

CeMPA WP 4/25

A difference-in-differences analysis of the well-being effects of Universal Credit

Andy Baxter, Martha Tindall, Sophie Wickham, Maria Marimpi, Heather Brown, Luke Monford, Matt Sutton, Matteo Guido Richiardi, Mandy Cheetam, Silas Amo-Agyei, David Taylor-Robinson, Clare Bamba, Srinivasa Vittal Katikireddi, Peter Craig

February 2025

A difference-in-differences analysis of the well-being effects of Universal Credit

Dr Andy Baxter (0000-0002-7654-9687), Research Associate, MRC/CSO Social and Public Health Sciences Unit, University of Glasgow

Martha Tindall (0009-0001-3606-4984), MRC/CSO Social and Public Health Sciences Unit, University of Glasgow

Dr Sophie Wickham (0000-0002-7515-2979), Wellcome Trust Research Fellow, Department of Public Health, Policy and Systems, Institute of Population Health, University of Liverpool

Dr Maria Marimpi (0000-0002-6649-730X), PDRA, Department of Public Health, Policy and Systems, Institute of Population Health, University of Liverpool

Prof Heather Brown (0000-0002-0067-991X), Professor of Health Inequalities, Division of Health Research, Lancaster University

Dr Luke Munford (0000-0003-4540-6744), Senior Lecturer in Health Economics, Health Organisation, Policy and Economics, School of Health Sciences, University of Manchester

Prof Matt Sutton (0000-0002-6635-2127), Chair in Health Economics, Health Organisation, Policy and Economics, School of Health Sciences, University of Manchester

Prof Matteo Richiardi (0000-0002-3749-7386), Professor in Economics & Director of CeMPA, Centre for Microsimulation and Policy Analysis, University of Essex

Dr Mandy Cheetham (0000-0002-2616-9205), Assistant Professor in Health and Social Care Research, Department of Nursing, Midwifery & Health, Northumbria University; and NIHR Applied Research Collaboration North East and North Cumbria

Dr Silas Amo-Agyei (0000-0001-9718-6363), Research Fellow, Health Organisation, Policy and Economics, School of Health Sciences, University of Manchester

Prof David Taylor-Robinson (0000-0002-5828-7724), Professor, Department of Public Health, Policy and Systems, Institute of Population Health, University of Liverpool

Prof Clare Bambra (0000-0002-1294-6851), Professor, Population Health Sciences Institute, Newcastle University

Prof Srinivasa Vittal Katikireddi (0000-0001-6593-9092), Professor, MRC/CSO Social and Public Health Sciences Unit, University of Glasgow

Prof Peter Craig (0000-0002-7653-5832), Professor of Public Health Evaluation, MRC/CSO Social and Public Health Sciences Unit, University of Glasgow

Abstract

Universal Credit (UC) was a large-scale reform of the UK welfare system reform, replacing six existing benefits. UC aimed to simplify claims and encourage more claimants into work. We identify its effect on mental well-being, treating the phased rollout from 2013-2018 as a natural experiment.

We estimated differences across well-being outcomes associated with UC exposure across Local Authorities, using not-yet-exposed areas as controls. We included working-age (18-64) respondents of the Annual Population Survey in Great Britain from 2012-2019 (n=245,658), living in low-income households. We tested for differential effects by markers of vulnerability.

UC was associated with per-claimant decreases in Life Satisfaction (-0.66; 95%CI -1.01 to -0.30), Happiness (-0.41; 95%CI -0.77 to -0.05) and Life Worthwhile (-0.73; 95%CI -1.03 to -0.42), and increases in Anxiety (+0.79; 95%CI 0.30 to 1.27). These changes were two to six times the effects of the COVID-19 pandemic. Several subgroups experienced greater effects, especially increased anxiety amongst disabled people (+0.19; 95%CI 0.12 to 0.27), single people (+0.13; 95%CI 0.06 to 0.21) and people aged under 25 (+0.27; 95%CI 0.15 to 0.39).

The introduction of UC had adverse effects across all four measures of well-being. Vulnerable groups typically experienced greater harms, reinforcing calls for health-prioritising reforms.

Keywords: Social security reform; UK Welfare Policy; mental well-being; natural experiment; policy evaluation; difference-in-differences

Highlights

- Changes to welfare policies may affect claimants' mental health and well-being
- Universal Credit – a new benefits system – was introduced in the UK from 2013–2018
- We observed relative changes in well-being associated with incremental local rollout
- Universal Credit rollout led to comparatively large negative effects on well-being
- Effects were greater amongst several vulnerable groups

Introduction

Universal Credit (UC) was introduced in the UK under the 2012 Welfare Reform Act as a replacement for six existing working-age benefits and tax credits. The UC system was proposed as an innovation to simplify the benefit system and reduce spending (National Audit Office, 2018; Department for Work & Pensions, 2022a). A further stated aim of UC was to encourage more claimants into work by setting stricter eligibility criteria and changing payment structure (Wickham *et al.*, 2020; Department for Work & Pensions, 2022a, 2022b). Welfare policies are an established determinant of health, and changes in social security systems are known to impact the mental health of benefits claimants (Bambra and Eikemo, 2009; Simpson *et al.*, 2021). A simplified claims system, improved access to employment and reduction in poverty have been proposed as routes to improving mental health and well-being via the UC system (Department for Work & Pensions, 2010, 2024). Health commentators and researchers have expressed concerns about the design and implementation of UC and have called for clearer evaluation of potential health effects (Alston, 2018; Arie, 2018; Child Poverty Action Group, 2021).

Several studies on the implementation of UC suggest that it adversely affects the health and well-being of some recipients (Wickham *et al.*, 2020; Brewer, Dang and Tominey, 2022; Thornton and Iacolla, 2022; Cheetham *et al.*, 2024). Such harms may be a combination of the effects of switching to and navigating an unfamiliar online system plus the lasting effects of a difference in award amounts or benefit administration. The minimum five-week

assessment period at the beginning of an award plus administrative delays have resulted in waits of up to 12 weeks for first payments (National Audit Office, 2018; Cheetham *et al.*, 2019). This waiting period has been shown to cause immediate distress in low-income households (Cheetham *et al.*, 2019; Work and Pensions Committee, 2020). The subsequent struggle to repay loans and advance payments taken to cover the waiting period may also have prolonged this effect beyond the initial months (Department for Work & Pensions, 2018a). More stringent work-search requirements combined with (the threat of) sanctions – reduced payments when conditions are not met – may also affect mental health and well-being throughout a spell of benefit receipt (Cheetham *et al.*, 2019; Department for Work & Pensions, 2023). The switch to a digital system, reported to be perceived by some claimants as “complicated, disorientating, impersonal, hostile and demeaning” (Cheetham *et al.*, 2019), may also contribute to poorer mental well-being. Conversely, tailored support in applying for jobs may improve mental well-being through increased employment (Department for Work & Pensions, 2010, 2022a). Short-term effects of a new system may be reversed by such longer-term benefits. Effects may differ by family circumstances, reasons for claiming benefits and other health conditions, and UC has been shown to mitigate the negative impacts of entering unemployment for some claimants (Brewer, Dang and Tominey, 2022; Thornton and Iacoella, 2022).

The replacement of legacy benefits with UC has taken place in three phases. Each phase involved a staggered implementation across job centres (Department for Work & Pensions, 2018b, 2022a; National Audit Office, 2018). The first phase, beginning in 2013, was a restricted rollout of the ‘live service’ to a limited subgroup, mainly single, unemployed claimants without dependent children. In the second ‘natural migration’ phase, from 2015 onwards, new claimants, existing recipients whose circumstances changed, and voluntary switchers moved onto UC. The concluding ‘managed migration’ phase, piloted in 2019–2020 but paused for the pandemic and restarted in 2022, involves a compulsory transition of all legacy claimants to UC. After repeated delays, this phase is currently planned for completion by 2028/29 (Mackley, Hobson and Kennedy, 2024). Wickham *et al.* (2020) previously used the ‘restricted rollout’ phase to create comparable exposed and unexposed populations within the limited at-risk population defined by their employment status. The natural migration phase, now complete, gives an opportunity to test effects across the broader scope of all eligible claimants over a longer period to test whether early observed harms persist or are ameliorated by the benefits of a maturing and adapting new system.

We aimed to estimate the effect of introducing UC on the well-being of working age individuals in low-income households over the full natural migration rollout period. Subjective well-being measures serve as valuable indicators of mental health, quality of life, and overall population welfare, offering unique insights into the economic, social, and health conditions of populations. Such measures are particularly valuable for understanding welfare reform effects on aspects like financial stability, social cohesion, and mental health, especially among specific population sub-groups (National Research Council, 2013; OECD, 2013; Public Health Scotland, 2022; Faculty of Public Health, 2024). Evidence on subjective well-being changes is increasingly recommended to inform economic policy (HM Treasury, 2021). Estimates of the changes in subjective well-being resulting from the UC rollout would provide a tangible measure of its overall impact on those affected by the benefit system reform.

We used the staggered rollout of the natural migration phases to create natural experimental comparisons between people living in areas exposed and areas not yet exposed to UC. To better understand impacts on inequalities, we investigated how effect sizes varied by characteristics which may determine eligibility and award amount, or which may make an individual more vulnerable to changes: family structure, sex, disability, ethnicity, age, education, student status, caring responsibilities and country.

Methods

We followed a pre-published protocol (Craig *et al.*, 2022) and analysis plan (Baxter *et al.*, 2022). Deviations from the analysis plan are outlined in Supplementary Material E.

Study design

We conducted a difference-in-differences analysis to estimate the effects of the staggered rollout of UC on well-being among recipients and potential recipients. We examined changes over time in four well-being measures – Life Satisfaction, Happiness, Life Worthwhile and Anxiety – in local authorities as UC was introduced. We compared these with simultaneous changes in areas in which it had not yet been introduced to account for common trends. We took an intention-to-treat approach, using the planned natural migration dates as a proxy for whole-area exposure (grouping jobcentre areas by Local Authority) (Department for Work & Pensions, 2018b). The order of rollout by Local Authority

appears random across the UK (Figure 1). Previous studies found no association between tested demographic variables (ethnicity, labour market attachment, marital status and health) and rollout date (Brewer, Dang and Tominey, 2022). Thus, as far as we are aware, there is no evidence of selectivity which may confound timing of rollout and vulnerability of the population to such changes.

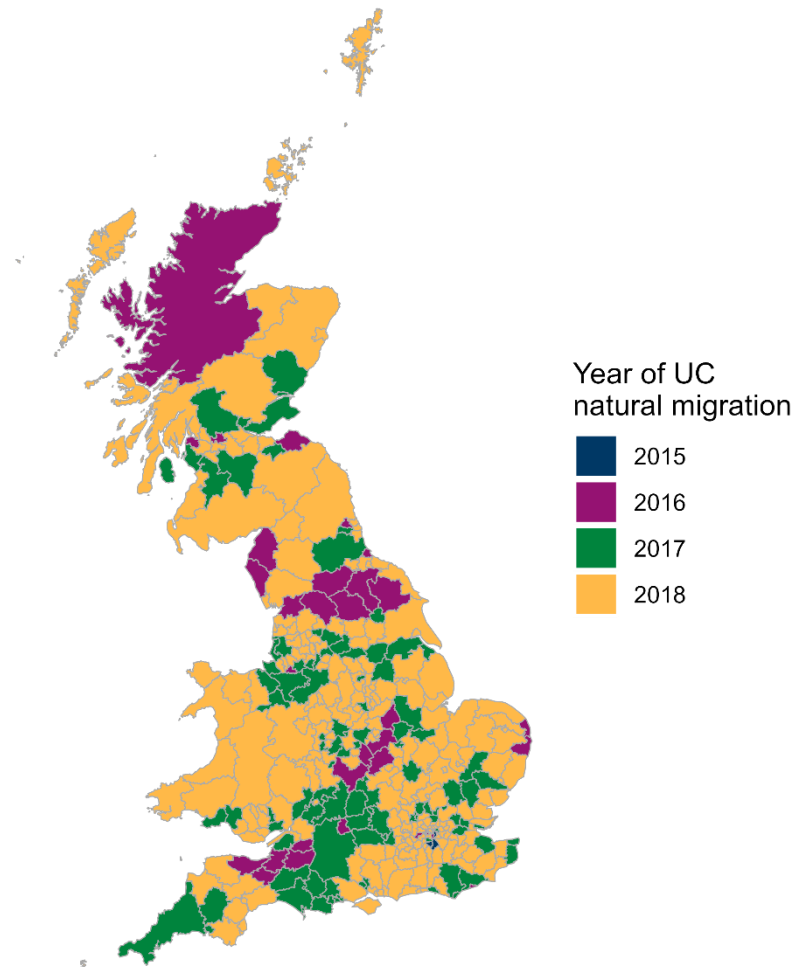


Figure 1 – Yearly Universal Credit rollout by Local Authority area. Dates for each jobcentre area are extracted from the Department for Work & Pensions schedule (2018b) and grouped by Local Authority.

