for each of these groups of households specifically in order to identify treatment effect heterogeneity.

But even within group we exploit a staggered roll-out. We follow the principles of Callaway and Sant'Anna (2021) and implemented by Lundborg et al. (2022) which is to estimate our benchmark model separately according the date the regions first implemented UC.

4.2 Mechanisms for the estimated treatment effects

Whilst estimation of the total treatment effect is important, future policy reform in the UK and in other countries will rely on identifying the "effect of the cause" (Gelman and Imbens, 2013). Which aspects of a welfare reform help attenuate and which exacerbate mental health effects of becoming unemployed? Our framework will estimate the causal effect of the welfare reform on six mediators reflecting the UC sub-policy rules, to understand the mechanisms behind the treatment effect estimated across the household demographics. The mediators include log benefit income, log household income, the administrative burden of the benefit application, difficulties paying bills, satisfaction with leisure time and exit from the welfare system when unemployed.

4.2.1 Effect on mediators

We estimate the causal treatment effect on mediator M^k_{idt} for individual i in district d and time period t, where $k = 1, .., 6$, by estimating the benchmark equation 1 with mediator M^k_{idt} as dependent variable. We can identify the causal treatment effect on each mediator under the same identification assumptions as equation 1 by estimating the following equation:

$$M^k_{idt} = \beta_0^{M^k} + \beta_{UD}^{M^k} U_{idt} D_{idt} + \boldsymbol{\beta}_Z^{M^k} \boldsymbol{Z}'_{idt} + \nu^k_{idt} \tag{2}$$

where $\nu^k_{idt} = \omega^k_i + \omega^k_d + \omega^k_t + e\prime^k_{idt}$ summarises the fixed effects at the individual, local authority and year level and the error term respectively.

An exemplar of the identification strategy estimating the effect of welfare reform on each mediator is to compare two individuals who enter unemployment within the same region but at different periods. Imagine they would be eligible for the same set of benefits, say job seekers allowance and housing benefit under the legacy system. The individual living in a UC roll-out area will make one benefit claim less, receive a different level of benefit payments and may experience more or less problems paying bills for example compared to the individual eligible for legacy benefits.

4.2.2 A descriptive mediation analysis

A natural next question asks to what extent our estimated treatment effect is explained by these mediators. Without exogenous variation in the mediators we interpret this analysis as descriptive analysis useful to understand the mechanisms behind the estimated treatment effects.[16]

We augment our model in Equation 1 with each mediator and its interaction with D_{idt}, estimating the following equation:

$$Y_{idt} = \beta_0^Y + \beta_{UD}^Y U_{idt} D_{idt} + \beta_{M^k}^Y \mathbf{M}_{idt} + \beta_{M^k D}^Y \mathbf{M}_{idt} D_{idt} + \boldsymbol{\beta}_4 \boldsymbol{Z}'_{idt} + \zeta_{idt} \tag{3}$$

where M_{idt}^k presents mediator k for individual i living in local authority district d in year t. $Z = U, D, X$ and the error term $\zeta_{idt} = \psi_i + \psi_d + \psi_t + \epsilon\prime_{idt}$ where ψ_i, ψ_d, ψ_t respectively denote the individual, local authority district and year fixed effects whilst ζ_{idt} is the error term. The set of control variables $\boldsymbol{X}$ is the same as equation 1.[17]

To decompose the α_3 in equation 1 - the "total" treatment effect, consider a change in treatment status from 0 to 1 which coincides with a change in eligibility for UC if unemployed from 0 to 1. The aim is to decompose the total effect of universal credit on mental health of newly unemployed given by the coefficient α_3 in equation 1 into the direct and indirect effects, calculated by combining equations 2–3.

The direct (or mediated) effect is the effect of treatment holding constant the mediators at the untreated level (m_0^k) and is given by the following equation

$$DE = E[Y(d_1, m_0^k) - Y(d_0, m_0^k)|Z] = \beta_{UD}^Y + \beta_{M^k D}^Y (\beta_0^{M^k} + \beta_{UD}^{M^k} + \beta_Z^{M^k}) \tag{4}$$

The indirect effect through mediator k is allowed to be heterogeneous across the treatment status and is the effect through a change in mediator k from the untreated to the treated levels (from m_0^k to m_1^k), holding constant treatment at the untreated level.

[16] See Celli et al. (2019) and Huber (2019) for reviews of causal mediation analysis.

[17] Adding the interactive terms with D_{idt} allows the indirect effects of each mediator to be heterogeneous across eligibility to UC, as suggested by VanderWeele and Vansteelandt (2009) and Deuchert et al. (2019). In our case setting for example, the treatment effect coming through the income channel may vary across the UC eligibility, due to the benefit payments for council tax and housing benefit being paid to the claimant rather than the council or landlord.

The indirect effect is calculated by combining equations 2–3 and using the following formula:

$$IE = E[Y(d_0, m_1^k) - Y(d_0, m_0^k)|Z] = (\beta^Y_{M^k}\beta^{M^k}_{UD}) + (\beta^Y_{M^kD}\beta^{M^k}_{UD}) \quad (5)$$

where the first term, $(\beta^Y_{M^k}\beta^{M^k}_{UD})$, represents the indirect effect through mediator k itself. The second term, $(\beta^Y_{M^kD}\beta^{M^k}_{UD})$, represents the differential indirect effect for UC claimants.

5 Results

5.1 Treatment effect on mental health

Did the UC welfare reform protect unemployed individuals from experiencing mental health problems? We report in Table 3, column (1) the parameters of interest from our benchmark model (equation 1) which are an indicator for being unemployed; an indicator for UC eligibility and an interaction between the two. The latter coefficient is our treatment effect and identifies the effect of an individual becoming unemployed whilst eligible for UC versus legacy benefits. The panel data model includes fixed effects at the individual, year and local authority district level and all regressions include a set of controls linked to eligibility. Because the groups of individuals eligible for UC changed across time, we report in columns (2)-(5) estimates for the sub-samples of single adults (not cohabiting with another adult, eligible from the pilot in 2013), lone parents (eligible from January 2016), couples without children (eligible since July 2014) and couples with children (eligible from January 2016).

The results in panel a) Table 3 reports the benchmark results for the continuous mental health factor. In order to understand whether the treatment drives individuals into experiencing mental health problems, we report also panel b) of Table 3 where the dependent variable is a binary indicator for poor mental health. The results show that as an individual enters unemployment, their mental health deteriorates by 14-22.9% of a standard deviation across the different samples (panel a) whilst the incidence of mental health problems increases by 5.9-8.9 percentage points (panel b). This is not a surprise and is consistent with the literature estimating poor mental health consequences of unemployment (see Björklund 1985; Hamilton et al. 1997; and Tefft 2011). Eligibility is defined as living in a roll-out area and satisfying the specific criteria for claiming UC. The results suggest lower mental health

for those eligible versus non-eligible for UC of 2.8-12% of a standard deviation (panel a) or increased incidence of mental health problems (panel b).

Moving to our parameter of interest, the negative coefficient on the interaction between unemployed and UC in columns (1)-(4) suggests that for all samples except couples with children, the UC system exacerbates mental health deterioration of unemployment, compared to the legacy system which is common to many welfare systems across the world. The differential effect of UC is to lower mental health by a further 13.9% for lone parents, 8.4% for single adults and 0.7% of a standard deviation for couples without children, although the latter coefficient is not statistically different to zero. Interestingly, for the sample of couples with children, whilst unemployment lowers mental health by 22% of a standard deviation, eligibility for UC attenuates the effect by improving mental health by 25% of a standard deviation relative to the legacy system.[18] These results are consistent in panel b of Table 3, which indicate that unemployment whilst eligible for UC raises mental health problems for lone parents, single adults and couples without children by 5.2, 2.7 and 2.8 percentage points respectively but reduces the incidence for couples with children by 9.4 percentage points.

There is clear heterogeneity in the treatment effects. Single adults and lone parents are the two groups without access to insurance either in the form of spousal income or support and we see an unintended consequence of the welfare reform is to exacerbate mental health problems from unemployment for these groups. For couples with no children the treatment effect is effectively zero whilst it is positive for couples with children. To understand why the estimates vary so much across household composition, we estimate the treatment effects on measures for the sub-policy rules of UC in Section 5.4.

Wickham et al. (2020) is the most comparable paper to ours and it is useful to assess the similarities in our estimates. In their paper, Wickham et al. (2020) showed that UC increased the prevalence of psychological distress among unemployed individuals by 6.6 percentage points (ppts) relative to employed individuals, using a difference-in-difference analysis (and controlling for country of residence, age, sex, education and marital status). Our analysis instead shows that individuals becoming unemployed under UC compared to legacy experience an increase in mental health problems by 2.8ppts on average, or up to 5.2ppts

[18]See Appendix Table A.5 for the full regression results which include both estimates for control variables for the benchmark estimates in panel a).

for lone parents. In our panel-data model we control for individual fixed effects which will remove potential confounders and may explain why our estimates are around half of the magnitude compared to Wickham et al. (2020). Combined with evidence from d'Este and Harvey (2024) that UC increased burglaries and vehicle crimes, we conclude that strengthening the economic incentive dimension of welfare systems can have substantial unintended negative consequences.

5.2 Persistence in effect

The estimates so far have expressed a negative contemporaneous mental health effect of UC for newly unemployed. The pilot analysis from the UK government suggested that UC did increase movement back into employment. In fact, we confirm that this is true for the full roll-out in Table A.6, which estimates the benchmark model but with the dependent variable as employment in the subsequent year following the initial spell of unemployment.[19] The estimates suggest there is some state dependence as those unemployed in period t are less likely to be in employment in period t+1. As the interaction between unemployment and UC eligibility is positive, UC does mitigate this relationship, with eligible more likely to move back into employment compared to the ineligible.

Given this, it is possible that the negative estimated mental health effects of UC fade-out as individuals re-enter the labour market. To see if this is true, we estimate the effect of unemployment whilst exposed to UC in an event study analysis. Figure 3 plots the coefficient of interest (i.e. the interaction between unemployment and UC) and their corresponding 95% confidence intervals on the indicator for poor mental health.[20] The estimates in year 0 represent the mental health differences for individuals newly unemployed in year 0 in UC compared to a legacy region; whilst in period -3 to -1 (+1) the coefficient represents the mental health differences for these two groups in the years before (the year after) the individuals became unemployed.[21]

[19]The sample size has fallen as for some individuals we do not observe a wave after the initial period of unemployment.

[20]See Figure A.3 which plots coefficients against the continuous measure of mental health - with very similar conclusions to poor mental health.

[21]The roll-out took place up to 2018 and the final wave of data is 2019 so we restrict the analysis to just one period post-unemployment.

The event study analysis for the total sample (panel (a)) shows that pre-unemployment, mental health for treated was not statistically different to that of the untreated. This is true for single adults (panel b), lone parents (panel c), couples without children (panel d) and couples with children (panel s). The increased incidence of poor mental health effects in the year of unemployment persist to subsequent year for the total sample, single adults and lone parents, although the estimates are imprecisely estimated for the latter group. The evidence suggests for the single adults and lone parents, even with an increased transition back to employment, the negative mental effects of UC persist.[22]

5.3 Sensitivity and heterogeneity

In this section we test for the sensitivity of our benchmark estimates to the assumptions of treatment effect homogeneity across time in the staggered roll-out; and to the sensitivity of the set of controls. We include gender heterogeneity analysis and finally examine the consequence of household composition changing across time. The results are reported for the continuous mental health measure, but available on request for the discrete measure picking up mental health problems.

Our identification of the differential effect of unemployment on mental health caused by the welfare reform comes from a staggered roll-out across regions. Estimating a two-way fixed effect by including fixed effects for time and region can result in biased estimates if there is treatment effect heterogeneity across the years of roll-out.[23] The difference-in-difference estimator will calculate a weighted sum of the average treatment effects (ATE) in each region and year with weights that may be negative.

Callaway and Sant'Anna (2021) propose analysis of the ATE parameter which varies across groups defined by the date first treated. In Table A.7 we compare estimates separately across early, late roll-out regions and excluding both early and late implementers. In all

[22]Ideally additional data collection would enable analysis further into the future, however as COVID occurred in 2019 isolating longer run mental health effects from the UC roll-out compared to COVID is not possible.