Data

We used data from Annual Population Surveys (APS) collected from April 2012 to March 2020 (April-March pooled datasets, 921,139 observations) (Office for National Statistics - Social Survey Division, 2023). Previous and simultaneous research on the effects of UC

have used the UK Household Longitudinal Survey and measures of mental health, quality of life and well-being (Wickham *et al.*, 2020; Brewer, Dang and Tominey, 2022; Craig *et al.*, 2022; Thornton and Iacolla, 2022). We sought to complement this research using a large, cross-sectional dataset and further well-being measures. The Annual Population Survey is a collation of the Labour Force Survey responses, consecutively gathered across five quarters. Only respondent's quarter one and five responses are included in sequential annual APS datasets, which are weighted to be a representative cross-section of the UK population. The survey records details of employment and benefit receipt (by type), alongside demographic variables (Office for National Statistics, 2012). Questions recording personal well-being across four measures – Life Satisfaction, Happiness, Life Worthwhile and Anxiety – were introduced from April 2012 (Office for National Statistics, 2018). We conducted a complete case analysis as, across all APS respondents in the 2012–2020 period, data across all selected variables were missing in only 1.6% of cases (14,745 observations removed).

We used the ONS personal well-being variables as measures of outcome and so included data from April 2012 onwards. We excluded observations from 2020 onwards as these would include COVID-19 affected responses and may have produced different patterns of employment and benefit claims. We used a secure access version of the dataset in which each respondent's area of residence was recorded, allowing for grouping of observations by Local Authority district. These districts were mapped onto the Department of Work and Pensions' Job Centre areas that were used in the stepwise 'natural migration' rollout of Universal Credit from 2015–2018 (Department for Work & Pensions, 2018b). We excluded Local Authorities with low numbers of observations (less than 100) in any quarter (8,920 observations removed).

To control for area-level confounders, we calculated yearly proportional changes in economic productivity and local government spending from the 2012 baseline. We used data from the ONS 'Regional economic activity by gross domestic product' dataset to calculate gross value added to represent yearly economic productivity by UK Local Authority (LA) (Office for National Statistics, 2023). To represent local government spending, we used recorded spending per capita on social care, culture and education as these were deemed to be not directly affected by UC rollout. These were obtained for England from the 'Place-based Longitudinal Data Resource' (Alexiou and Barr, 2019a,

2019c, 2019b), StatsWales open data for Welsh LAs (StatsWales, 2023), and from Scottish Local Government Finance Statistics (collated across years upon email request) (Scottish Government, 2024).

Population

To identify an ‘at risk’ population comparable across all time points, we included residents of low-income households, aged 18 or over who were not retired and not working twenty or more hours per week. This would include most respondents who are eligible for benefits but may also include many who are not eligible (such as self-employed people who report no earnings). In our main analyses we use income rather than reported benefit receipt to identify the at-risk population for two reasons: (1) benefit receipt may have been under-reported in the survey; (2) the effects of the change from legacy benefits to UC may extend beyond benefit recipients, for example by prompting claimants to enter or increase employment and end benefit claim. By including all low-income households, we aimed to make all observations comparable across time periods.

To identify low-income households, we calculated household equivalised income using the modified OECD equivalence scale (Office for National Statistics, 2015). We set a threshold of under £12,000 equivalised annual household income for inclusion. This was derived from the upper quartile of incomes amongst earners reporting benefit claims and the lower quartile of earners reporting no benefit claims (Supplementary Material Table A-3 and Figure A-1).

In sensitivity analyses we repeated these analyses for all respondents reporting a benefit claim (UC or at least one equivalent legacy benefit) to test for similarities in effect direction and magnitude.

Exposure

We used the planned rollout dates to determine exposure to UC for each Local Authority (Department for Work & Pensions, 2018b). We matched APS observations by Local authority and calendar quarter to assign a dummy variable coding UC exposure (‘1’ in the quarter of rollout and all quarters following; ‘0’ otherwise) and a count of quarterly leads/lags to UC rollout (centred at ‘0’ in the rollout quarter).

Outcomes

We used the ‘ONS4’ personal well-being measures to capture the impact of the UC rollout on individuals’ well-being and lived experiences across four key domains: Life Satisfaction, Happiness, Life Worthwhile, and Anxiety. Respondents were asked to what extent they were currently feeling in each domain and rated each from 0–10, with 0 representing “not at all” and 10 “completely” (see questions in Supplementary Material A.2). Unlike traditional economic and social metrics, subjective well-being reflects individuals’ lived experiences, preferences, and personal values, capturing the net impact of policy changes on diverse groups. These measures offer a multidimensional view of well-being by assessing life satisfaction, emotional state, and a sense of meaning and purpose in life – critical for understanding the nuanced effects of welfare reform on individuals’ quality of life (OECD, 2013). By treating these outcomes as continuous variables (Office for National Statistics, 2018), we can quantify the specific ways the UC rollout influenced well-being, providing valuable insights into the reform’s overall impact on vulnerable populations.

Covariates

In confounder-adjusted models, estimates were adjusted for age, age squared, sex, ethnicity (combined into two categories: white and non-white), disability, whether has a work-limiting health condition, highest level of qualification, employment status (employed/inactive/seeking), housing tenure, whether has caring responsibilities (reporting not seeking work as looking after home/family), number of children (categorised 0, 1, or 2+), marital status (non-married or married/cohabiting), year of observation, area-level unemployment rate, area-level disability rate, area-level gross value added, area-level culture spending per capita (adjusted relative to 2013), and quarter of local authority migration to UC.

Statistical analysis

We used difference-in-differences methods to estimate the effects of the introduction of UC on well-being. We used person-weights as provided in the APS datasets to make the sample representative of the UK population by sex and age group (Office for National Statistics, 2022).

Classic difference-in-differences models examining staggered exposure across multiple units use two-way fixed-effects (TWFE) models to estimate average effects of exposure. This method assumes treatment effects do not change over time: if treatment leads to changes in trends, early-treated units become non-parallel controls for later-treated units, creating “forbidden” comparisons and thus potentially biasing results (Goodman-Bacon, 2021; Gardner, 2022; Roth *et al.*, 2022). This assumption is likely to be violated in examining effects of UC due to incremental increases in numbers of claimants and thus an intensifying population-wide effect in the post-rollout period.

To study differences in effect across the post-rollout period robustly, we used several methods to account for this expected bias (Roth *et al.*, 2022). We used the two-stage difference-in-differences method and the `did2s` R package (Butts and Gardner, 2021; Gardner, 2022) as the most suitable for our (non-balanced) data. This method estimates a ‘never-treated’ potential outcome from a regression across not-yet-treated observations while accounting for period and time effects before estimating effects as observed differences from this imputed counterfactual outcome. Each model estimated dynamic event-study estimates for each outcome across quarters following rollout and a static effect estimate across the whole exposed period. We recorded static estimates – average effects across the exposure period – as primary measurements of effect size for interpretability. We plotted event-study estimates to visually examine changes over time. In our main analysis we included all observations across the 2012–2019 period.

As a sensitivity analysis, we fitted a model to a ‘truncated’ dataset to exclude observations relatively distant from the rollout date. We excluded early observations before 2013 and late observations more than two years after UC rollout relative to respondents’ local area.

We conducted TWFE sensitivity analyses to test whether the expected biases produced differing estimates, as outlined in our protocol (Baxter *et al.*, 2022). We fitted unadjusted and fully adjusted TWFE models, limiting post-rollout observations to the four quarters following the rollout date in each local authority. We fitted two further models with one post-rollout time point at 1 year and 2 years after the natural migration date – this prevents use of post-rollout observations as controls and estimates time-changing effects.

To give interpretable estimates of effects, population-wide differences in outcomes were scaled to a ‘per claimant’ indicator of effect sizes by dividing the estimated average change

in outcome by the proportion of respondents reporting UC receipt in the exposed period. Per-claimant standardised measures of change from pre-rollout means were calculated by dividing scaled estimates by pre-rollout standard deviations. We further used the April 2020–March 2021 APS dataset to estimate equivalent per-person effects of the COVID pandemic (2020 compared to previous years and adjusting for yearly trend) as a comparable measure of changes in well-being.

To test for differences of effect on vulnerable subgroups, we fitted two-stage models with separate baselines and differences across subgroups. As factors directly determining UC award, we tested effects on full-time students, young people (aged under 25, matching standard allowance threshold) (HM Government, 2023), disabled people, people with dependent children, single people, people with caring responsibilities and lone parents. We tested for differences on women, people of non-white ethnicity and people with lower educational outcomes as groups potentially affected indirectly by changes. We reported effect sizes for both vulnerable and baseline groups and tested for differences between groups. We also compared Scotland and Wales with England to test for differences in effects across the three countries which may be produced by differences in benefit administration.

We tested for parallel pre-intervention trends across all Local Authority areas grouped by quarter of UC rollout (thirteen quarters). We plotted quarterly pre-rollout mean outcomes across all grouped observations with fitted trend lines and inspected these visually. We further tested differences in trends relative to the trends of the latest quarter for unadjusted and fully adjusted models.

All statistical analyses were conducted in R (v4.2.2) (R Core Team, 2023). Rendered documents containing analysis results were added to OSF at osf.io/knajb (Baxter *et al.*, 2022).

Role of the funding source

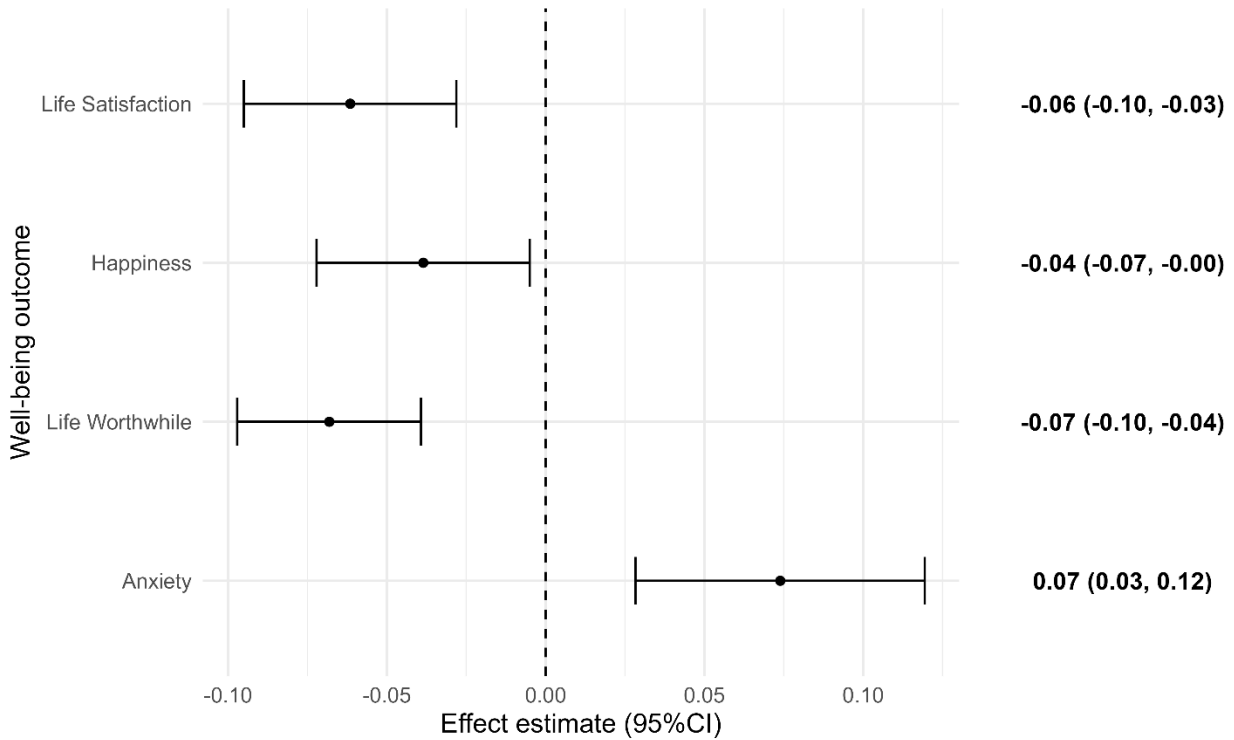
The funder had no role in the study design, data collection and analysis, interpretation or decision to submit for publication.