[23]See Goodman-Bacon (2021), De Chaisemartin and d'Haultfoeuille (2020), Callaway and Sant'Anna (2021), Sun and Abraham (2021) and Borusyak et al. (2024).

specifications the estimated treatment effects are similar to our benchmark estimation. We conclude that our estimates are not biased by treatment effect heterogeneity.[24]

To understand how sensitive our results are to the control variables and assess the validity of our strategy, panel a) of Table A.8 excludes all covariates from the analysis. The intuition behind this sensitivity analysis is to understand whether the controls included respond to the eligibility status and therefore confound the benchmark estimates. The results reported in the table are very similar to the benchmark estimates and our conclusions remain. In panel b) of Table A.8 we widen the set of controls in the model beyond the eligibility criteria, to include the incidence of a prior mental health disorder, highest educational qualifications and gender. Omitting these controls should not induce a bias in our estimated treatment effect, which identifies the differential effect of unemployment across the two welfare systems, as long as the roll-out of UC was exogenous. Indeed, including the additional controls leads to results similar to the benchmark.

In the benchmark analysis, eligibility to UC depends not just on the roll-out date but also on a set of eligibility criteria. To ensure that our results are not driven by the latter, panel c) of Table A.8 estimates the benchmark analysis for a sub-sample in which we exclude those who do not meet the UC eligibility criteria including self-employed individuals and fulltime students. The estimates are very similar to the benchmark estimates.

To check whether our treatment effect is driven local labour market conditions which potentially vary across the years, panel d) of Table A.8 includes local job density into the set of control variables. Local job density is measured as the yearly number of jobs per resident aged 16-64 in the local authority district and therefore a good proxy for local market conditions. Our estimates for this exercise are nearly identical to the benchmark estimates.

It may be that the treatment effect of UC on mental health differs across gender. Table A.9 interacts the variables unemployed, eligibility for UC and the interaction with a male dummy. The results suggest that he negative mental health effects for singles and lone parents - and the positive effects for couples with children - are greater for men than women. The precision of these estimates are low, and only the latter interaction for couples with

[24]The coefficients on the indicator for unemployment and for eligibility are also not statistically different across the panels, compared to the benchmark specification.

children is statistically significant but may still indicate that men are more vulnerable to negative mental health effects from welfare reform.

Finally, we define household composition within each wave but it is very likely that this definition changes across wave. If a household changes the status, for example moving from a lone parent household to a couple with children, the baseline value of mental health will not be included in the within-subgroup analysis. In Table A.10 the sample is restricted to those households who do not change their status in between the wave pre- and post-rollout of UC. Reassuringly, the estimates are very similar to our benchmark suggesting that they are robust to the final sensitivity analysis.

5.4 Mechanisms

In this section, we estimate the causal treatment effect of the welfare reform on a set of mediators linked to the policy rules and run a (descriptive) decomposition analysis of the treatment effect of becoming unemployed and claiming UC on mental health into the direct effect and the indirect effects via sub-policies applied under the UK welfare reform. Can the specific policy rules of UC explain why for single adults and lone parents UC exacerbates - but for couples with children UC acts as a mediator to - the mental health effects of unemployment.

5.4.1 Causal treatment effect on mediators

The six potential mechanisms that we analyse come from the sub-policy rules enacted under the UC welfare reform. We measure the administrative burden of applying for benefits (measured by the number of benefits applications the claimant makes), benefit payments, net household income, problems paying bills (caused by move to monthly benefit payments and increased debt through loans and housing payments), leisure satisfaction (a proxy for the increased intensity of job search requirements) and an indicator for exiting the welfare system (owing to increased complexity of successfully claiming benefits or a lower savings eligibility threshold).

Under the assumptions that treatment is randomized across regions and time and the common trends assumption, we can identify the causal effect of exposure to becoming unemployed whilst eligible for UC (relative to legacy) on six potential mediators. Table 4 estimates the causal treatment effect of UC from the benchmark model equation 1, replacing the dependent variable with each mediator including log benefit income, log household income, administrative burden of receiving benefits, bill problems, leisure satisfaction and welfare exit in panels a)-f) respectively. The table reports the coefficient on the interaction term between unemployment and UC, identifying the differential effect of becoming unemployed under the UC versus legacy system for the samples of single adults, lone parents, couples without children and couples with children across columns (1)-(4) respectively.

UC was designed to reduce the administrative burden of applying for benefit applications and panel a) shows that for all groups the number of benefit claims made by newly unemployed individuals was lower under UC compared to legacy by between 0.057-0.398 applications. The coefficient is slightly higher for couples with children and all are statistically significant except for lone parents. UC therefore met it's aim of reducing administrative burden of benefit applications.

Brewer et al. (2012) estimate that the UC reform raises benefit income for a set of households including couples with children, but lowers income for those with weaker attachment to the labour market such as single adults or lone parents. This is partially reflected in our results. From panel b), comparing two individuals living in the same region but becoming unemployed under two welfare systems, benefit income is statistically significantly lower by 53.2% and 57% for single adults or couples with children, although not statistically different for lone parents or couples with children.

The mediating effect of UC on mental health through income should consider disposable household income because households with more than one working age adult have insurance possibilities against negative mental health effects of UC. For example the response to unemployment of one partner can be to increase work hours of the other partner. Indeed, panel c) result suggest that the treatment effect of unemployment whilst on UC for the individuals with a partner - couples without (column 3) or with children (column 4) - is to raise household income compared to the legacy system by 4.2% and 4.7% respectively. On the other

hand, for the more vulnerable households without access to intrahousehold insurance, unemployment whilst eligible for UC rather than legacy leads to lower household income by 15.9% and 2.3% for single adults and lone parents respectively, although the latter coefficient is not statistically significant. To confirm the idea of intrahousehold insurance through spousal labour supply, Table A.11 shows that for couples without and with children, a response of the focal individual becoming unemployed is for the partner to increase their weekly hours worked by 1.5-1.8 more under UC compared to legacy. The reduction in household income under UC for unemployed single adults and the increase for couples may partially explain the negative treatment effect of UC on mental health for single adults and the different treatment effects on mental health.

Due to the implementation of UC financial difficulties are likely higher under UC. This is borne out in panel d) which suggests that relative to the legacy system, UC increased problems paying bills of unemployed by 3.4 and 8.9 percentage points for single adults and lone parents respectively. These estimates are statistically significant at the 1% level. Again for the couples (either with or without children) we do not see the same increase in financial difficulty under UC compared to legacy, as the estimated coefficients are close to zero or negative.

An aim of UC was to incentivise claimants to move into sustained employment by increasing the job search criteria. Panel e) asks whether a potential mechanism for the negative mental health effects of UC was by lowering leisure satisfaction. For single adults the differential effect of unemployment under UC compared to legacy was to reduce leisure satisfaction by 3.1 percentage points (compared to the mean of 34%). These coefficients suggest a reduction (increase) in leisure satisfaction also for lone parents and couples without children (couples with children), although the estimates are not statistically significant.

Finally, there is evidence that the complexity of UC or the higher savings threshold for UC caused some individuals to exit the welfare system entirely. The final mediator in panel f) asks whether UC differentially caused welfare exit for newly unemployed individuals by estimating the treatment effect on the probability to be unemployed but claiming no benefits at all. Welfare exit rose for all groups to a greater extent under UC compared to the legacy system - by between 49.3 percentage points for couples with children to 15.1 percentage points for lone parents. To understand the magnitude of the estimate, compared to the mean in the

total sample, UC raised the probability of exiting the welfare system when unemployed from a mean of 26% for the total sample to at most 38% for couples with children. These estimates are large highlights some of the difficulties encountered through a digitalized welfare system which led individuals to leave the benefits system. In summary, the results suggest that the sub-policy tools of the implementation of UC can partially explain the large heterogeneity found in the treatment effects of UC on mental health.

5.4.2 Decomposition of the treatment effect

What proportion of the total treatment effect is explained by each mediator? Table A.12 reports the results from equation 3, estimating the treatment effect conditional on the mediators and benchmark controls. Columns (1), (2), (3) and (4) report the results across the samples of single adults, lone parents, couples without and with children respectively, for the conditional treatment effect of UC including the set of mediators of administrative burden, household income, bill problems, leisure satisfaction and welfare exit.[25] Because the variation in mediators may be correlated with mental health, we interpret this analysis as descriptive and use it to gain understanding of whether a policy rule is a positive or negative mediator for the effect of UC on mental health.

The indirect effect of UC through each mediator, given by equation 5, is calculated by combining effect of each mediator (and it's interaction with UC) on mental health from equation 3 with the treatment effect on each mediator from equation 2. Panel a) of Table A.13 reports the indirect effect in levels and panel b) the indirect effect as a percentage of the total effect estimated in Table 3. A negative (positive) indirect effect can be interpreted as the mediator worsening (improving) mental health.

We see from Table A.12 that an increase in the administrative burden of receiving benefits tends to lower mental health. For single adults and lone parents, the negative correlation with mental health is particularly pronounced for those eligible for UC whereas for couples with children the correlation is lower under UC eligibility compared to legacy. These results are combined with results in Table 4 for the decomposition analysis which suggests that

[25]We include household income rather than benefit income in this analysis, to reflect that any negative impact of UC on mental health in households with a working age partner may be mediated by the labour market response of the partner.

the reduced administrative burden from UC relative to legacy is a positive mediator which improves mental health. Table A.13 shows the positive improvement to mental health from the reduced administrative burden contributes the largest value towards the total effect for the single adults (0.032 or 38% of the total effect) and between 0.004-0.005 for other subgroups. The outlier here is the group of couples with children for whom UC eligible on average have a slightly positive coefficient from increasing the administrative burden on mental health - possibly because an increased number of benefit claims stems from eligibility to benefits not covered by UC such as child benefit.

From Table A.12, an increase in income raises mental health of all groups with the largest coefficient for lone parents. A 1% increase in household net income improves mental health by 1.6%, 7.8%, 2.6% and 4.5% of a standard deviation for single adults, lone parents, couples without and couples with children respectively. The contribution of the change in income towards the treatment effect is reported in Table A.13. Because household income fell under UC for single adults and lone parents and is positively correlated with mental health, in Table A.13 the indirect effect of UC working through income for these groups is to lower mental health by 0.002 and 0.001, which represents 2.38% and 0.72% of the total treatment effect respectively.

Table 4 revealed that compared to legacy, under UC unemployed couples without or with children received a *higher* level of household income. This means that, because income improves mental health for these groups, the indirect effect of income is to improve mental health by 0.002 and 0.003 (28.57% and 1.18% of the total effect) for couples without and with children respectively.

In Table A.12, as we would expect, having problems paying bills lowers mental health for all groups and the negative relationship is strongest for those eligible for UC in the case of single adults, lone parents and couples with no children. In these samples, individuals eligible for UC facing difficulties paying bills experience 12.4%, 8.8% and 9.8% of a standard deviation lower mental health respectively. For couples with children difficulties paying bills does not statistically significantly correlate with mental health. Combining these estimates with the treatment effect on difficulty paying bills in Table A.13, the mediator contributes an indirect effect of -0.008 or 9.52% and -0.013 or 9.35% for singles and lone parents respectively. For the couples without or with children on the other hand, because UC did not increase or,

in the latter case even decreased problems paying bills, the indirect effect if bill problems is zero or 0.79% making it a positive mediator in the latter sample.

Leisure satisfaction is associated with better mental health for individuals eligible for legacy, with a positive differential for UC eligible in the samples of lone parents or couples without or with children (Table A.12). This differential effect is potentially caused by the intensive job search requirements for UC. Combining these coefficients with the treatment effect on leisure satisfaction from Table 4, in Table A.13 leisure satisfaction contributes between -0.005-0.015 (or between 10-71%) of the treatment effect for single adults, lone parents and couples with children. Again leisure satisfaction seems to rise under UC for couples with children (Table 4) although not statistically significantly, leading leisure satisfaction to be a positive mediator.