Results

We included 245,658 observations in our study sample (Table 1). Using survey weighting for representativeness, the mean age was 39.2 years in pre-local-rollout periods and 39.9 in post-rollout periods exposed to UC. 55.2% of pre-rollout and 56.4% of post-rollout respondents were women. Most respondents were white (80.9% pre and 78.6% post), living in England (85.2% and 86.5%), not disabled (65.5% and 61.9%) and living in rented accommodation (63.2% in both periods). Pre-rollout respondents had a mean Life Satisfaction score of 7.0 (SD = 2.1), mean Happiness score of 7.0 (SD = 2.4), mean Life Worthwhile score of 7.4 (SD = 2.1) and mean Anxiety score of 3.4 (SD = 3.0). Each outcome increased by ~0.1 points after rollout (not adjusting for pre-rollout trends).

An average of 6.3% of the sample reported receiving Universal Credit in the first year after rollout, increasing to 9.4% across all post-rollout time periods (37.8% of respondents reported still claiming legacy benefits in the post-rollout period). Small proportions (<2%) of respondents reported claiming UC in the period before the 'natural migration' rollout date (see Supplementary Material Figure A-2), potentially having transitioned to UC during the 'restricted rollout' phase. A clear change in trend is seen at the intended transition period, with numbers of UC-claiming respondents rising rapidly in the first four quarters after exposure and continuing beyond this period. There is a rapid decrease in numbers of observations in later quarters, with only 67 of the 380 LAs being observed for nine or more quarters post-rollout.

Two-stage model estimates are presented in Figure 2. Rollout of UC was associated with an average -0.06 point drop in life rated as 'worthwhile' (-0.09 to -0.03), a -0.04 point drop in Life Satisfaction (-0.07 to -0.00), a -0.07 point drop in Happiness (-0.10 to -0.04), and a 0.07 point increase in Anxiety (0.03 to 0.12; Figure 2). Given that on average 9.4% of exposed people report claiming Universal Credit, this is equivalent to a -0.66 (-1.01 to -0.30) point per claimant change in Life Satisfaction (-0.31 standard deviations (SDs) from a pre-rollout mean of 7.0), a -0.41 (-0.77 to -0.05) point per claimant change in Happiness (-0.17 SDs from a mean of 7.0), a -0.73 (-1.03 to -0.42) point per claimant change in feeling life is worthwhile (-0.36 SDs from a mean of 7.4), and a 0.79 (0.30 to 1.27) point per claimant change in Anxiety (0.26 SDs from a mean of 3.4; Table 2).



Unweighted N = 245,658

Figure 2 – Well-being effects across all observed post-rollout periods, estimated using a 'two-stage difference-in-differences' model adjusted for all confounders

In event-study plots produced from two-stage difference-in-differences models, across all four outcomes clear harms appear across the early period after the rollout dates (around the first two years), with diverging and uncertain effect estimates and effect directions in later periods (Figure 3).

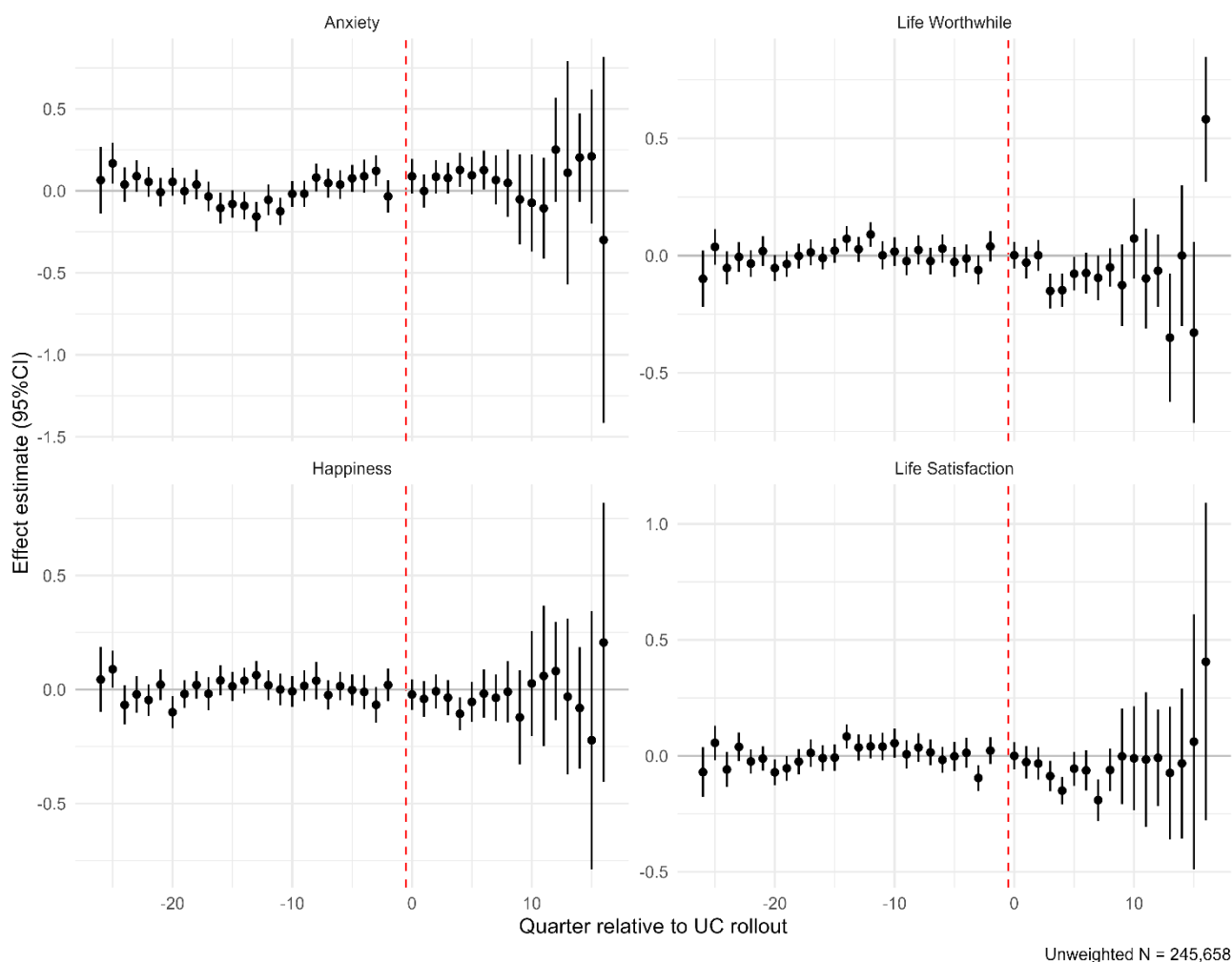


Figure 3 – Dynamic event-study plots of effects by quarter relative to the rollout of UC (at quarter ‘0’)

In subgroup analyses we found evidence of greater effects across several markers of vulnerability (Supplementary Material C). Single people saw greater effects on Life Satisfaction and Life Worthwhile and greater Anxiety (Supplementary Material Figure C-1). Disabled people experienced greater effects across all four well-being domains (Supplementary Material Figure C-2). We found greater Anxiety among people aged under 25, women, carers and full-time students, with no clear differences across other outcomes. Few clear differences in effect were seen across levels of educational attainment (Supplementary Material Figure C-10). We found no clear evidence of UC-related effects on well-being among people from minority ethnic groups whilst people of white ethnicity experienced negative effects across all four outcomes (Supplementary Material Figure C-9).

Across the three countries, there was some evidence of larger adverse effects among people in Wales on Life Satisfaction (-0.07 (-0.14 to -0.01)), Happiness (-0.11 (-0.22 to

-0.01)), Life Worthwhile (-0.07 (-0.16 to 0.02)) and Anxiety (0.12 (-0.07 to 0.31)) than people in England. Scottish respondents saw greater harms to Life Satisfaction (-0.09 (-0.16 to -0.02)) compared to England (Supplementary Material Table C-1 and Figure C-7).

Across all observations, parents with caring responsibilities for 1+ children saw more positive outcomes in Life Satisfaction (0.12 (0.07 to 0.18)), Happiness (0.11 (0.04 to 0.18)) and Life Worthwhile (0.08 (0.03 to 0.13)) compared to non-parents. Single parents experienced greater harms to Life Satisfaction (-0.06 (-0.14 to 0.02)) and Anxiety (0.20 (0.03 to 0.31)) compared to coupled parents, with the largest increases in anxiety across all groups, whilst seeing potentially positive differences in the other outcomes from single non-parents.

Across pre-intervention periods, grouped by quarter of rollout, most groups show stable trends in Anxiety and small increasing trends across Happiness, Life Satisfaction and Life Worthwhile, with some diverging trend lines (Supplementary Material Figure A-3). Once adjusting for potential confounders, any differential trends across LAs were largely diminished (Supplementary Material Figure A-5). We took this as sufficient indication of parallel trends.

Sensitivity analyses

Two way fixed-effect estimates are presented in Supplementary Material B. Across the first year following UC rollout, estimated effect directions and magnitudes are very similar to two-stage model estimates (Supplementary Material Figure B-9). Effects observed at the single time point one year after rollout were larger than period-average effects (two-to-three times larger than first year averages). At two years, effects were reduced across all four outcomes, with large confidence intervals likely driven by smaller numbers of observations (Supplementary Material Figure B-10).

In truncated models, restricting to observations from 2013 until two years after rollout dates, effect estimates were similar to main analyses for Life Satisfaction (-0.06 (-0.09 to -0.03)), Happiness (-0.04 (-0.07 to -0.00)) and Life Worthwhile (-0.06 (-0.09 to -0.03)), and smaller effects were seen for Anxiety (0.03 (-0.01 to 0.08); Supplementary Material Figure B-12).

Restricting analyses to 189,844 respondents reporting a benefit claim (Universal Credit or one of the six 'legacy benefits') produced larger effect estimates for Life Satisfaction (-0.10

(-0.14 to -0.06)), Happiness (-0.07 (-0.11 to -0.03)), Life Worthwhile (-0.10 (-0.13 to -0.07)) and Anxiety (0.10 (0.04 to 0.15); Supplementary Material D). Reported receipt of Universal Credit was greater in this population (18.1% compared with 9.8% of low-income population, which includes non-claimants). These estimates scale to a per-claimant effect on Life Satisfaction of -0.54 (-0.76 to -0.33), Happiness of -0.38 (-0.60 to -0.15), Life Worthwhile of -0.56 (-0.73 to -0.39) and Anxiety of 0.54 (0.25 to 0.82).

Discussion

The rollout of Universal Credit was associated with a reduction in each of the measured domains of well-being of adults in low-income households. These effects persisted across the first two years of rollout in each locality and were consistent across models with differing assumptions. We identified variation in the effects of UC among specific sub-populations, notably greater anxiety among young people, disabled people, women, full time students, those with caring responsibilities and single people (with a stronger effect on single parents). Conversely people of non-white ethnicity conversely experience better well-being changes than those of white ethnicity, and couples with children may have experienced relatively positive effects. People living in Scotland and Wales experienced poorer outcomes in some domains compared to people living in England. The potentially greater impact in Scotland is contrary to the expected effects of differences in administration of benefits, which aimed to reduce the impact of benefits system change – these estimates may indicate that such amendments were ineffective or insufficient (Child Poverty Action Group, 2023). Similar effects in Scotland and Wales may be indicative of populations which were more vulnerable to the UC rollout.

The effect sizes averaged across the population represent an average effect in the magnitude of a ~1 percentage point change in the 10-point scale but are potentially produced by a comparatively small subset of the observed population with only up to <10% of respondents reporting UC receipt. When standardising to a per-person effect (under the assumption that the effects of benefits change were fully or substantially felt by those switching to the new benefit), these represent potentially substantial impacts on a person's well-being. Although small in absolute terms they are considerably larger (1.8 to over 6 times) than the effects of the COVID-19 pandemic (**Error! Reference source not found.**).

Well-being measures provide valuable insights into the complex effects of policy changes. Public consultations identified 'Life satisfaction' as an important indicator of national well-being, and it is increasingly used in economic analyses through the WELLBY (well-being adjusted life year) framework to quantify and monetise the well-being effects of policies (OECD, 2013; HM Treasury, 2021). In our baseline analysis, the estimated 0.66-point reduction in life satisfaction across the UC rollout period translates into a significant well-being cost. Based on the recommended WELLBY values of £10,000 to £16,000 per person per year (HM Treasury, 2021), this reduction corresponds to a monetary loss of between £6,600 and £10,560 per person per year (in 2019 prices). These figures highlight the substantial welfare costs of the rollout of the policy, which should be considered in further economic evaluations of the reform.

Our findings are consistent with previous research which finds harms to mental health in cases of reforms to social security, including transition to UC, and additional harms for some groups of claimants (Power *et al.*, 2021; Pybus *et al.*, 2021; Simpson *et al.*, 2021). Our observations build on Wickham *et al.*'s (2020) analysis of changes across the 'restricted rollout' period by assessing effects across all low income households at the subsequent ('natural migration') phase of UC implementation. Our findings on well-being follow a similar pattern to earlier reports of unequal increases in psychological distress. Exploring similar axes of inequality as examined by Brewer, Dang and Tominey (2022), we find lower well-being among single people and lone parents. These observations are consistent with the finding of poorer mental health of such groups entering unemployment under UC relative to the legacy benefits – a difference potentially attributable to having less social support than married and cohabiting couples. Similar to Thornton and Iacolla (2022), we saw smaller effects on claimants with children than those without – in our analyses comparing amongst both coupled and single parents. The exception to this pattern appears to be the increase in Anxiety amongst single parents over all other family structures. Potential positive effects of UC – e.g. simplifying the claims process, incentivising entry into work – may have produced stronger effects in some claimants or social circumstances may have buffered some of the negative effects felt more strongly by others.

We were unable to distinguish immediate effects of transitioning to or claiming UC from lasting effects of the difference in benefit administration or payment amount. Our data

examined the population cross-sectionally. An observed increase of proportions of respondents reporting claiming UC – as expected from the structure of the ‘natural migration’ rollout – would produce greater average effects across time if the treatment effect were static. Some indication of intensifying effects can be seen across the initial quarters of the exposed period, which is consistent with this. Alternatively, if a more intense ‘shock’ effect were seen by individuals upon first switching, this effect would reduce over time. As data did not record length of time on UC, we were unable to test for individual-level dynamics of effects.

Our analyses assumed an ‘as if’ random rollout of UC by local authority in the absence of a formal outline of how the order of rollout was decided (Dunning, 2012). Clustering of areas with similar factors affecting well-being earlier or later in the rollout schedule may have introduced bias if these corresponded with either other national events or changes in UC implementation. Testing of pre-UC trends across all LAs, grouped by rollout quarter, showed no evidence of diverging trends which strengthens the inference that subsequent differences are produced by the transition to UC.

A limitation of our study is that our comparison across low-income households had low specificity in identifying claimants. Our use of an income marker would also have excluded higher-income households with circumstances eligible for higher extra award amounts (HM Government, 2023). The potential insensitivity of using observed benefit receipt and the threat to exchangeability of exposed and unexposed populations is discussed above. Using an equivalised income threshold determined from the data, our intention-to-treat approach aimed to include all households who were ‘at risk’ from changes in benefit systems, exchangeable across exposure states. Similarities in effect estimate when restricting to only those reporting a benefit claim indicate that our low-income household estimates appear generalisable to the benefit-claiming population, whilst accounting for potential bias.

Implications

Our results add to existing evidence of mental health harms due to changing social security policies by showing that the rollout of Universal Credit has had adverse effects on the well-being of claimants and potential claimants relative to the legacy benefit system it replaces. To understand how best to mitigate these effects further investigation should seek to identify which of the hypothesised mechanisms – including the wait for first payment,

increased deductions and debt, increased conditionality and (threat of) sanctions, digital format of accessing UC system – account for most adverse effects and are modifiable.

Statements

Author contributions

PC and CB were joint lead applicants on the NIHR grant and conceived the overall study aim and methods. AB led on data retrieval, development of methods, analysis and writing and revision of the manuscript. MT conducted second checking of analysis code and contributed to writing of manuscript. PC, SW, MM, SVK and DT-R contributed to selection of methods, review of results, drafting and revision of manuscript. HB, LM, MS, MR, MC and SA provided specialist advice on aspects of methods and interpretation and contributed to writing the paper. All authors reviewed and approved the final manuscript.

Acknowledgements

Several other members of the Evaluation of the health impacts of Universal Credit team contributed to the conduct and reporting of this study. Dr Marcia Gibson (University of Glasgow) and Dr Steph Morris (Newcastle University) gave advice on the formulation of research questions and the formation of an underlying logic model. Martin Taulbut (Public Health Scotland) and Prof Ben Barr (University of Liverpool) were members of the study management group which oversaw the wider project.

Role of the funding source

This study is part of an NIHR-funded study on evaluating the mental health impacts of Universal Credit, grant number NIHR131709 (Craig *et al.*, 2022). We also acknowledge funding from the Medical Research Council (MC_UU_00022/2), the Scottish Government Chief Scientist Office (SPHSU17) and the European Research Council (949582).

Ethics approval

We used a Special Licence version of the APS datasets, under the UK Data Service Secure Lab Project No. 116676. Survey respondents provided informed consent before being interviewed. All other data were openly published online. Further ethical approval for analysis was not required.

Transparency statement

The lead author (AB) affirms that the manuscript is an honest, accurate, and transparent account of the study being reported; that no important aspects of the study have been omitted; and that any discrepancies from the study as originally planned have been explained.

Competing interests

The authors declare none.

Patient and Public Involvement

The NIHR-funded study benefits from regular contributions from public partners, people with experience of claiming UC and staff supporting them (Craig *et al.*, 2022). In addition, one public partner is a member of the Study Advisory Group, where the findings were presented and implications discussed.

Our evolving approach to public involvement in this study is published at <https://journals.sagepub.com/doi/full/10.1177/17579139221103178> (Cheetham *et al.*, 2022)

Data sharing

Participant survey data are available through the Secure Access service at UK Data Service. The following datasets were used:

Office for National Statistics, Social Survey Division. Annual Population Survey, 2004-2022: Secure Access. [data collection]. 29th Edition. UK Data Service, 2023 [Accessed 18 June 2024]. Available from: DOI: <http://doi.org/10.5255/UKDA-SN-6721-28>

Office for National Statistics, Social Survey Division. Annual Population Survey Household, 2004-2021: Secure Access. [data collection]. 9th Edition. UK Data Service, 2023 [Accessed 18 June 2024]. Available from: DOI: <http://doi.org/10.5255/UKDA-SN-6725-9>

Tables

Demographic	Pre rollout	Post rollout
Observed Population		
Unweighted N	193,668	51,990
Weighted %	76.5%	23.5%
Well-being outcomes - Mean (SD)		
Life Satisfaction	7.0 (2.1)	7.1 (2.1)
Happiness	7.0 (2.4)	7.1 (2.4)
Life Worthwhile	7.4 (2.0)	7.5 (2.1)
Anxiety	3.4 (3.0)	3.5 (3.1)
Age		
Mean (SD)	39.2 (14.3)	39.9 (14.4)
Sex - N (%)		
Male	74,214 (44.8%)	19,477 (43.6%)
Female	119,454 (55.2%)	32,513 (56.4%)
Ethnicity - N (%)		
White	166,152 (80.9%)	44,171 (78.6%)
Non-white	27,516 (19.1%)	7,819 (21.4%)
Country - N (%)		
England	144,110 (85.2%)	38,982 (86.5%)
Wales	24,175 (5.7%)	5,447 (4.8%)
Scotland	25,383 (9.1%)	7,561 (8.7%)
Disabled - N (%)		
Not disabled	116,526 (65.5%)	29,256 (61.9%)
Disabled	77,142 (34.5%)	22,734 (38.1%)
Work-limiting health condition - N (%)		
No	126,539 (70.3%)	32,193 (67.5%)
Yes	67,129 (29.7%)	19,797 (32.5%)
Highest level of qualification - N (%)		
Degree or College	48,300 (25.7%)	14,805 (28.6%)
Upper secondary	43,053 (25.9%)	11,688 (26.8%)
Lower secondary	47,215 (23.1%)	12,283 (21.8%)
Tertiary	23,250 (11.6%)	5,427 (10.2%)
None	31,850 (13.7%)	7,787 (12.5%)
Employment status - N (%)		
In employment	82,480 (41.8%)	22,659 (43.4%)
ILO unemployed	21,963 (12.8%)	4,231 (9.1%)
Inactive	89,225 (45.5%)	25,100 (47.5%)
Housing tenure - N (%)		
Outright	40,252 (16.9%)	12,023 (18.4%)

Mortgaged	41,292 (18.8%)	10,012 (17.1%)
Rented	110,378 (63.2%)	29,413 (63.2%)
Other	1,746 (1.1%)	542 (1.3%)
Relationship status - N (%)		
Married/Cohabiting/Civil Partnership	93,404 (43.0%)	24,613 (42.1%)
Non married	100,264 (57.0%)	27,377 (57.9%)
Number of children - N (%)		
0	120,235 (61.5%)	33,617 (64.0%)
1	32,495 (17.4%)	7,736 (15.2%)
2+	40,938 (21.1%)	10,637 (20.8%)
Caring responsibilities - N (%)		
No	161,672 (84.7%)	43,670 (85.4%)
Yes	31,996 (15.3%)	8,320 (14.6%)

Ns represent unweighted counts of observations. Means, percentages and standard deviations (SDs) are weighted for representativeness. Total Unweighted N = 245,658

Table 1 – Population demographics, counted by observation and summarised by survey weighting.

Outcome	Per-person effect of:	
	Switching to UC	Entering COVID pandemic*
Life Satisfaction	-0.66 (-1.01 to -0.30)	-0.23 (-0.30 to -0.17)
Happiness	-0.41 (-0.77 to -0.05)	-0.23 (-0.36 to -0.11)
Life Worthwhile	-0.73 (-1.03 to -0.42)	-0.12 (-0.16 to -0.08)
Anxiety	+0.79 (0.30 to 1.27)	+0.43 (0.20 to 0.67)

*‘COVID pandemic’ effects estimated as weighted average, adjusting for year trends and month of observation; all survey participants.

Table 2 – estimated effects of Universal Credit compared with the effect of the COVID-19 pandemic

References

Alexiou, A. and Barr, B. (2019a) ‘Local Authority Finance: Gross Current Expenditure – Cultural and related services (FIN_07_26) [Open Dataset]’, *Place-based Longitudinal Data*

Resource. doi: 10.17638/datacat.liverpool.ac.uk/1388.