The correlation between welfare exit and mental health of UC eligible single adults is statistically significant, suggesting mental health of UC eligible falls by 19.6% of a standard deviation (Table A.12). Combining the estimates with the treatment effect on the mediator from Table 4 tells us that -0.042 (50%) of the negative mental health treatment effect for single adults stems from the increased welfare exit, respectively. The indirect effect for lone parents is 0.003 (2.16% of the treatment effect) whilst for couples without and with children is -0.002 (28.57% of the treatment effect) and 0.018 (7.09%) respectively. For couples with children, welfare exit can be made more likely by higher household savings which protected the unemployed individuals from mental health effects which may explain why it is a positive mediator for this group.

The table reports also the direct effect, calculated via equation 4. The direct effect seems high as a proportion of the total effect. This is because some mediators positively and others negatively contribute towards the treatment effect. This is clearest for couples without children, where the positive mediators of income and administrative burden explain the same proportion of the total effect as the negative mediators of leisure satisfaction and welfare exiting, leading to a direct effect exactly equal to the total effect. For this reason, the direct effect does not provide much information. It is worth asking whether the mediators explain a reasonable proportion of the treatment effect. Often in such mediation analysis the mediators explain around 15-60% of the treatment effect (for example see Heckman and Pinto 2015, and Macmillan and Tominey 2023). Taking the sum of the absolute value of the

indirect effects, the mediators explain a minimum of 13% of the treatment effect for couples with children and a much larger proportion for the other groups.

In sum, for single adults and lone parents, UC did in part fulfill it's aim of simplifying the benefit system through a reduced administrative burden of the application process and this proved to improved mental health of newly unemployed, relative to the former legacy system. But this improvement to mental health was more than canceled out by the reduced income, increased difficulties paying bills, reduced leisure satisfaction and (for single adults) an increased likelihood of exiting the welfare system whilst unemployed. This explains why overall there is a negative mental health treatment effect for single adults or lone parents who enter unemployment under UC (relative to legacy).

For couples without children the treatment effect was negative but not statistically different to zero. Our results show that the positive mediators to mental health effects of UC of the increased income and reduced administrative burden or exit from the welfare system more or less balance with the negative mediators - the largest of which was a reduced satisfaction with leisure time. Finally we saw that unemployed couples with children experienced a large, positive treatment effect under UC relative to legacy, which is partially explained by a small increase in their household income combined with positive mediating effects of a fall in problems paying bills and welfare exit. Consequently, unlike the more vulnerable single adults or lone parents, couples are partially protected from the more draconian sub-policies of UC.

6 Discussion

In this section we consider how to interpret the magnitude of our estimated treatment effects, by benchmarking them against the wider literature, and consider how to compare estimates from the specific UK welfare reform to other international contexts.

6.1 Benchmarking estimated treatment effects against other policy reforms

Universal Credit was a welfare reform which we have shown increases the incidence of poor mental health for unemployed, amongst the more vulnerable groups of single adults and lone parents. We consider now the magnitudes of estimated treatment effects, and how these estimates compare to other studies which investigate the effect of different shocks which also reduce mental health. The two such shocks we consider are the 2008 financial crisis and the incidence of domestic violence - both which induce significant life trauma, which may be considered as an upper bound on any policy effect on mental health.

First, McInerney et al. (2013) found that the loss of wealth induced by the 2008 economic depression increased feelings of depression among older adults in the US, with an 8% increase for a loss of a large sum of money - $50,000 - for those with previous high values of stocks but statistically insignificant otherwise. Compared to the baseline incidence of depression, this represents an effect of around 50% of the mean. Instead, we find an increase in mental health problems for newly unemployed under the new benefit system of 2.8ppts (15% of the mean) for the whole sample and up to 5.2ppts (31% of the mean) for single parents. Given that we evaluate the change in a welfare system, rather than a large reduction in wealth, this suggests to us that we estimate a relatively large effect.

Next, Bhuller et al. (2024) estimate the effect on mental health from domestic violence. In their study, women who experienced domestic violence were 35% (compared to the mean) more likely to use mental health consultations compared to those without such experiences. Compared to this very traumatic life event, our estimates are lower but comparable, which indicates a real role for policy to help mitigate the mental health effects of unemployment.

On the other hand, our estimates point towards a mental health improvement for couples with children of 25.4% of a standard deviation or a reduction in the incidence of poor mental health by 9.4ppts. Whilst it is difficult to find studies which examine mental health effects for coupled men, a number of studies have found positive impacts on mental health for married women from policy reform. Evans and Garthwaite (2014) study the expansion of the Earned Income Tax Credit (EITC) in the US and find a 25% reduction in poor mental health days for married women with at least two children from a $500 per annum increase in the EITC.

Similarly, Boyd-Swan et al. (2016) find that the EITC expansion in 1990 led to significant improvements in mental health through a reduction in depression by 15.7% - slightly larger than our estimate in panel b) of Table 3 of 9.4ppts. Our treatment effect estimate for couples with children is larger than that estimated from the introduction of paid maternity leave in Norway, which led to a 10% of a standard deviation improvement in mental health index for women (Bütikofer et al. 2021).

6.2 Learning lessons for welfare reform outside of the UK

The UC reform changed many aspects of the welfare system simultaneously. This bears some resemblance to the US welfare reforms studied in Bitler et al. (2005), which concurrently tightened welfare eligibility - through financial sanctions, time limits, and work requirements for example - at the same time as changing income levels - for example by lowering the tax for earned income. Given these multiple policy changes within UC, we discuss now what can be learned about welfare reform and mental health beyond the UK context.

First, the sample of couples with children was less affected by the sub-policies of UC to enhance incentives to work. Table 4 suggests that the couples with children were able to enjoy the positive benefits of a more simple welfare system without the associated loss in income or increased financial strain - as the income levels rose for this group. The improvement of mental health from the simplified welfare regime is a message relatable in different contexts.

Second, the lessons from the decomposition analysis, whilst descriptive, do help to understand which sub-policies of UC improved, and which worsened the mental health of unemployed individuals. Strikingly, the reduced administrative burden improved the mental health for all groups. For the couples, this improvement was enough to compensate for any potential negative effects of UC through the tightened economic incentives. This was not the case for single adults and lone parents of course, who experienced a negative treatment effect. For these groups, what was interesting was that the mediators picking up increased financial uncertainty (problems paying bills and a reduction in leisure time) contributed more to the negative mental health effect compared to the loss in income experienced.

All in all, the results suggest first that a reform to simplify the benefits system can be beneficial for well-being and second that the well-being of vulnerable individuals is sensitive to the financial insecurity embedded in a welfare system.

7 Conclusion

This paper has analysed the unintended consequences of a welfare reform in the UK from a system common in many OECD countries where individuals or households apply for a range of benefits, to a universal credit system which replaced six benefit applications and payments into just one. The benefit reform was aimed at reducing the administrative burden to the government agencies and individual claimants whilst strengthening the incentives of individuals to move into employment with a sustainable level of income.

Individuals became eligible for UC not just by living in a roll-out area and satisfying eligibility criteria, but additionally if they changed their housing or employment status. Given this, we estimate a panel data model, including fixed effects at the individual, local district and time level which identifies the differential effect of unemployment under the reformed UC system compared to the former 'legacy' system.

Our results suggest that unemployed single adults or lone parents eligibile for UC experience a greater reduction in their mental health compared to comparable individuals unemployed under the former legacy system. On the other hand, for couples without or with children, the differential effect on mental health is negligible or even positive. Whilst we show that transition back into employment is more likely for the UC eligible, even in the year after unemployment the negative mental health effects for single adults and lone parents persist.

To understand why such individuals have such different treatment effects, we analyse the treatment effect on six mediators linked to the sub-policies of UC. Comparing two single adults becoming unemployed under the two welfare systems, benefit and total household income was lower under the UC welfare system and problems paying bills higher. Similarly for lone parents, whilst there was no differential significant effect on benefit income from unemployment under the two systems, problems paying bills rose. For these two groups, leisure satisfaction from unemployment fell under UC compared to legacy and the individuals

were more likely to exit the welfare system entirely. Therefore despite a positive mental health effect of UC through reduced administrative burden, the total effect of UC for newly unemployed single adults and lone parents was to reduce their mental health.

In contrast, comparing two newly unemployed individuals living with a partner under the two benefit systems, benefit income fell for those without children and slightly increased for those with children owing to the different policy rules. In both cases though, there was evidence of intrahousehold insurance to protect against UC as, compared to a couples unemployed under legacy, household income under UC actually rose for couples and as such they experienced fewer problems paying bills than under legacy.

References

Atkinson, A. B. and J. Micklewright (1991). Unemployment compensation and labor market transitions: a critical review. *Journal of Economic Literature 29*(4), 1679–1727.

Bailey, M. J., H. W. Hoynes, M. Rossin-Slater, and R. Walker (2020). Is the social safety net a long-term investment? large-scale evidence from the food stamps program. Technical report, National Bureau of Economic Research.

Baird, S., J. De Hoop, and B. Özler (2013). Income shocks and adolescent mental health. *Journal of Human Resources 48*(2), 370–403.

Bhuller, M., G. B. Dahl, K. V. Løken, and M. Mogstad (2024). Domestic violence reports and the mental health and well-being of victims and their children. *Journal of Human Resources 59*(S), S152–S186.

Bitler, M. P., J. B. Gelbach, and H. W. Hoynes (2005). Welfare reform and health. *Journal of Human resources 40*(2), 309–334.

Björklund, A. (1985). Unemployment and mental health: some evidence from panel data. *Journal of Human Resources 20*(4), 469–483.

Blank, R. M. (1997). Policy watch: The 1996 welfare reform. *Journal of Economic Perspectives 11*(1), 169–177.

Blank, R. M. (2002). Evaluating welfare reform in the united states. *Journal of Economic Literature 40*(4), 1105–1166.

Borjas, G. J. (2003). Welfare reform, labor supply, and health insurance in the immigrant population. *Journal of Health Economics 22*(6), 933–958.

Borusyak, K., X. Jaravel, and J. Spiess (2024). Revisiting event-study designs: robust and efficient estimation. *Review of Economic Studies 0*(0), rdae007.

Boyd-Swan, C., C. M. Herbst, J. Ifcher, and H. Zarghamee (2016). The earned income tax credit, mental health, and happiness. *Journal of Economic Behavior and Organization 126*, 18–38.

Brewer, M., J. Browne, and W. Jin (2012). Universal credit: a preliminary analysis of its impact on incomes and work incentives. *Fiscal Studies 33*(1), 39–71.

Brewer, M., A. Duncan, A. Shephard, and M. J. Suarez (2006). Did working families' tax credit work? the impact of in-work support on labour supply in great britain. *Labour Economics 13*(6), 699–720.

Brewer, M. and H. Hoynes (2019). In-work credits in the uk and the us. *Fiscal Studies 40*(4), 519–560.

Brown, S., M. N. Harris, P. Srivastava, and K. Taylor (2018). *Mental health and reporting bias: Analysis of the GHQ-12*. IZA Discussion Paper.

Bütikofer, A., J. Riise, and M. M. Skira (2021). The impact of paid maternity leave on maternal health. *American Economic Journal: Economic Policy 13*(1), 67–105.

Callaway, B. and P. H. Sant'Anna (2021). Difference-in-differences with multiple time periods. *Journal of Econometrics 225*(2), 200–230.

Card, D. and P. B. Levine (2000). Extended benefits and the duration of ui spells: evidence from the new jersey extended benefit program. *Journal of Public economics 78*(1-2), 107–138.

Celli, V. et al. (2019). Causal mediation analysis in economics: objectives, assumptions, models. Technical report, Sapienza University of Rome, DISS Working Papers.

De Chaisemartin, C. and X. d'Haultfoeuille (2020). Two-way fixed effects estimators with heterogeneous treatment effects. *American Economic Review 110*(9), 2964–96.

Department for Work and Pensions (2014). Universal credit pathfinder evaluation. Technical report, The Department for Work and Pensions.

Department for Work and Pensions (2018). Guidance: Universal credit transition to full service. Technical report, The Department for Work and Pensions.

Deuchert, E., M. Huber, and M. Schelker (2019). Direct and indirect effects based on difference-in-differences with an application to political preferences following the vietnam draft lottery. *Journal of Business & Economic Statistics 37*(4), 710–720.