Alexiou, A. and Barr, B. (2019b) 'Local Authority Finance: Gross Current Expenditure – Education services (FIN_07_19) [Open Dataset]', *Place-based Longitudinal Data Resource*. doi: 10.17638/datacat.liverpool.ac.uk/1321.

Alexiou, A. and Barr, B. (2019c) 'Local Authority Finance: Gross Current Expenditure – Social Care services (FIN_07_21) [Open Dataset]', *Place-based Longitudinal Data Resource*. doi: 10.17638/datacat.liverpool.ac.uk/1312.

Alston, P. (2018) *Statement on Visit to the United Kingdom, by Professor Philip Alston, United Nations Special Rapporteur on extreme poverty and human rights - London, 16 November 2018*.

Arie, S. (2018) 'Doctors' concerns over universal credit are mounting', *BMJ*, 363. doi: 10.1136/BMJ.K5131.

Bambra, C. and Eikemo, T. A. (2009) 'Welfare state regimes, unemployment and health: A comparative study of the relationship between unemployment and self-reported health in 23 European countries', *Journal of Epidemiology and Community Health*, 63(2), pp. 92–98. doi: 10.1136/jech.2008.077354.

Baxter, A. *et al.* (2022) 'Difference-in-difference effect estimates of the mental health impacts of the implementation of Universal Credit using Annual Population Survey data (2013-2018 rollout period) - Protocol and documentation', *OSF*. doi: 10.17605/OSF.IO/KNAJB.

Brewer, M., Dang, T. and Tominey, E. (2022) *Universal Credit: Welfare Reform and Mental Health*. Available at: <https://ideas.repec.org/p/iza/izadps/dp15178.html>.

Butts, K. and Gardner, J. (2021) 'did2s: Two-Stage Difference-in-Differences', *arXiv*, pp. 1–13. Available at: <http://arxiv.org/abs/2109.05913>.

Cheetham, M. *et al.* (2019) 'Impact of Universal Credit in North East England: a qualitative study of claimants and support staff', *BMJ Open*, 9(7), p. e029611. doi: 10.1136/BMJOPEN-2019-029611.

Cheetham, M. *et al.* (2022) 'Exploring the mental health effects of Universal Credit: a

journey of co-production', *Perspectives in Public Health*, 142(4), pp. 209–212. doi: 10.1177/17579139221103178/SUPPL_FILE/SJ-DOCX-2-RSH-10.1177_17579139221103178.DOCX.

Cheetham, M. *et al.* (2024) “You can see when your parents are struggling”: a qualitative study of children and young people’s views of Universal Credit’, *Journal of Social Policy*, pp. 1–21. doi: 10.1017/S0047279424000333.

Child Poverty Action Group (2021) *Universal credit: what needs to change to make it fit for children and families?* Available at: <https://cpag.org.uk/news/universal-credit-what-needs-change-make-it-fit-children-and-families> (Accessed: 17 June 2024).

Child Poverty Action Group (2023) *Universal credit Scottish choices*. Available at: <https://cpag.org.uk/welfare-rights/benefits-scotland/scottish-benefits/other-scottish-benefits/universal-credit-scottish-choices> (Accessed: 16 May 2024).

Craig, P. *et al.* (2022) ‘Evaluation of the mental health impacts of Universal Credit: protocol for a mixed methods study’, *BMJ Open*, 12(4), p. e061340. doi: 10.1136/BMJOPEN-2022-061340.

Department for Work & Pensions (2010) *Universal Credit: Welfare That Works*. Available at: assets.publishing.service.gov.uk/media/5a7a269ae5274a34770e49dd/universal-credit-full-document.pdf.

Department for Work & Pensions (2018a) *Universal Credit Full Service Survey*. Available at: <https://www.gov.uk/government/publications/universal-credit-full-service-claimant-survey> (Accessed: 13 December 2022).

Department for Work & Pensions (2018b) *Universal Credit transition rollout schedule March 2018 to December 2018*. Available at: <https://www.gov.uk/government/publications/universal-credit-transition-to-full-service/universal-credit-transition-rollout-schedule-march-2018-to-december-2018> (Accessed: 16 February 2022).

Department for Work & Pensions (2022a) *Completing the move to Universal Credit*. London. Available at: <https://www.gov.uk/government/publications/completing-the-move-to-universal-credit/completing-the-move-to-universal-credit--2> (Accessed: 15 June 2022).

Department for Work & Pensions (2022b) *Universal Credit and your claimant commitment*, GOV.UK Guidance. Available at: <https://www.gov.uk/government/publications/universal-credit-and-your-claimant-commitment-quick-guide/universal-credit-and-your-claimant-commitment> (Accessed: 21 December 2022).

Department for Work & Pensions (2023) *Universal Credit statistics: background information and methodology*. London. Available at: <https://www.gov.uk/government/publications/universal-credit-statistics-background-information-and-methodology/universal-credit-statistics-background-information-and-methodology> (Accessed: 17 March 2023).

Department for Work & Pensions (2024) *Estimating the employment impact of Universal Credit among single parents*. London. Available at: <https://www.gov.uk/government/publications/estimating-the-employment-impact-of-universal-credit-among-single-parents> (Accessed: 25 March 2024).

Dunning, T. (2012) 'How plausible is as-if random?', in *Natural Experiments in the Social Sciences*. Cambridge University Press, pp. 235–255. doi: 10.1017/CBO9781139084444.012.

Faculty of Public Health (2024) *Outcome frameworks in England*. Available at: <https://www.fph.org.uk/policy-advocacy/special-interest-groups/public-mental-health-special-interest-group/better-mental-health-for-all/measurements-of-mental-health-outcomes-and-key-sources-of-data/outcome-frameworks-in-england/> (Accessed: 27 September 2024).

Gardner, J. (2022) 'Two-stage differences in differences'. doi: 10.48550/arXiv.2207.05943.

Goodman-Bacon, A. (2021) 'Difference-in-differences with variation in treatment timing', *Journal of Econometrics*, 225(2), pp. 254–277. doi: 10.1016/J.JECONOM.2021.03.014.

HM Government (2023) *Universal Credit: What you'll get*. Available at: <https://www.gov.uk/universal-credit/what-youll-get> (Accessed: 26 August 2022).

HM Treasury (2021) *Wellbeing Guidance for Appraisal: Supplementary Green Book Guidance*. Available at: <https://www.gov.uk/government/publications/green-book-supplementary-guidance-wellbeing>.

Mackley, A., Hobson, F. and Kennedy, S. (2024) *Managed migration: Completing Universal Credit rollout*. Available at: <https://commonslibrary.parliament.uk/research-briefings/cbp-9984/> (Accessed: 21 June 2024).

National Audit Office (2018) *Rolling out Universal Credit*. London. Available at: <https://www.nao.org.uk/wp-content/uploads/2018/06/Rolling-out-Universal-Credit.pdf> (Accessed: 17 August 2021).

National Research Council (2013) 'Subjective Well-Being: Measuring Happiness, Suffering, and Other Dimensions of Experience'. doi: 10.17226/18548.

OECD (2013) *OECD Guidelines on Measuring Subjective Well-being*. doi: 10.1787/9789264191655-EN.

Office for National Statistics (2012) *Annual population survey (APS) QMI*. Available at: <https://www.ons.gov.uk/employmentandlabourmarket/peopleinwork/employmentandemployeetypes/methodologies/annualpopulationsurveyapsqmi> (Accessed: 11 February 2022).

Office for National Statistics (2015) *Equivalised income - Office for National Statistics, Family spending in the UK*. Available at: <https://www.ons.gov.uk/peoplepopulationandcommunity/personalandhouseholdfinances/incomeandwealth/compendium/familyspending/2015/chapter3equivalisedincome> (Accessed: 16 May 2024).

Office for National Statistics (2018) *Personal well-being user guidance*. Available at: <https://www.ons.gov.uk/peoplepopulationandcommunity/wellbeing/methodologies/personalwellbeingsurveyuserguide> (Accessed: 17 March 2023).

Office for National Statistics (2022) 'Background and methodology 2022', in *Labour Force Survey: User Guide*. Available at: <https://www.ons.gov.uk/employmentandlabourmarket/peopleinwork/employmentandemployeetypes/methodologies/labourforcesurveyuserguidance#2022-update>.

Office for National Statistics (2023) *Regional economic activity by gross domestic product, UK: 1998 to 2021*. Available at: <https://www.ons.gov.uk/economy/grossdomesticproductgdp/bulletins/regionaleconomicactivitybygrossdomesticproductuk/1998to2021> (Accessed: 17 June 2024).

Office for National Statistics - Social Survey Division (2023) 'Annual Population Survey, 2004-2022: Secure Access'. UK Data Service. doi: 10.5255/UKDA-SN-6721-22.

Power, M. *et al.* (2021) "The reality is that on Universal Credit I cannot provide the recommended amount of fresh fruit and vegetables per day for my children": moving from a behavioural to a systemic understanding of food practices', *Emerald Open Research*, 1(10). doi: 10.1108/EOR-10-2023-0007.

Public Health Scotland (2022) *Adult mental health indicators*. Available at: <https://publichealthscotland.scot/publications/adult-mental-health-indicator-resources/>.

Pybus, K. *et al.* (2021) 'Functional assessments in the UK social security system: the experiences of claimants with mental health conditions', *Journal of Social Policy*, 50(2), pp. 305–322. doi: 10.1017/S0047279420000094.

R Core Team (2023) 'R: A Language and Environment for Statistical Computing'. Vienna, Austria. Available at: <https://www.r-project.org/>.

Roth, J. *et al.* (2022) 'What's Trending in Difference-in-Differences? A Synthesis of the Recent Econometrics Literature', *Papers*, 8(2), pp. 235–275. doi: 10.1086/711509.

Scottish Government (2024) *Local government finance statistics*. Available at: <https://www.gov.scot/collections/local-government-finance-statistics/> (Accessed: 17 June 2024).

Simpson, J. *et al.* (2021) 'Effects of social security policy reforms on mental health and inequalities: A systematic review of observational studies in high-income countries', *Social Science & Medicine*, 272, p. 113717. doi: 10.1016/J.SOCSCIMED.2021.113717.

StatsWales (2023) *Revenue outturn expenditure, by authority*. Available at: <https://statswales.gov.wales/Catalogue/Local-Government/Finance/Revenue/Outturn/revenueoutturnexpenditure-by-authority> (Accessed: 17 June 2024).

Thornton, I. and Iacoella, F. (2022) 'Conditionality and contentment: Universal Credit and UK welfare benefit recipients' life satisfaction', *Journal of Social Policy*, pp. 1–29. doi: 10.1017/S0047279422000241.

Wickham, S. *et al.* (2020) 'Effects on mental health of a UK welfare reform, Universal Credit: a longitudinal controlled study', *The Lancet Public Health*, 5(3), pp. e157–e164. doi: 10.1016/S2468-2667(20)30026-8.

Work and Pensions Committee (2020) *Universal Credit: the wait for a first payment*. London. Available at: <https://committees.parliament.uk/work/135/universal-credit-the-wait-for-a-first-payment/publications/> (Accessed: 17 September 2024).

Supplement A - Selecting population and pre-analysis checks

A.1 Population counts and data removed due to missingness or ineligibility.

Level	Removed	Population
All observations	-	921,139
No missing data	14,745	906,394
Sufficient pre-post data	8,920	898,104
Over 18 and pre-2020	83,372	814,787
Low-income population	569,129	245,658

Table A-1 – Population inclusion by criteria

A.2 Outcome variable questions

The wellbeing outcomes are captured in the 'ONS 4' questions on wellbeing: 'Life satisfaction', 'Happiness', 'Life worthwhile' and 'Anxiety' (Table A-2).

Question wording	Scale	Variable name in dataset
Overall, how satisfied are you with your life nowadays?	0 = 'not at all satisfied' To 10 = 'completely satisfied'	SATIS
How happy did you feel yesterday?	0 = 'not at all happy' To 10 = 'completely happy'	HAPPY
Overall, to what extent do you feel that the things you do in your life are worthwhile?	0 = 'not at all worthwhile' To 10 = 'completely worthwhile'	WORTH

Question wording	Scale	Variable name in dataset
How anxious did you feel yesterday?	0 = 'not at all anxious' To 10 = 'completely anxious'	ANXIOUS

Table A-2 – Questions, scales and variable names of the four wellbeing questions asked of APS respondents

A.3 Income across populations

	Lower quartile		Median		Upper quartile	
Received UC	Income	Unweighted N	Income	Unweighted N	Income	Unweighted N
No	£1,100	1,906	£1,830	2,866	£2,730	728
Yes	£390	1,584	£670	3,569	£1,070	2,066

Unweighted N = 542,383

Table A-3 – Median, lower quartile and upper quartile of monthly equivalised income across households receiving and not receiving Universal Credit or a legacy benefit

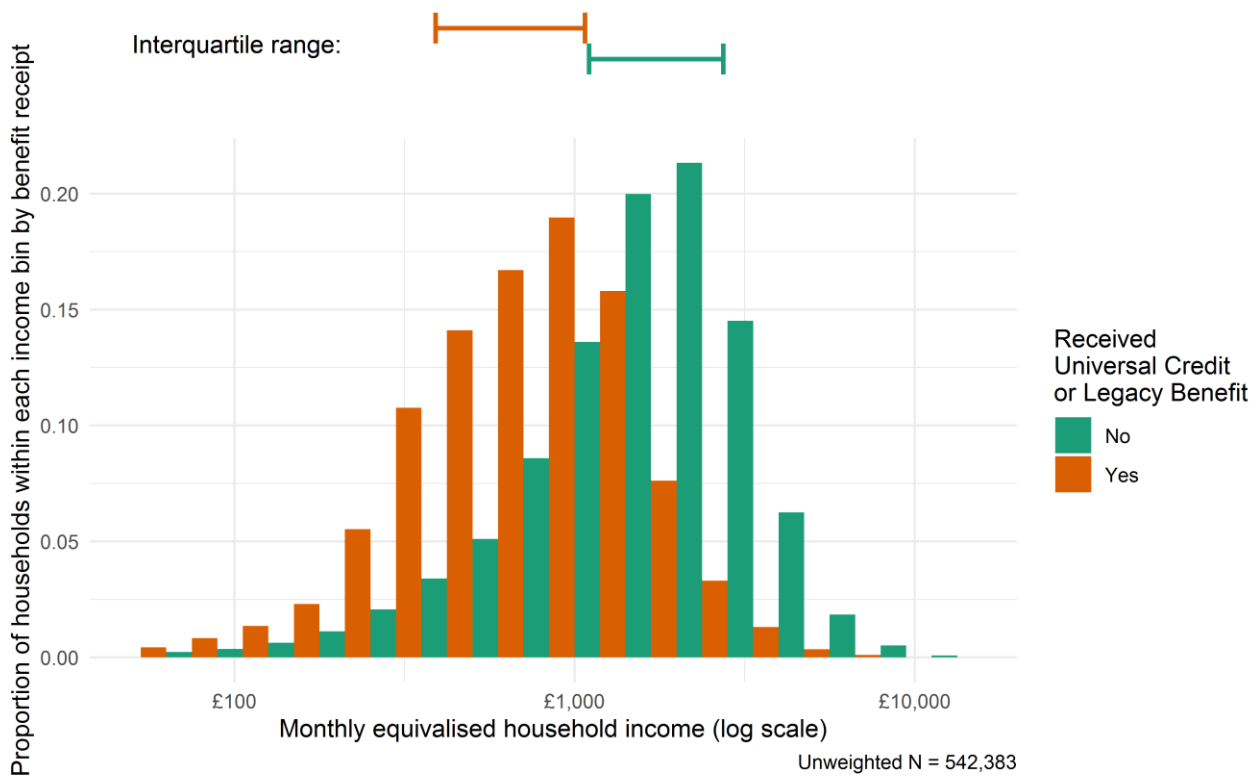


Figure A-1 – Distribution of Household equivalised income across reported receipt of UC or a Legacy Benefit, bars with fewer than 50 observations removed.

A.4 Exposure in post-UC period

Population = 245,658 (unweighted individuals). Weighted observations: 88,122,688 - living in households with equivalised household income < £12,000pa, not retired and not working more than average 20 hours per week.

Figure A-2 shows the percentage of low-income respondents in each period relative to the rollout of UC who report claiming Universal Credit.

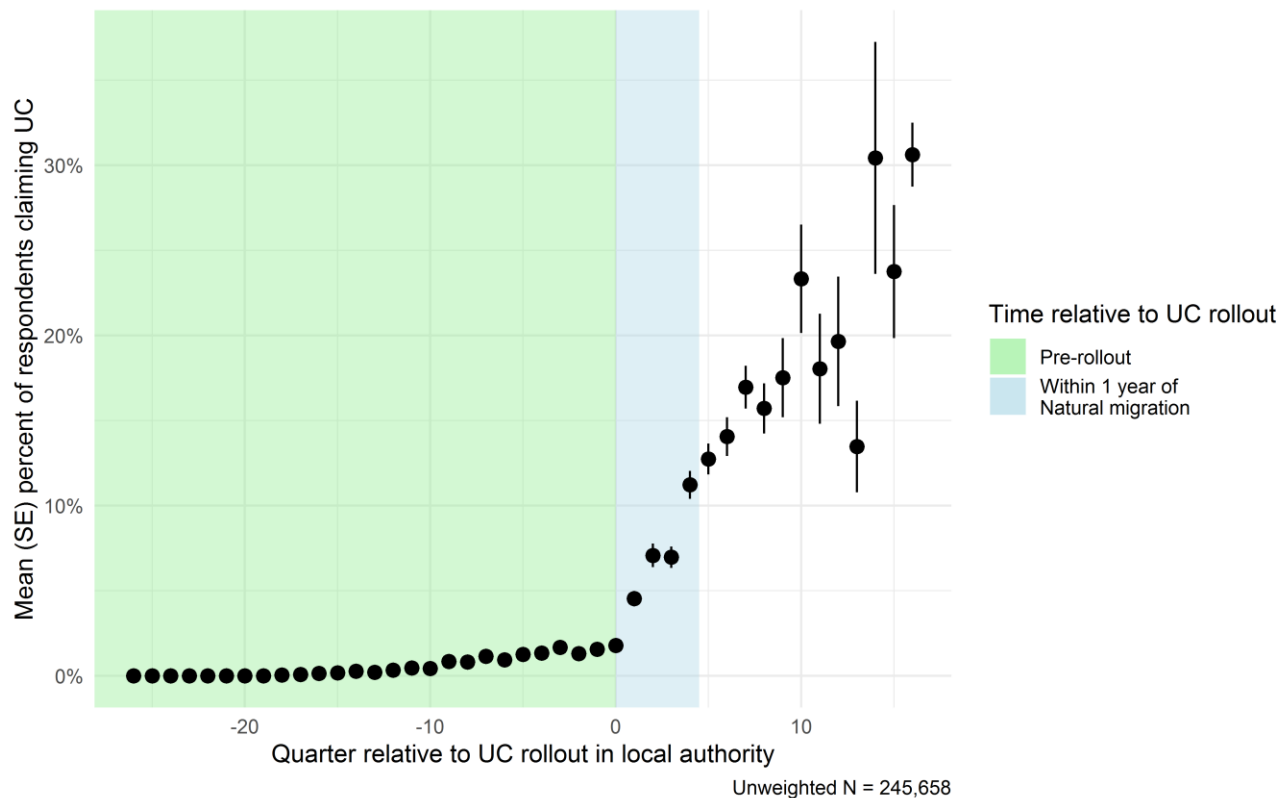


Figure A-2 – Percentage of respondents per Local Authority reporting claiming UC in each quarter relative to UC rollout in their area.

A.5 Low income population within 1 year

An average of 6.3% (N = 2089) of respondents in low-income households reported receiving Universal Credit across the first year following UC rollout.

9.4% (N = 4666) reported receiving UC across all years where UC was available in their Local Authority (37.8%, N = 22520 claimed legacy benefits).

At 1 year, 10.6% (N = 695) of surveyed respondents in low-income households reported receiving UC. At 2 years, 15.7% (N = 370) reported receiving UC.

A.6 Trends before intervention

Figure A-3 shows fitted trends across outcomes in the period before UC rollout. Figure A-4 shows the unadjusted differences between pre-intervention trends across grouped rollout periods. Figure A-5 shows the differences in trends when correcting for covariates.

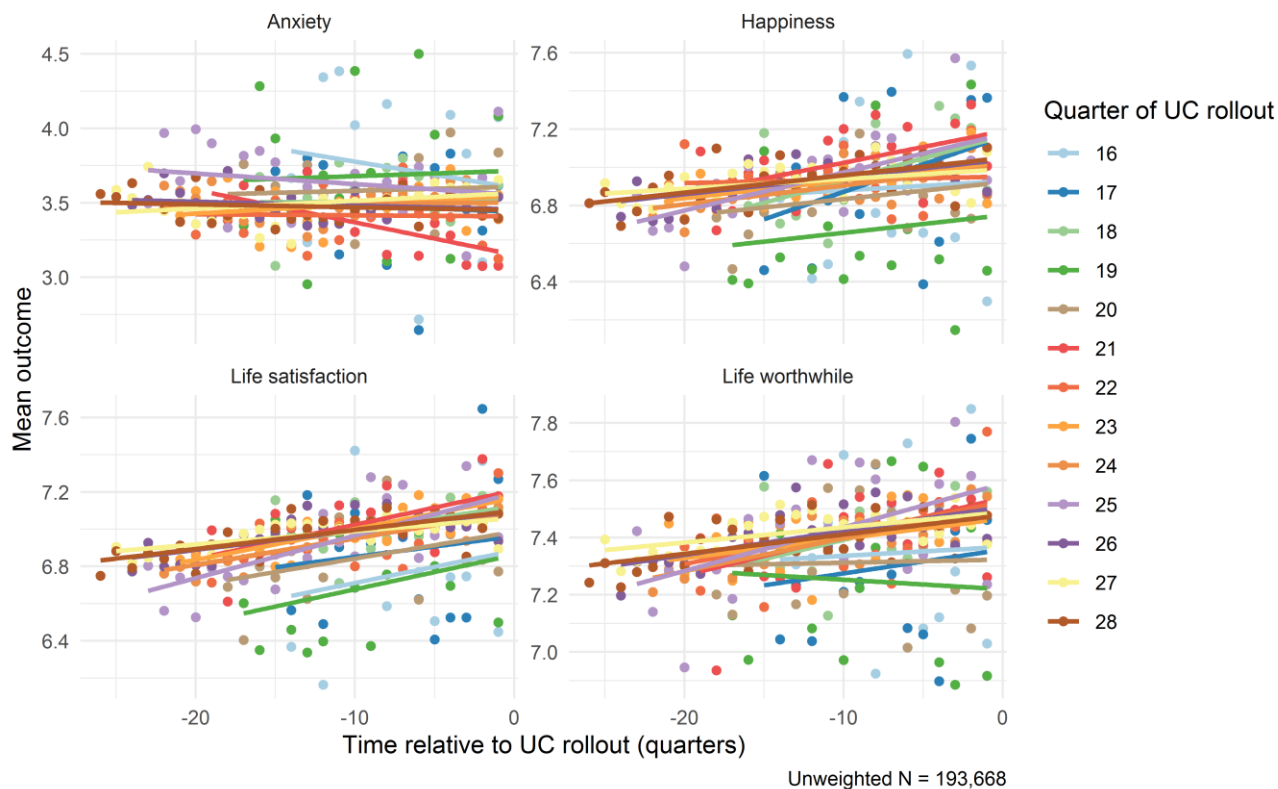
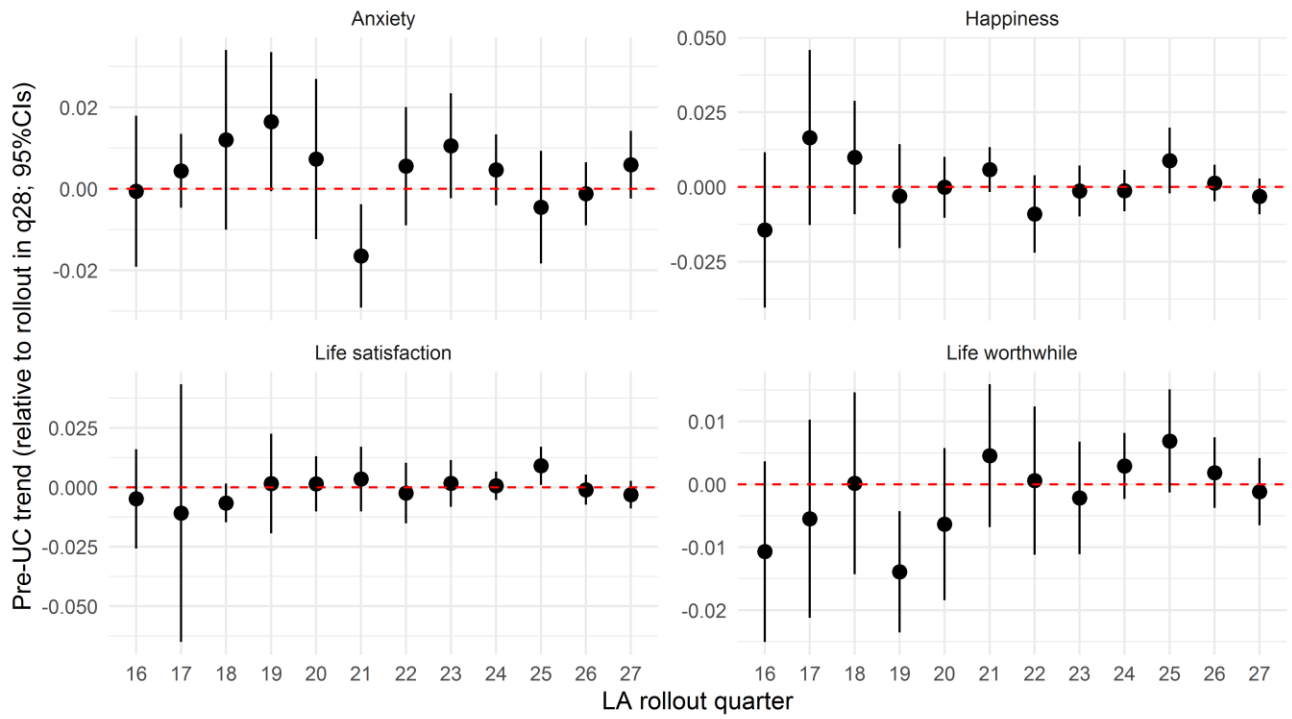