Dwyer, P. and S. Wright (2014). Universal credit, ubiquitous conditionality and its implications for social citizenship. *The Journal of Poverty and Social Justice 22*(1), 27.

d'Este, R. and A. Harvey (2024). The unintended consequences of welfare reforms: Universal credit, financial insecurity, and crime. *The Journal of Law, Economics, and Organization 40*(1), 129–181.

Evans, W. N. and C. L. Garthwaite (2014). Giving mom a break: The impact of higher eitc payments on maternal health. *American Economic Journal: Economic Policy 6*(2), 258–290.

Fetzer, T. (2019). Did austerity cause brexit? *American Economic Review 109*(11), 3849–86.

Foley, B. (2016). Delivering on universal credit. Technical report, Citizens Advice.

Francesconi, M. and W. Van der Klaauw (2007). The socioeconomic consequences of "in-work" benefit reform for british lone mothers. *Journal of Human Resources 42*(1), 1–31.

Gelman, A. and G. Imbens (2013). Why ask why? forward causal inference and reverse causal questions. Technical report, National Bureau of Economic Research.

Giulietti, C. and B. McConnell (2020). Kicking you when you're already down: The multi-pronged impact of austerity on crime. Technical report, Working Paper.

Goodman-Bacon, A. (2021). Difference-in-differences with variation in treatment timing. *Journal of econometrics 225*(2), 254–277.

Gregg, P., S. Harkness, and S. Smith (2009). Welfare reform and lone parents in the uk. *The Economic Journal 119*(535), F38–F65.

Hamilton, V. H., P. Merrigan, and É. Dufresne (1997). Down and out: estimating the relationship between mental health and unemployment. *Health Economics 6*(4), 397–406.

Hartley, R. P., C. Lamarche, and J. P. Ziliak (2022). Welfare reform and the intergenerational transmission of dependence. *Journal of Political Economy 130*(3), 000–000.

Hausman, J. A., J. Abrevaya, and F. M. Scott-Morton (1998). Misclassification of the dependent variable in a discrete-response setting. *Journal of Econometrics 87*(2), 239–269.

Heckman, J. J. and R. Pinto (2015). Econometric mediation analyses: Identifying the sources of treatment effects from experimentally estimated production technologies with unmeasured and mismeasured inputs. *Econometric Reviews 34*(1-2), 6–31.

Herbst, C. M. (2013). Welfare reform and the subjective well-being of single mothers. *Journal of Population Economics 26*(1), 203–238.

House of Commons Library (2018). Constituency data: Universal credit rollout. Technical report, House of Commons Library.

Huber, M. (2019). A review of causal mediation analysis for assessing direct and indirect treatment effects. Technical report, Working Paper SES.

Jackson, C. (2007). The general health questionnaire. *Occupational Medicine 57*(1), 79–79.

Kalil, A., H. Corman, D. M. Dave, O. Schwartz-Soicher, and N. Reichman (2022). Welfare reform and the quality of young children's home environments. Technical report, National Bureau of Economic Research.

Katz, L. F. and B. D. Meyer (1990). The impact of the potential duration of unemployment benefits on the duration of unemployment. *Journal of public economics 41*(1), 45–72.

Lalive, R. (2007). Unemployment benefits, unemployment duration, and post-unemployment jobs: A regression discontinuity approach. *American Economic Review 97*(2), 108–112.

Lopes, M. C. (2022). A review on the elasticity of unemployment duration to the potential duration of unemployment benefits. *Journal of Economic Surveys 36*(4), 1212–1224.

Lundborg, P., D.-O. Rooth, and J. Alex-Petersen (2022). Long-term effects of childhood nutrition: evidence from a school lunch reform. *The Review of Economic Studies 89*(2), 876–908.

Macmillan, L. and E. Tominey (2023). Parental inputs and socio-economic gaps in early child development. *Journal of Population Economics 36*(3), 1513–1543.

Marinescu, I. and D. Skandalis (2021). Unemployment insurance and job search behavior. *The Quarterly Journal of Economics 136*(2), 887–931.

McInerney, M., J. M. Mellor, and L. H. Nicholas (2013). Recession depression: mental health effects of the 2008 stock market crash. *Journal of Health Economics 32*(6), 1090–1104.

Narendranathan, W., S. Nickell, and J. Stern (1985). Unemployment benefits revisited. *The Economic Journal 95*(378), 307–329.

Nicholson, W. and K. Needels (2006). Unemployment insurance: Strengthening the relationship between theory and policy. *Journal of Economic Perspectives 20*(3), 47–70.

Nickell, S. (1979). Estimating the probability of leaving unemployment. *Econometrica: Journal of the Econometric Society 47*(5), 1249–1266.

Office for Budget Responsibility (2017). An obr guide to welfare spending. Technical report, Office for Budget Responsibility.

Reeves, A. and R. Loopstra (2021). The continuing effects of welfare reform on food bank use in the uk: the roll-out of universal credit. *Journal of Social Policy 50*(4), 788–808.

Sun, L. and S. Abraham (2021). Estimating dynamic treatment effects in event studies with heterogeneous treatment effects. *Journal of Econometrics 225*(2), 175–199.

Tefft, N. (2011). Insights on unemployment, unemployment insurance, and mental health. *Journal of Health Economics 30*(2), 258–264.

Tominey, E. (2016). Female labour supply and household employment shocks: Maternity leave as an insurance mechanism. *European Economic Review 87*, 256–271.

Tseliou, F., M. Donnelly, and D. O'Reilly (2018). Screening for psychiatric morbidity in the population-a comparison of the ghq-12 and self-reported medication use. *International Journal of Population Data Science 3*(1), 1–11.

Tuttle, C. (2019). Snapping back: Food stamp bans and criminal recidivism. *American Economic Journal: Economic Policy 11*(2), 301–27.

VanderWeele, T. J. and S. Vansteelandt (2009). Conceptual issues concerning mediation, interventions and composition. *Statistics and its Interface 2*(4), 457–468.

Wanberg, C. R., E. A. van Hooft, K. Dossinger, A. E. van Vianen, and U.-C. Klehe (2020). How strong is my safety net? perceived unemployment insurance generosity and implications for job search, mental health, and reemployment. *Journal of Applied Psychology 105*(3), 209.

Watson, B., M. Guettabi, and M. Reimer (2020). Universal cash and crime. *Review of Economics and Statistics 102*(4), 678–689.

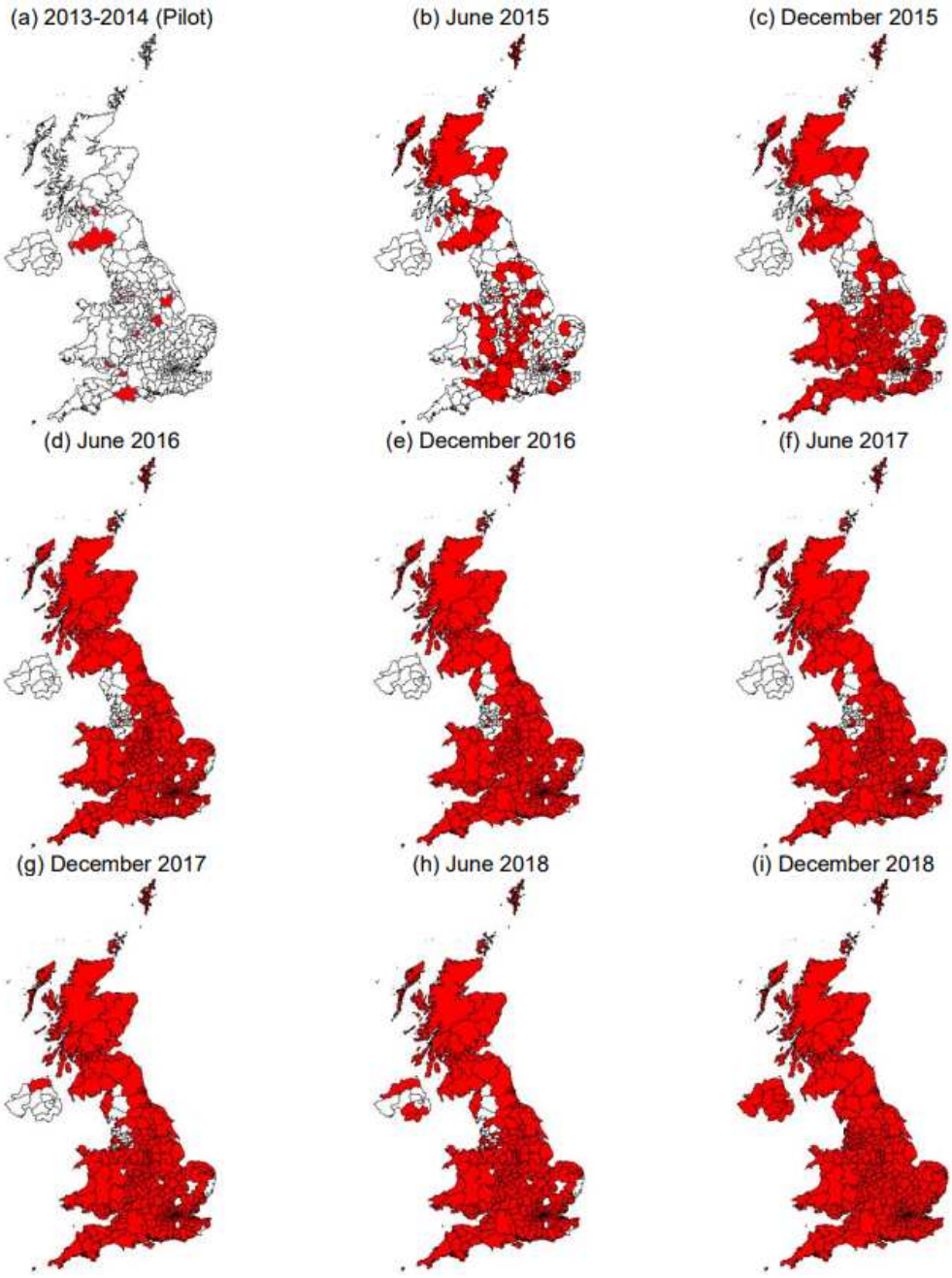
Wickham, S., L. Bentley, T. Rose, M. Whitehead, D. Taylor-Robinson, and B. Barr (2020). Effects on mental health of a uk welfare reform, universal credit: a longitudinal controlled study. *The Lancet Public Health 5*(3), e157–e164.

Williams, E. (2021). Punitive welfare reform and claimant mental health: The impact of benefit sanctions on anxiety and depression. *Social Policy & Administration 55*(1), 157–172.

Windle, W. and Martin (2019). The impact of universal credit examining the risk of debt and hardship among social housing residents. Technical report, Peabody.