Figure A-3 – Trends in anxiety, life worthwhile, life satisfaction and happiness in pre-UC period, grouped by quarter of rollout for low income households. Dots represent mean scores for each outcome across all respondents grouped by quarter of rollout.

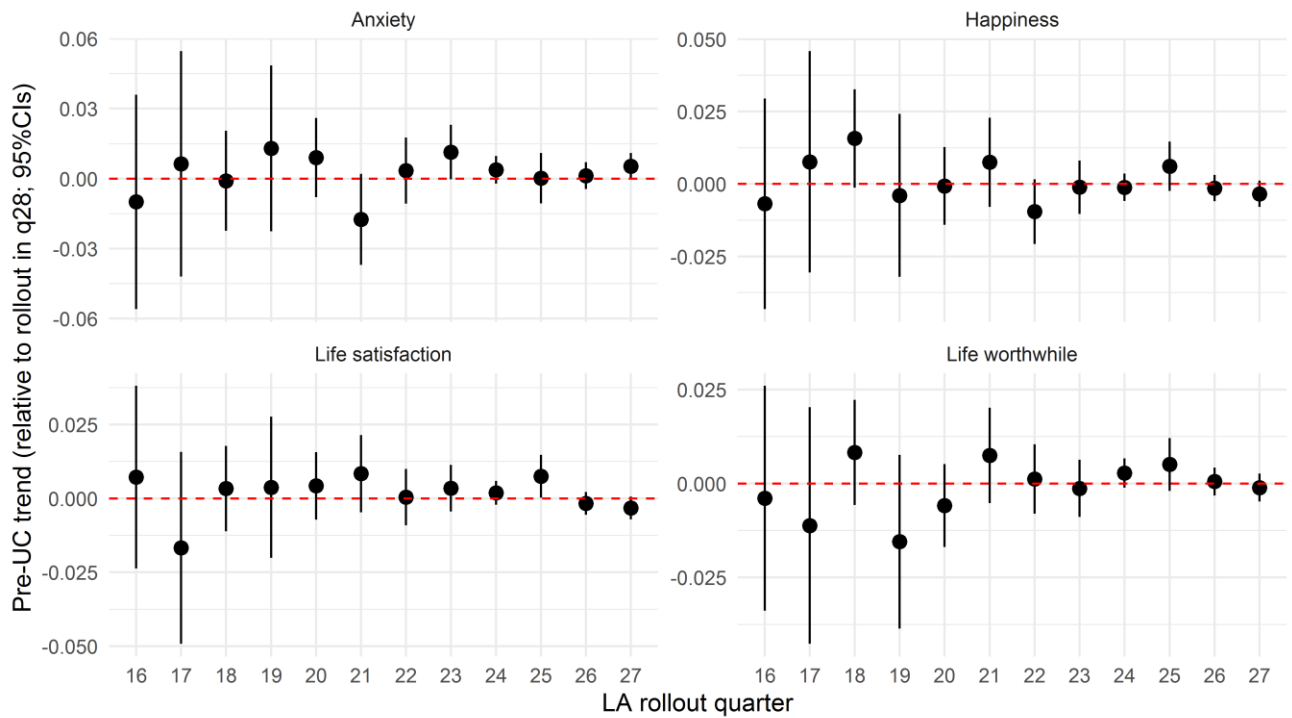
Unadjusted pre-intervention trends



Unweighted N = 193,668

Figure A-4 – Differences in pre-exposure trends in anxiety, happiness, life satisfaction and life worthwhile. Areas grouped by quarter of rollout, relative to latest quarter (Q28 = Q4, 2018).

Controlled pre-intervention trends



Unweighted N = 193,668

Figure A-5 – Differences in pre-exposure trends in anxiety, happiness, life satisfaction and life worthwhile, adjusted for all controls. Areas grouped by quarter of rollout, relative to latest quarter (Q28 = Q4, 2018).

Supplement B - Main effects analysis outputs

B.1 Life Satisfaction

B.1.1 TWFE models

B.1.1.1 In first year of rollout

Table B-1: Unadjusted and fully adjusted differences in 'Life Satisfaction' across 1st year

term	Unadjusted		Fully adjusted	
	Estimate	95%CI	Estimate	95%CI
UC rollout	0.0886	0.0652, 0.1120	-0.0489	-0.0899, -0.0079

Unweighted N = 245,658

B.1.1.2 Observations at 1-year and 2-years

Table B-2: Adjusted differences in 'Life Satisfaction' at 1 year and 2 years post-UC

term	1 year post-UC		2 years post-UC	
	Estimate	95%CI	Estimate	95%CI
UC rollout	-0.1483	-0.2126, -0.0841	-0.0630	-0.1579, 0.0319

Unweighted N = 245,658

B.1.2 Two-stage models

B.1.2.1 All observations

Table B-3: Static effects of UC on Life Satisfaction (Two-stage model)

Coefficient	Estimate	Standard Error	95%CI
UC exposure	-0.0615	0.0171	-0.0950, -0.0281

Unweighted N = 245,658

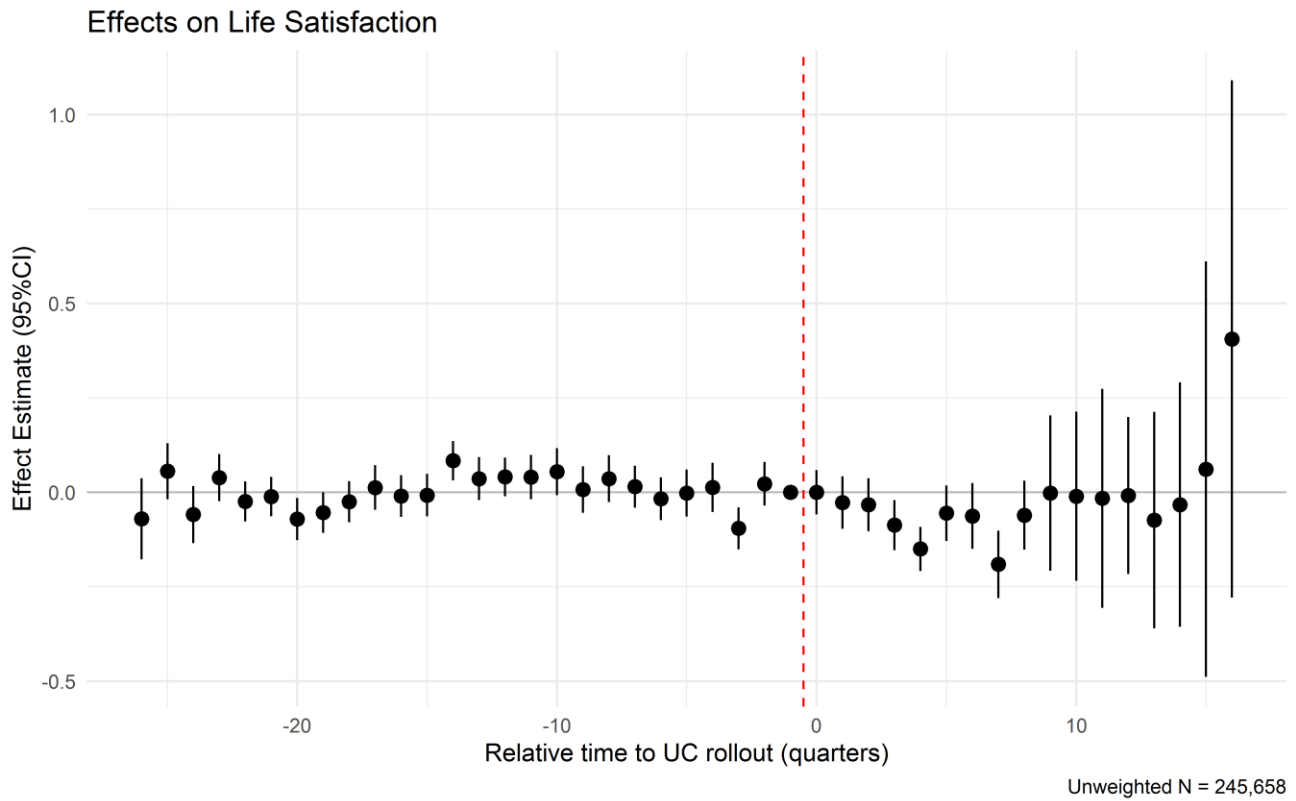


Figure B-1 Event-study plot of two-stage DiD Life Satisfaction model

B.1.2.2 Truncated time period

Table B-4: Static effects of UC on Life Satisfaction (Two-stage model)

Coefficient	Estimate	Standard Error	95%CI
UC exposure	-0.0578	0.0152	-0.0876, -0.0280