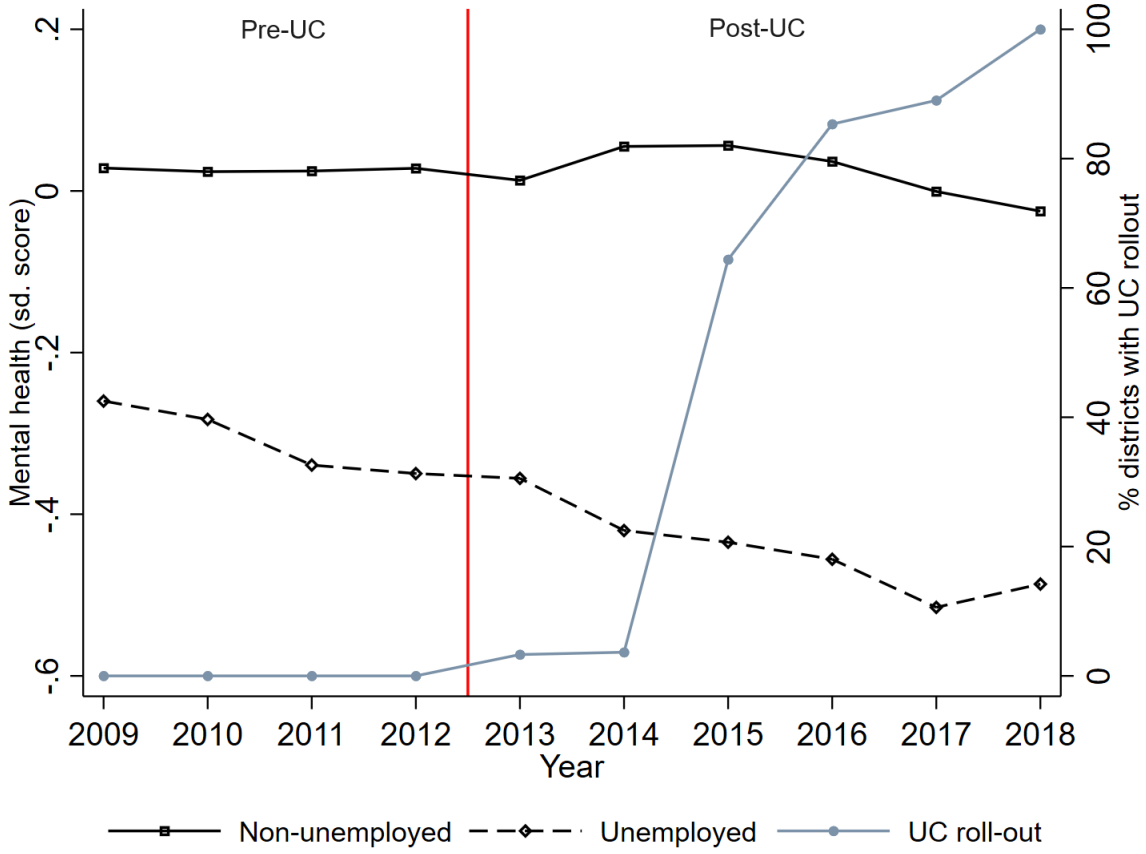
Figures and Tables

Figure 1: Roll-out of UC



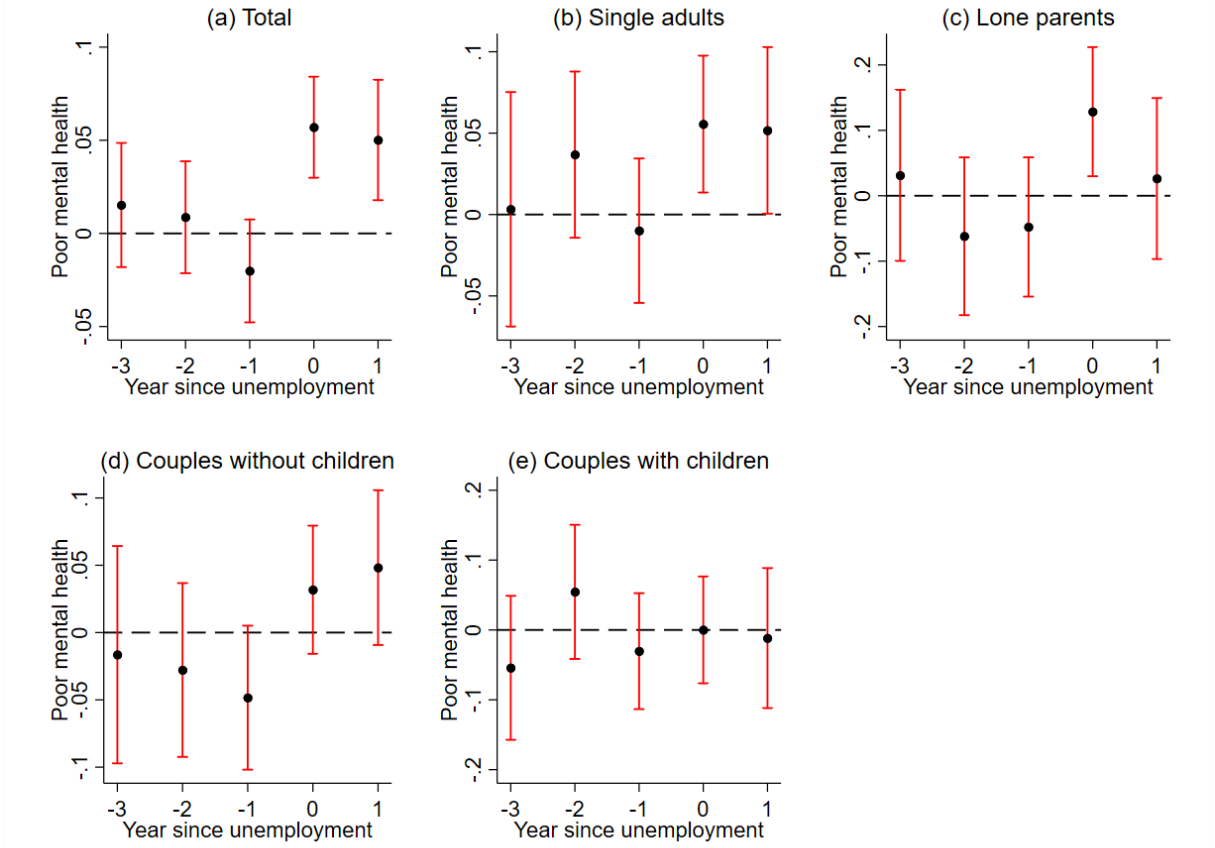
This figure illustrates the geographic expansion of the UC roll-out coverage between April 2013 and December 2018. Each panel shows the geographic coverage of UC roll-out at a specific time. The roll-out dates are at the local authority district level. Data source: UK's Department for Work and Pensions (DWP).

Figure 2: The evolution of mental health and UC roll-out, 2009–2018



This figure illustrates the changes in the mental health and UC roll-out between 2009 and 2018. Mental health which is measured as a standardized score is in the left vertical axis. The black dash and solid lines respectively show the mental health score for the unemployed and employed. The proportion of districts rolled out to UC is represented on the right vertical axis. Data source: UK Department for Work and Pensions (DWP) and UKLHS (2009–2018).

Figure 3: Treatment effect before and after the period of unemployment on incidence of poor mental health



Event-study graphs of the impact of unemployment in year 0 interacted with eligibility to UC in year 0 (the reference year) on an indicator for poor mental health. Year -1 or -2 (year 1) refers to the mental health in years -1 or -2 (in year 1) from unemployment in year 0 whilst eligible for UC in year 0. The x-axis represents the year since unemployment in the reference year (year 0). The y-axis represents an indicator for poor mental health. Point estimates in black and 95% confidence intervals represented by bars. Data source: UKLHS (2009–2019).

Table 1: Summary statistics

	(1) Total	(2)	(3) Single adults	(4) Lone parents	(5) Couples no children	(6) Couples with children
	Mean	SD	Mean	Mean	Mean	Mean
Mental health (std)	0.000	1.000	-0.079	-0.169	0.057	0.048
Mental health problems	0.184	0.388	0.217	0.241	0.167	0.161
Unemployed	0.065	0.246	0.102	0.127	0.041	0.043
Age	39.848	12.045	34.843	33.659	45.690	38.843
Cohabitation	0.650	0.477	0.000	0.000	1.000	1.000
Have a child	0.363	0.481	0.000	1.000	0.000	1.000
Fulltime student	0.059	0.235	0.159	0.123	0.009	0.009
Self-employed	0.088	0.283	0.059	0.046	0.114	0.094
Mediators						
Admin burden	0.651	0.962	0.315	1.768	0.264	1.162
Benefit income	404.1	591.81	360.12	955.46	231.82	516.23
Household income	3142.594	3882.017	2656.121	2223.693	3553.198	3331.337
Bill problem	0.073	0.260	0.080	0.184	0.040	0.079
Leisure satisfaction	0.372	0.483	0.416	0.336	0.378	0.331
Welfare exit	0.026	0.158	0.042	0.022	0.023	0.014
Observations	199,563		54,326	15,457	72,733	57,047

Notes: This table presents summary statistics for main variables used for our analysis. Columns (1)-(2) shows the mean and standard deviation for the total sample; column (3) single adults; column (4) for lone parents; column (5) for couples without children and column (6) for couples with children, respectively. Mental health is a factor constructed from the GHQ-12; benefit and income are measured at the household level, monthly and reported in 2010 prices; admin burden measures the number of benefit applications made; welfare exit takes the value of 1 if the individual is unemployed but claiming no benefits and 0 otherwise. Data source: UKLHS (2009–2019).

Table 2: Eligibility status

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
	Total		Single adults		Lone parents		Couples without children		Couples with children	
	N	% Eligible	N	% Eligible	N	% Eligible	N	% Eligible	N	% Eligible
2009	16,747	0.0%	4,087	0.0%	1,730	0.0%	5,252	0.0%	5,678	0.0%
2010	27,908	0.0%	6,831	0.0%	2,935	0.0%	8,451	0.0%	9,691	0.0%
2011	24,316	0.0%	5,904	0.0%	2,435	0.0%	7,364	0.0%	8,613	0.0%
2012	23,012	0.0%	5,577	0.0%	2,335	0.0%	6,975	0.0%	8,125	0.0%
2013	21,957	0.1%	6,053	0.3%	1,678	0.0%	6,773	0.0%	7,453	0.0%
2014	19,918	1.5%	5,821	2.3%	1,079	0.0%	7,775	2.0%	5,243	0.0%
2015	18,430	18.3%	5,419	22.3%	935	0.0%	8,560	25.4%	3,516	0.0%
2016	19,310	74.9%	5,928	66.5%	1,004	78.3%	8,784	77.3%	3,594	81.7%
2017	18,404	78.3%	5,723	69.8%	847	82.5%	8,487	80.9%	3,347	85.3%
2018	8,723	80.8%	2,699	72.4%	433	85.0%	3,977	83.2%	1,614	87.8%
2019	838	80.1%	284	70.1%	46	89.1%	335	83.9%	173	86.7%
Total	199,563		54,326		15,457		72,733		57,047	

Notes: This table reports the eligibility for UC across years for the total sample and the sub-samples of single adults, lone parents, couples without children and couples with children. For each sub-sample, the first column reports the total number of observations and the second column the percentage of UC eligible from the total number of observations within the sub-sample. Eligibility takes the value of 1 if an individual lives in a roll-out area and satisfies the relevant eligibility criteria described in Section 3. Data source: UKLHS (2009–2019).

Table 3: Treatment effect on mental health

	(1) Total	(2) Single adults	(3) Lone parents	(4) Couples without children	(5) Couples with children
a) Mental health score					
Unemployed	-0.201***	-0.206***	-0.140***	-0.229***	-0.223***
	(0.009)	(0.016)	(0.026)	(0.018)	(0.019)
UC eligibility	-0.037***	-0.023	-0.120***	-0.028***	-0.026
	(0.008)	(0.015)	(0.040)	(0.011)	(0.018)
Unemployed x UC eligibility	-0.064***	-0.084***	-0.139*	-0.007	0.254***
	(0.019)	(0.029)	(0.072)	(0.033)	(0.051)
b) Poor mental health					
Unemployed	0.077***	0.075***	0.059***	0.089***	0.086***
	(0.004)	(0.007)	(0.011)	(0.008)	(0.009)
UC eligibility	0.011***	0.003	0.033*	0.006	0.009
	(0.003)	(0.006)	(0.017)	(0.005)	(0.008)
Unemployed x UC eligibility	0.028***	0.027**	0.052*	0.028*	-0.094***
	(0.008)	(0.012)	(0.031)	(0.015)	(0.023)
Number of individuals	49,571	18,566	6,134	21,884	16,829
Observations	199,563	54,326	15,457	72,733	57,047

Notes: The dependent variable is a standardised factor of positive mental health from the GHQ-12. The sample is restricted to observations aged 18–60. Standard errors are clustered at the local authority district level. Regressions include fixed effects for individual, year and local authority district. Further controls include age, age squared and dummies for cohabitation, having a child, fulltime student and being self-employed. The coefficient for **Unemployed x UC eligibility** is the parameter of interest and measures the differential effect of unemployment under UC versus the former legacy system on mental health. Full regression results are reported in Table A.5. * $p<0.1$, ** $p<0.05$, *** $p<0.01$. Data source: UKLHS (2009–2019).

Table 4: Treatment effect on mediators

	(1) Single adults	(2) Lone parents	(3) Couples with no children	(4) Couples with children
a) Admin burden				
Unemployed x UC eligibility	-0.261***	-0.057	-0.223***	-0.398***
	(0.016)	(0.057)	(0.020)	(0.044)
Observations	54,326	15,457	72,733	57,047
b) Log benefit income				
Unemployed x UC eligibility	-0.523***	0.122	-0.570***	0.040
	(0.090)	(0.074)	(0.114)	(0.107)
Observations	54,326	15,457	72,733	57,047
c) Log household income				
Unemployed x UC eligibility	-0.159***	-0.023	0.042*	0.047*
	(0.033)	(0.038)	(0.022)	(0.027)
Observations	54,326	15,457	72,733	57,047
d) Bill problem				
Unemployed x UC eligibility	0.034***	0.089***	-0.002	-0.028*
	(0.008)	(0.027)	(0.007)	(0.016)
Observations	54,326	15,457	72,733	57,047
e) Leisure satisfaction				
Unemployed x UC eligibility	-0.031**	-0.035	-0.019	0.028
	(0.015)	(0.034)	(0.019)	(0.029)
Observations	54,326	15,457	72,733	57,047
f) Welfare exit				
Unemployed x UC eligibility	0.236***	0.151***	0.192***	0.493***
	(0.005)	(0.010)	(0.004)	(0.006)
Observations	54,326	15,457	72,733	57,047

Notes: This table reports the treatment effect - the differential effect of unemployment under UC versus the former legacy system on each mediator. The sample is restricted to observations aged 18–60. Standard errors are clustered at the local authority district level. Regressions include fixed effects for individual, year and local authority district. Further controls include an indicator for unemployed, a UC eligibility indicator, age, age squared and dummies for cohabitation, having a child, fulltime student and being self-employed. Each coefficient represents a separate regression. * $p<0.1$, ** $p<0.05$, *** $p<0.01$. Data source: UKLHS (2009–2019).

A Online Appendix

A.1 Details on legacy benefits

Income based JSA offers financial support whilst looking for work. Eligible individuals would have worked as an employee and paid national insurance in the last 2 to 3 years be aged 18 to pension age, not in full-time education and available for work but currently out of work. Payments made every 2 weeks.

Income based Employment Support Allowance (ESA) is paid for individuals with a disability or health condition which affects how much they can work. For employed, self-employed, unemployed to give money for living costs if out of work and support getting back to work if and when able.

Income support is for those with low or no income with savings less than £16,000, aged 16 up to the pension age, not in full-time work and satisfying one of these conditions: lone parent, lone foster parent, carer, on parental leave, unable to work and receiving benefits for sickness or disability, in full-time education (not university) age 16-20 and a parent or not living with a parent, a refugee learning English, in custody or due to attend court or a tribunal. It is usually paid to claimants every 2 weeks.

Housing benefit offers help paying rent for unemployed, low income or claiming benefits. This benefit is not eligible under if paying a mortgage rather than rent. Importantly, payments are made straight to the landlords.

Working tax credits eligibility requires working a certain number of hours per week which varies across demographic, from at least 16 hours for single with at least one child, over 60s or disabled and at least 30 hours for age 25-59.

Child Tax credits is an extension of working tax credits for those with children, where since 2017 payments are made only for the first two children.

A.2 Factor analysis

In this section, we show how we perform our factor analysis for the mental health measurement, including 12 components of mental health (concentration; loss of sleep; playing a

useful role; being capable of making decisions; constantly under strain; problem overcoming difficulties; enjoy day-to-day activities; ability to face problems; unhappy or depressed; losing confidence; believe worthless; and general happiness). We particular estimate the following equation:

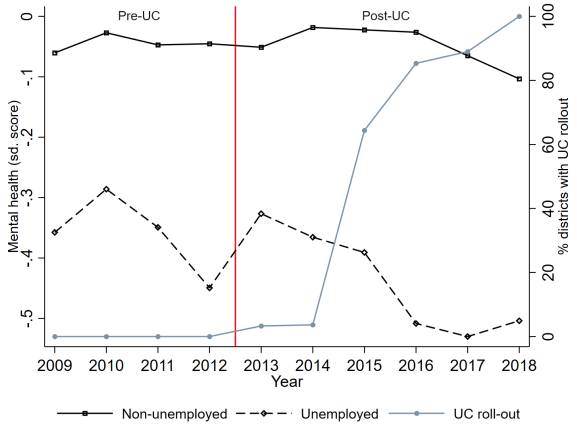
$$Y_{ic} = \alpha_c + \beta_c \gamma_{ic} + e_{ic} \tag{6}$$

where Y_{ic} is the c-th component of the mental health of individual i ($c = 1, ..., 12$). α_c is the intercept of and β_c is a factor loading specific for mental health component c. e_{ic} is the measure-specific measurement error which has mean zero and is assumed to be uncorrelated with γ_{ic} and also independently distributed across individuals and mental health components. Finally, γ_{ic} is the latent factor for mental health-specific component c which can be identified and extracted by setting the factor mean to 0 and β_1 to 1.

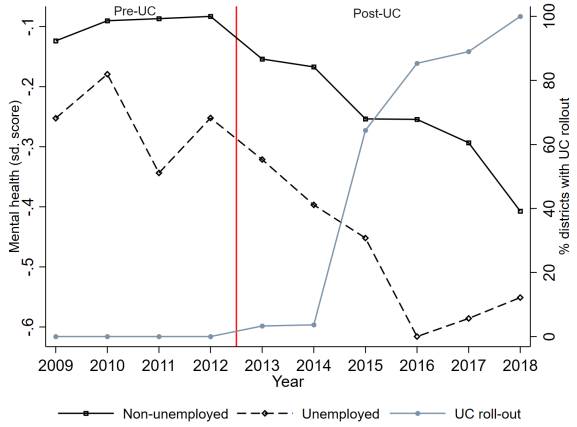
A.3 Figures

Figure A.1: The evolution of mental health and UC roll-out (subgroups), 2009–2018

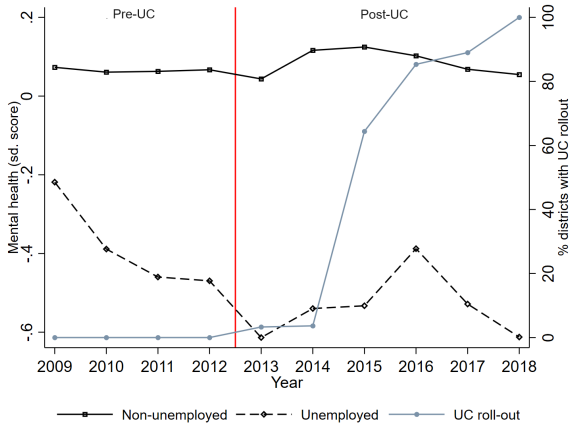
(a) Single adults



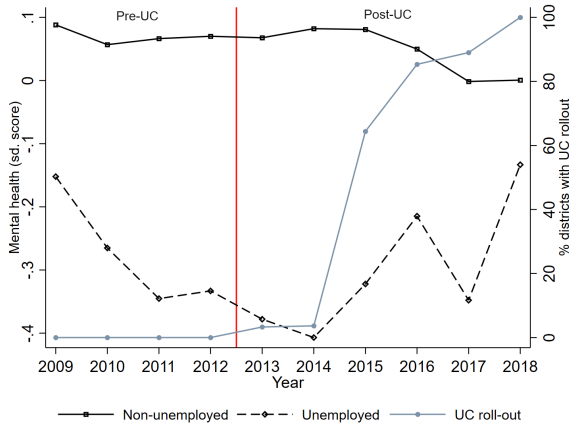
(b) Lone parents



(c) Couples without children

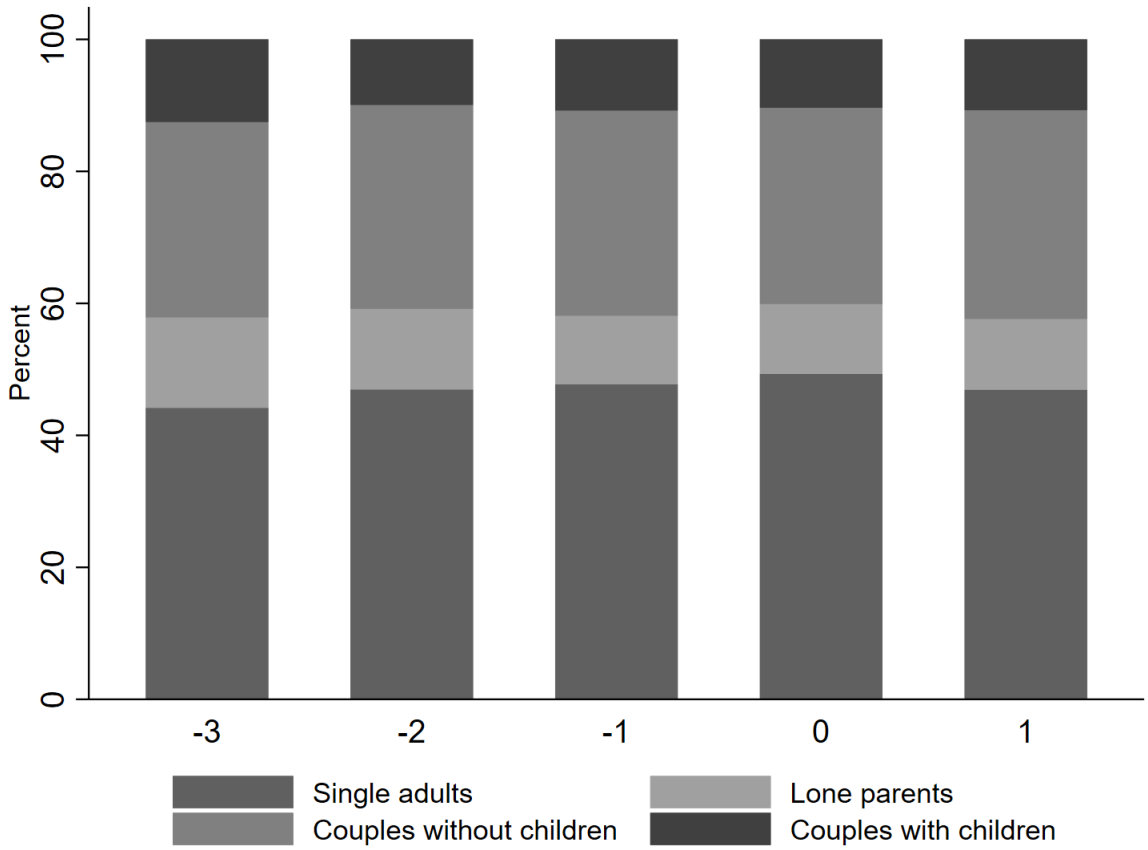


(d) Couples with children



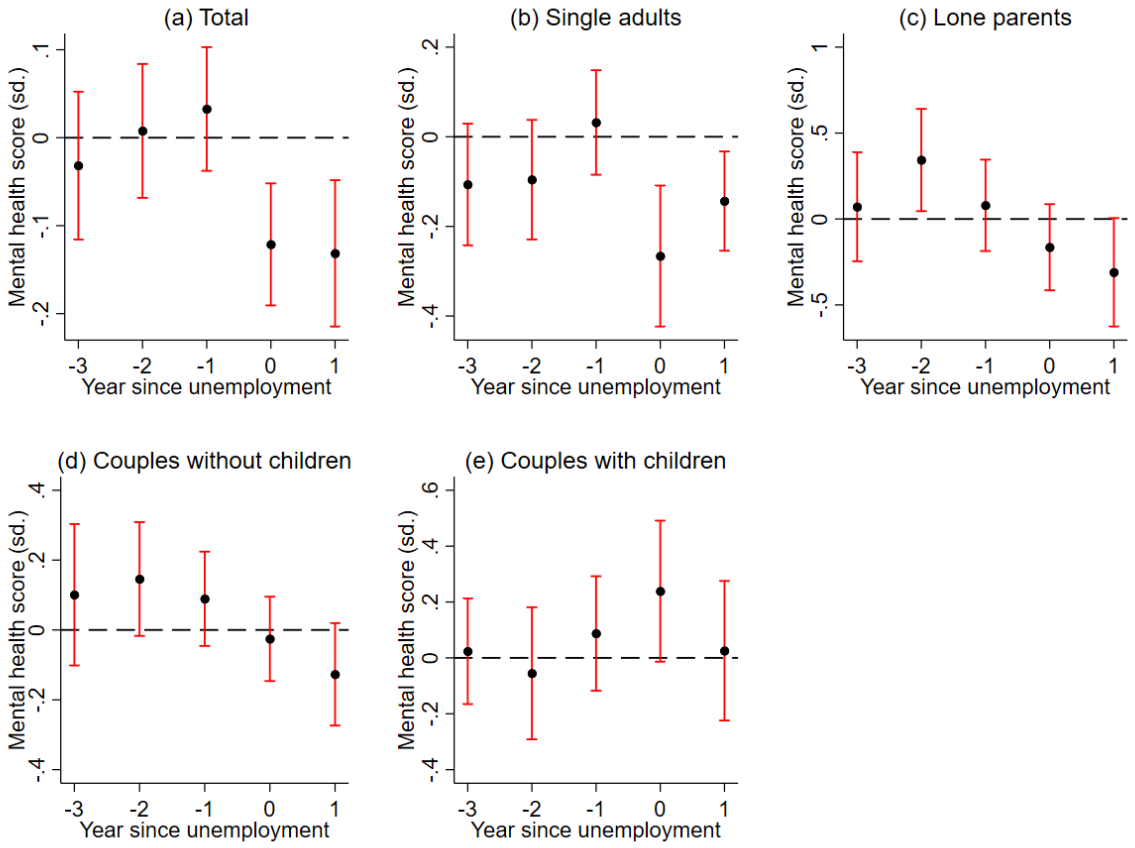
This figure illustrates the changes in the mental health and UC roll-out for subgroups between 2009 and 2018. Mental health which is measured as a standardized score is in the left vertical axis. The black dash and solid lines respectively show the mental health score for the unemployed and employed. The proportion of districts rolled out to UC is represented on the right vertical axis. Data source: UK Department for Work and Pensions (DWP) and UKLHS (2009–2018).

Figure A.2: Household compositions among unemployed: Pre- versus post-UC roll-out



This bar chart illustrates the changes in household composition among those who enter unemployment in the years before and after the UC roll-out. The horizontal axis represents the year since the UC roll-out, in particular 0 and 1 respectively indicate the first and second year since the roll-out of UC while -3, -2, and -1 respectively indicate 3 years, 2 years and 1 year before the starting of UC implementation. The vertical axis represents the share of household compositions (single adults, lone parents, couples without children, and couples with children). Data source: UKLHS (2009–2019).

Figure A.3: Treatment effect before and after the period of unemployment on mental health score



Event-study graphs of the impact of unemployment in year 0 interacted with eligibility to UC in year 0 (the reference year) on mental health. Year -1 or -2 (year 1) refers to the mental health in years -1 or -2 (in year 1) from unemployment in year 0 whilst eligible for UC in year 0. The x-axis represents the year since unemployment in the reference year (year 0). The y-axis represents standardized mental health score. Point estimates in black and 95% confidence intervals represented by bars. Data source: UKLHS (2009–2019).

A.4 Tables

Table A.1: General Health Questionnaire -12

	Mental health measure	(1) Scale 1	(2) Scale 2	(3) Scale 3	(4) Scale 4
GHQ 1	Concentration	Better than usual	Same as usual	Less than usual	Much less than usual
GHQ 2	Loss of sleep	Not at all	No more than usual	Rather more than usual	Much more than usual
GHQ 3	Playing a useful role	More so than usual	Same as usual	Less so than usual	Much less than usual
GHQ 4	Capable of making decisions	More so than usual	Same as usual	Less so than usual	Much less capable
GHQ 5	Constantly under strain	Not at all	No more than usual	Rather more than usual	Much more than usual
GHQ 6	Problem overcoming difficulties	Not at all	No more than usual	Rather more than usual	Much more than usual
GHQ 7	Enjoy day-to-day activities	More so than usual	Same as usual	Less so than usual	Much less than usual
GHQ 8	Ability to face problems	More so than usual	Same as usual	Less able than usual	Much less able
GHQ 9	Unhappy or depressed	Not at all	No more than usual	Rather more than usual	Much more than usual
GHQ 10	Losing confidence	Not at all	No more than usual	Rather more than usual	Much more than usual
GHQ 11	Believe worthless	Not at all	No more than usual	Rather more than usual	Much more than usual
GHQ 12	General happiness	More so than usual	About the same as usual	Less so than usual	Much less than usual

Notes: This table shows the measurement of 12 mental health measures from General Health Questionnaire–12. Columns (1)-(4) show four different scales indicating the mental health degree for each measure which ranges from a positive (negative) to negative (positive) score. Source: UKLHS Questionnaire (2009–2019).

Table A.2: Factor loadings of mental health measures

	Mental health measure	Factor loadings	Signal
GHQ 1	Concentration	1.0000	0.1743
GHQ 2	Loss of sleep	1.6961	0.3707
GHQ 3	Playing a useful role	1.0143	0.2172
GHQ 4	Capable of making decisions	0.8311	0.1553
GHQ 5	Constantly under strain	1.7365	0.3308
GHQ 6	Problem overcoming difficulties	1.7979	0.2648
GHQ 7	Enjoy day-to-day activities	1.1563	0.1753
GHQ 8	Ability to face problems	0.9597	0.1526
GHQ 9	Unhappy or depressed	2.1819	0.2403
GHQ 10	Losing confidence	2.0926	0.2491
GHQ 11	Believe worthless	1.7325	0.2433
GHQ 12	General happiness	1.2732	0.1886

Notes: This table presents the factor analysis results for 12 measures of mental health problems using General Health Questionnaire–12 as described in Table A.1. Columns (1) and (2) respectively present the factor loadings and signal estimates for each of these mental health measures. Reference category is *Concentration* (QHQ 1). Data source: UKLHS (2009–2019).

Table A.3: Balance tests

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Population (log, 1000 persons)	-0.2673									-0.8636
	(1.0918)									(1.3236)
Share of white population (%)		0.0534								0.0463
		(0.0555)								(0.0911)
Share of working-age population aged 16-64 (%)			-0.0646							-0.3788
			(0.2202)							(0.5277)
Share of being married for those aged 16 and over (%)				-0.0841						-0.3403
				(0.1113)						(0.3043)
Share of economically active population aged 16-74 (%)					-0.3430					-0.2721
					(0.3148)					(0.5464)
Share of population aged 16-74 with a full-time job (%)						-0.1805				0.1411
						(0.2525)				(0.3786)
Share of households with unshared dwelling (%)							4.2876			10.0857
							(6.8480)			(11.5593)
Share of population with very good health (%)								-0.3676		-0.2448
								(0.3379)		(0.3865)
Local job density (number of jobs per resident aged 16-64)									-0.1143	-0.1463
									(0.1771)	(0.1984)
p-value for joint significance of covariates										0.6824
R-squared	0.0002	0.0024	0.0002	0.0015	0.0031	0.0013	0.0010	0.0031	0.0011	0.0173
Observations	382	382	382	382	382	382	382	382	382	382

Notes: This table presents the correlational estimates for the relationship between the timing of UC roll-out and local authority district characteristics. Observations are measured at the local authority district level. The dependent variable is the UC roll-out date (month and year). Standard errors are in parentheses. * $p<0.1$, ** $p<0.05$, *** $p<0.01$. Data source: UK Census (2011).

Table A.4: The relationship between living in UC area and unemployment

	(1) Total	(2) Single adults	(3) Lone parents	(4) Couples without children	(5) Couples with children
Living in UC area	0.000	0.006	0.004	0.002	0.000
	(0.002)	(0.004)	(0.007)	(0.003)	(0.004)
Age	-0.016***	-0.029***	-0.010**	-0.006***	-0.008***
	(0.001)	(0.002)	(0.005)	(0.001)	(0.002)
Age squared	0.000***	0.000***	0.000	0.000***	0.000***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Cohabitation	-0.019***	-	-	-	-
	(0.002)				
Having a child	0.000	-	-	-	-
	(0.002)				
Fulltime student	-0.177***	-0.209***	-0.259**	-0.116***	-0.078**
	(0.003)	(0.005)	(0.012)	(0.008)	(0.008)
Self-employed	-0.090***	-0.157***	-0.150***	-0.073***	-0.075***
	(0.003)	(0.007)	(0.017)	(0.003)	(0.004)
Number of individuals	49,571	18,566	6,134	21,884	16,829
Observations	199,563	54,326	15,457	72,733	57,047

Notes: This table shows the correlates between living in UC roll-out area and unemployment. The dependent variable is a dummy for being unemployed. The sample is restricted to observations aged 18–60. Standard errors are clustered at the local authority district level. Regressions include fixed effects for individual, year and local authority district. Further controls include age, age squared and dummies for cohabitation, having a child, fulltime student and being self-employed. * $p<0.1$, ** $p<0.05$, *** $p<0.01$. Data source: UKLHS (2009–2019).

Table A.5: Treatment effect on mental health: An augmented version of Table 3

	(1) Total	(2) Single adults	(3) Lone parents	(4) Couples without children	(5) Couples with children
Unemployed	-0.201***	-0.206***	-0.140***	-0.229***	-0.223***
	(0.009)	(0.016)	(0.026)	(0.018)	(0.019)
UC eligibility	-0.037***	-0.023	-0.120***	-0.028***	-0.026
	(0.008)	(0.015)	(0.040)	(0.011)	(0.018)
Unemployed x UC eligibility	-0.064***	-0.084***	-0.139*	-0.007	0.254***
	(0.019)	(0.029)	(0.072)	(0.033)	(0.051)
Age	-0.048***	-0.058***	-0.055***	-0.045***	-0.037***
	(0.003)	(0.006)	(0.015)	(0.006)	(0.008)
Age squared	0.001***	0.001***	0.001***	0.000***	0.000***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Cohabitation	0.074***	-	-	-	-
	(0.009)				
Having a child	0.016***	-	-	-	-
	(0.006)				
Fulltime student	-0.065***	-0.093***	-0.081**	-0.052	-0.075**
	(0.012)	(0.016)	(0.039)	(0.037)	(0.037)
Self-employed	0.042***	0.066***	0.003	0.040***	0.055***
	(0.010)	(0.024)	(0.053)	(0.015)	(0.017)
Number of individuals	49,571	18,566	6,134	21,884	16,829
Observations	199,563	54,326	15,457	72,733	57,047

Notes: This table is an augmented version of Table 3 in which reports additionally coefficients for control variables. The sample is restricted to observations aged 18–60. Standard errors are clustered at the local authority district level. Regressions include fixed effects for individual, year and local authority district. Further controls include age, age squared and dummies for cohabitation, having a child, fulltime student and being self-employed. The coefficient for **Unemployed x UC eligibility** is the parameter of interest. * $p<0.1$, ** $p<0.05$, *** $p<0.01$. Data source: UKLHS (2009–2019).

Table A.6: Treatment effect on future employment

	(1) Total	(2) Single adults	(3) Lone parents	(4) Couples without children	(5) Couples with children
Unemployed	-0.023***	-0.001	-0.004	-0.004	0.017**
	(0.004)	(0.006)	(0.010)	(0.006)	(0.007)
UC eligibility	-0.012***	-0.037***	0.010	-0.003	0.014*
	(0.003)	(0.006)	(0.018)	(0.004)	(0.008)
Unemployed x UC eligibility	0.046***	0.086***	0.045	0.022	0.056**
	(0.009)	(0.014)	(0.037)	(0.014)	(0.028)
Mean of dependent variable	0.763	0.701	0.595	0.833	0.776
Number of individuals	37,035	12,810	4,697	16,721	13,669
Observations	149,992	38,198	12,027	53,117	46,650

Notes: This table shows the treatment effect of unemployment across eligibility for UC on future employment measured in the subsequent wave of the UKHLS. The dependent variable is a dummy for being employed at year t+1. The sample is restricted to observations aged 18–60. Standard errors are clustered at the local authority district level. Regressions include fixed effects for individual, year and local authority district. Further controls include age, age squared and dummies for cohabitation, indicator for a child, fulltime student and being self-employed. The coefficient for **Unemployed x UC eligibility** is the parameter of interest. * $p<0.1$, ** $p<0.05$, *** $p<0.01$. Data source: UKLHS (2009–2019).

Table A.7: Sensitivity: Heterogeneity across the timing of roll-out

	(1) Total	(2) Single adults	(3) Lone parents	(4) Couples without children	(5) Couples with children
a) Benchmark					
Unemployed x UC eligibility	-0.064***	-0.084***	-0.139*	-0.007	0.254***
	(0.019)	(0.029)	(0.072)	(0.033)	(0.051)
Observations	199,563	54,326	15,457	72,733	57,047
b) Early implementers (<= 2015)					
Unemployed x UC eligibility	-0.046	-0.034		0.018	
	(0.039)	(0.063)		(0.071)	
Observations	34,927	8,444		13,441	
c) Late implementers (>=2016)					
Unemployed x UC eligibility	-0.072***	-0.109***	-0.016	-0.029	0.258***
	(0.021)	(0.034)	(0.080)	(0.039)	(0.057)
Observations	164,636	45,882	13,084	59,292	46,378
d) Excluding 2013 and 2014 implementers					
Unemployed x UC eligibility	-0.069***	-0.085***	-0.148**	-0.025	0.280***
	(0.019)	(0.030)	(0.073)	(0.034)	(0.052)
Observations	195,343	53,387	15,118	71,112	55,726
e) Excluding 2018-2019 implementers					
Unemployed x UC eligibility	-0.070***	-0.100***	-0.137	0.009	0.256***
	(0.022)	(0.035)	(0.085)	(0.039)	(0.060)
Observations	122,328	30,305	8,711	46,450	36,862
f) Excluding 2019 implementer					
Unemployed x UC eligibility	-0.063***	-0.079***	-0.179**	-0.004	0.253***
	(0.019)	(0.029)	(0.073)	(0.033)	(0.052)
Observations	198,725	54,042	15,411	72,398	56,874

Notes: This table shows the heterogeneity for the treatment effect across the timing of roll-out. The benchmark estimates from panel a) is compared to the restricted sample sub-groups of early or late implementers in panels b) and c); to all areas excluding the early implementers (panel d); and to all areas excluding the late implementers (panel e). The sample is restricted to observations aged 18–60. Standard errors are clustered at the local authority district level. Regressions include fixed effects for individual, year and local authority district. Further controls include an indicator for unemployment, an eligibility indicator, age, age squared and dummies for cohabitation, having a child, fulltime student and being self-employed. * $p<0.1$, ** $p<0.05$, *** $p<0.01$. Data source: UKLHS (2009–2019).

Table A.8: Treatment effect on mental health: Changing the sets of controls and sample

	(1) Total	(2) Single adults	(3) Lone parents	(4) Couples without children	(5) Couples with children
a) No controls					
Unemployed x UC eligibility	-0.073***	-0.095***	-0.159**	-0.008	0.249***
	(0.019)	(0.029)	(0.072)	(0.033)	(0.051)
b) Additional controls					
Unemployed x UC eligibility	-0.072***	-0.093***	-0.144**	-0.010	0.252***
	(0.019)	(0.029)	(0.072)	(0.033)	(0.051)
c) Excluding self-employed and students					
Unemployed x UC eligibility	-0.055***	-0.072**	-0.137*	-0.007	0.269***
	(0.019)	(0.031)	(0.075)	(0.034)	(0.052)
d) Additional control for local labor market conditions					
Unemployed x UC eligibility	-0.064***	-0.084***	-0.140*	-0.007	0.254***
	(0.019)	(0.029)	(0.072)	(0.033)	(0.051)
Number of individuals	49,571	18,566	6,134	21,884	16,829
Observations	199,563	54,326	15,457	72,733	57,047

Notes: This tables presents a sensitivity analysis of the benchmark estimates of the treatment effect - the differential effect of unemployment under UC versus legacy on mental health but in panel a) excludes all controls except for an indicator for unemployment, UC eligibility and their interaction; panel b) includes benchmark controls plus additionally an indicator for prior mental health disorder and highest educational levels (higher degree, first degree, higher diploma, A-level and GCSE/0-level); panel c) estimates on the benchmark model but excludes individuals not eligibility for UC because of being self-employed or a student. * $p<0.1$, ** $p<0.05$, *** $p<0.01$. Data source: UKLHS (2009–2019).

Table A.9: Treatment effect on mental health: Heterogeneity by gender

	(1) Total	(2) Single adults	(3) Lone parents	(4) Couples without children	(5) Couples with children
Unemployed	-0.180***	-0.250***	-0.137***	-0.222***	-0.129***
	(0.013)	(0.025)	(0.028)	(0.026)	(0.025)
UC eligibility	-0.041***	-0.021	-0.125***	-0.033**	-0.025
	(0.009)	(0.017)	(0.041)	(0.013)	(0.018)
Unemployed x Male	-0.046**	0.075**	-0.025	-0.014	-0.222***
	(0.018)	(0.032)	(0.082)	(0.036)	(0.039)
UC eligibility x Male	0.011	-0.006	0.155	0.009	0.031
	(0.009)	(0.020)	(0.136)	(0.014)	(0.083)
Unemployed x UC eligibility	-0.045*	-0.029	-0.136*	0.016	0.149***
	(0.026)	(0.045)	(0.074)	(0.050)	(0.054)
Unemployed x UC eligibility x Male	-0.042	-0.092	-0.198	-0.039	0.806***
	(0.037)	(0.059)	(0.395)	(0.067)	(0.311)
Number of individuals	49,571	18,566	6,134	21,884	16,829
Observations	199,563	54,326	15,457	72,733	57,047

Notes: This table shows the gender heterogeneity for the treatment effect of unemployment under UC versus legacy on mental health. The sample is restricted to observations aged 18–60. Standard errors are clustered at the local authority district level. Regressions include fixed effects for individual, year and local authority district. Further controls include age, age squared and dummies for cohabitation, having a child, fulltime student and being self-employed. The coefficients for **Unemployed x UC eligibility** and **Unemployed x UC eligibility x Male** are the parameters of interest. * $p<0.1$, ** $p<0.05$, *** $p<0.01$. Data source: UKLHS (2009–2019).

Table A.10: Treatment effect on mental health: individuals reporting the same household status across pre and post-rollout waves

	(1) Total	(2) Single adults	(3) Lone parents	(4) Couples without children	(5) Couples with children
Unemployed	-0.222***	-0.218***	-0.162***	-0.285***	-0.202***
	(0.015)	(0.026)	(0.044)	(0.031)	(0.032)
UC eligibility	-0.026**	-0.008	-0.061	-0.035**	-0.004
	(0.011)	(0.021)	(0.064)	(0.015)	(0.026)
Unemployed x UC eligibility	-0.056**	-0.094**	-0.200**	0.085-	0.199***
	(0.024)	(0.038)	(0.094)	(0.045)	(0.065)
Observations	94,742	26,634	6,134	35,900	29,074

Notes: The sample is restricted to households who do not change their household status in between the wave pre- and post-UC roll-out. The dependent variable is a standardised factor of positive mental health from the GHQ-12. The sample is restricted to observations aged 18–60. Standard errors are clustered at the local authority district level. Regressions include fixed effects for individual, year and local authority district. Further controls include age, age squared and dummies for cohabitation, having a child, fulltime student and being self-employed. The coefficient for **Unemployed x UC eligibility** is the parameter of interest and measures the differential effect of unemployment under UC versus the former legacy system on mental health. Full regression results are reported in Table A.5. * $p<0.1$, ** $p<0.05$, *** $p<0.01$. Data source: UKLHS (2009–2019).

Table A.11: Treatment effect on weekly hours worked by partners for couples without and with children

	(1) Couples without children	(2) Couples with children
Unemployed	-1.701***	-0.979***
	(0.288)	(0.314)
UC eligibility	-0.793***	-1.485***
	(0.170)	(0.298)
Unemployed x UC eligibility	1.807***	1.466*
	(0.523)	(0.840)
Mean of dep. var.	20.382	21.088
Number of individuals	21,884	16,829
N	72,733	57,047

Notes: The dependent variable measures hours worked in the week before survey for partners of the focal individual, for couples without children (column 1) and couples with children (column 2). The sample is restricted to observations aged 18–60. Standard errors are clustered at the local authority district level. Regressions include fixed effects for individual, year and local authority district. Further controls include age, age squared and dummies for cohabitation, having a child, fulltime student and being self-employed. The coefficient for **Unemployed x UC eligibility** is the parameter of interest. * $p<0.1$, ** $p<0.05$, *** $p<0.01$. Data source: UKLHS (2009–2019).

Table A.12: Treatment effect on mental health conditional on mediators

	(1) Single adults	(2) Lone parents	(3) Couples without children	(4) Couples with children
Unemployed x UC elig	0.079	-0.095	0.039	0.195*
	(0.052)	(0.088)	(0.062)	(0.114)
Admin burden	-0.028***	-0.001	-0.011	-0.026***
	(0.008)	(0.010)	(0.007)	(0.005)
Admin burden x UC elig	-0.096***	-0.069*	-0.010	0.042**
	(0.032)	(0.041)	(0.016)	(0.019)
Income	0.016***	0.078***	0.026***	0.045***
	(0.004)	(0.016)	(0.006)	(0.008)
Income x UC elig	-0.003	-0.035	0.014	0.020
	(0.008)	(0.043)	(0.010)	(0.018)
Bill problem	-0.099***	-0.054**	-0.089***	-0.081***
	(0.017)	(0.023)	(0.019)	(0.014)
Bill problem x UC elig	-0.124***	-0.088*	-0.098***	0.023
	(0.032)	(0.053)	(0.032)	(0.038)
Leisure satisfaction	0.257***	0.303***	0.183***	0.164***
	(0.009)	(0.018)	(0.007)	(0.008)
Leisure satisfaction x UC elig	0.029	0.111**	0.058***	0.077***
	(0.018)	(0.049)	(0.013)	(0.019)
Welfare exit	0.018	-0.026	0.032	-0.008
	(0.029)	(0.068)	(0.034)	(0.038)
Welfare exit x UC elig	-0.196***	0.046	-0.041	0.045
	(0.064)	(0.164)	(0.072)	(0.128)
N	54,326	15,457	72,733	57,047

Notes: This table reports the treatment effect - the differential effect of unemployment under UC versus the former legacy system on mental health *conditional* on mediators and their interactions with UC eligibility. Income measures log household income in 2010 prices. The sample is restricted to observations aged 18–60. Standard errors are clustered at the local authority district level. Regressions include fixed effects for individual, year and local authority district. Further controls include an indicator for unemployed, a UC eligibility indicator, age, age squared and dummies for cohabitation, having a child, fulltime student and being self-employed. * $p<0.1$, ** $p<0.05$, *** $p<0.01$. Data source: UKLHS (2009–2019).

Table A.13: Decomposition of the treatment effect on mental health

	(1) Single adults	(2) Lone parents	(3) Couples without children	(4) Couples with children
Indirect effect: Admin burden	0.032	0.004	0.005	-0.006
Indirect effect: Income	-0.002	-0.001	0.002	0.003
Indirect effect: Bill problem	-0.008	-0.013	0.000	0.002
Indirect effect: Leisure	-0.009	-0.015	-0.005	0.007
Indirect effect: Welfare exit	-0.042	0.003	-0.002	0.018
% IE Admin burden	-38.10%	-2.88%	-71.43%	-2.36%
% IE Income	2.38%	0.72%	-28.57%	1.18%
% IE Bill problem	9.52%	9.35%	0.00%	0.79%
% IE Leisure	10.71%	10.79%	71.43%	2.76%
% IE Welfare exit	50.00%	-2.16%	28.57%	7.09%
Direct effect	-0.055	-0.117	-0.007	0.230
Total effect	**-0.084**	**-0.139**	**-0.007**	**0.254**

Notes: The table decomposes the total effect from Table 3 into the indirect effect from equation 5 and the direct effect from equation 4 by combining estimates from Table 4 and A.12. For example the indirect effect via household income for single adults in column (1) is the product of the treatment effect of income of -0.159 (Table 4) and the effect on MH of household income through UC of 0.016 - 0.003 (Table A.12). A negative (positive) sign on the indirect effect indicates the indirect effect of UC through the mediator is to reduce (increase) mental health for participants. The sample is restricted to observations aged 18–60. Data source: UKLHS (2009-2019).