Unweighted N = 213,829

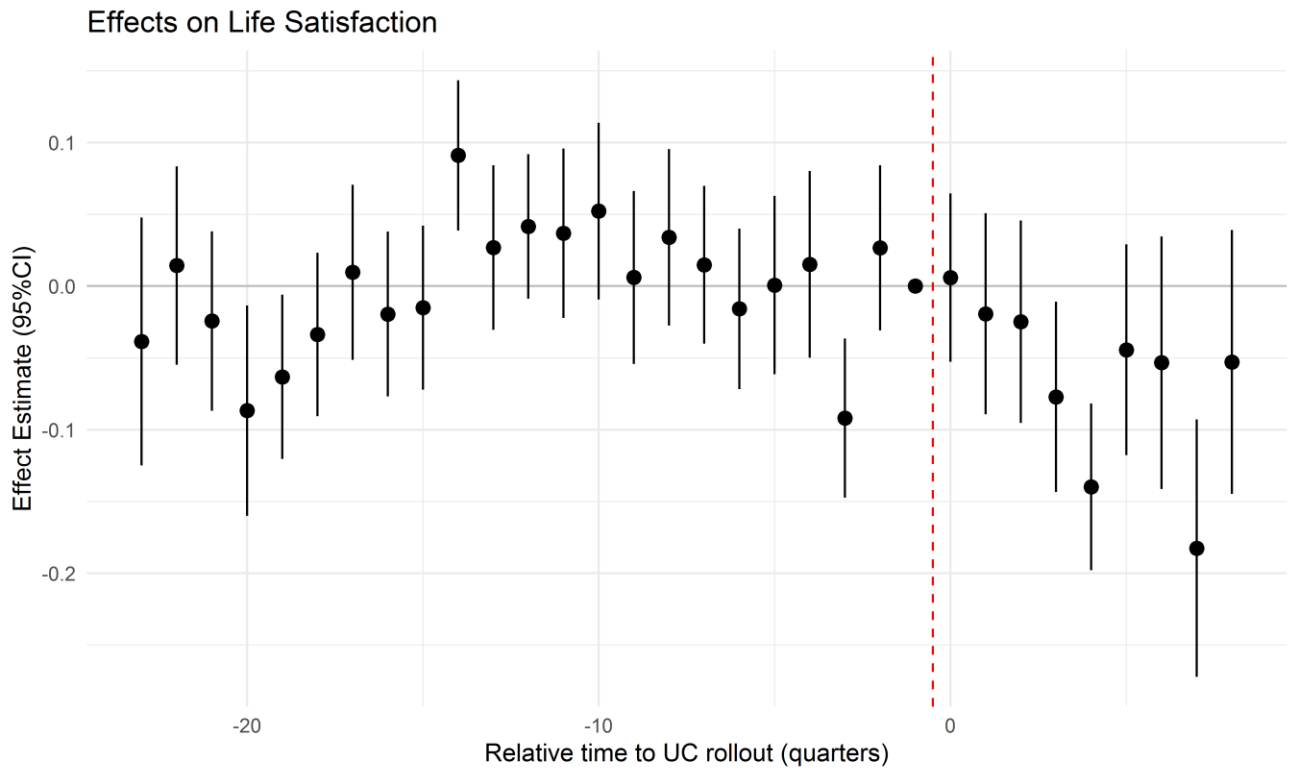


Figure B-2 Event-study plot of two-stage DiD Life Satisfaction model across time-truncated population

B.2 Happiness

B.2.1 TWFE models

B.2.1.1 In first year of rollout

Table B-5: Unadjusted and fully adjusted differences in 'Happiness' across 1st year

term	Unadjusted		Fully adjusted	
	Estimate	95%CI	Estimate	95%CI
UC rollout	0.0804	0.0537, 0.1070	-0.0393	-0.0855, 0.0070

Unweighted N = 245,658

B.2.1.2 Observations at 1-year and 2-years

Table B-6: Adjusted differences in 'Happiness' at 1 year and 2 years post-UC

term	1 year post-UC		2 years post-UC	
	Estimate	95%CI	Estimate	95%CI
UC rollout	-0.1108	-0.1862, -0.0355	-0.0172	-0.1515, 0.1172

Unweighted N = 245,658

B.2.2 Two-stage models

B.2.2.1 All observations

Table B-7: Static effects of UC on Happiness (Two-stage model)

Coefficient	Estimate	Standard Error	95%CI
UC exposure	-0.0385	0.0171	-0.0721, -0.0050

Unweighted N = 245,658

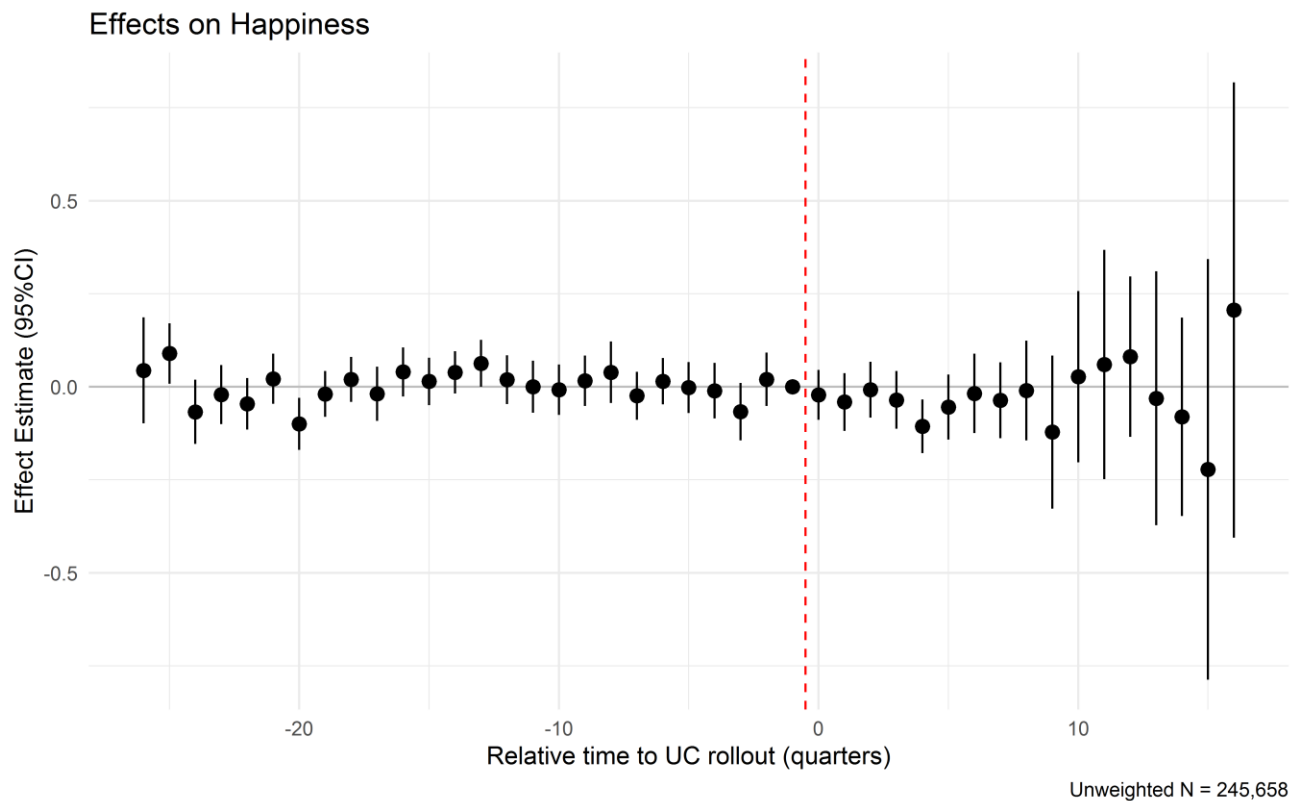


Figure B-3 Event-study plot of two-stage DiD Happiness model

B.2.2.2 Truncated time period

Table B-8: Static effects of UC on Happiness (Two-stage model)

Coefficient	Estimate	Standard Error	95%CI
UC exposure	-0.0360	0.0168	-0.0689, -0.0031

Unweighted N = 213,829

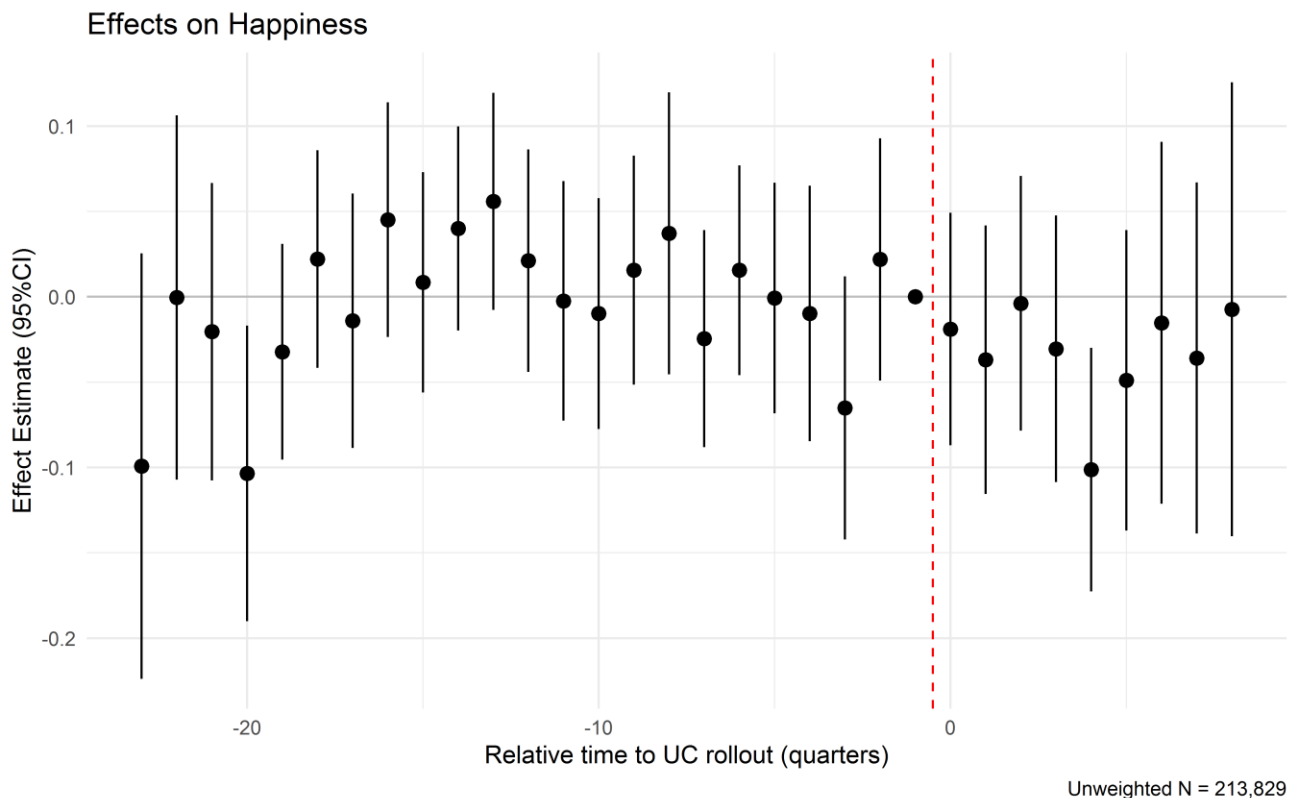


Figure B-4 Event-study plot of two-stage DiD Happiness model across time-truncated population

B.3 Life Worthwhile

B.3.1 TWFE models

B.3.1.1 In first year of rollout

Table B-9: Unadjusted and fully adjusted differences in 'Life Worthwhile' across 1st year

term	Unadjusted		Fully adjusted	
	Estimate	95%CI	Estimate	95%CI
UC rollout	0.0535	0.0311, 0.0760	-0.0607	-0.1026, -0.0188

Unweighted N = 245,658

B.3.1.2 Observations at 1-year and 2-years

Table B-10: Adjusted differences in 'Life Worthwhile' at 1 year and 2 years post-UC

term	1 year post-UC		2 years post-UC	
	Estimate	95%CI	Estimate	95%CI
UC rollout	-0.1507	-0.2261, -0.0754	-0.0548	-0.1411, 0.0315

Unweighted N = 245,658

B.3.2 Two-stage models

B.3.2.1 All observations

Table B-11: Static effects of UC on Life Worthwhile (Two-stage model)

Coefficient	Estimate	Standard Error	95%CI
UC exposure	-0.0681	0.0148	-0.0971, -0.0392

Unweighted N = 245,658

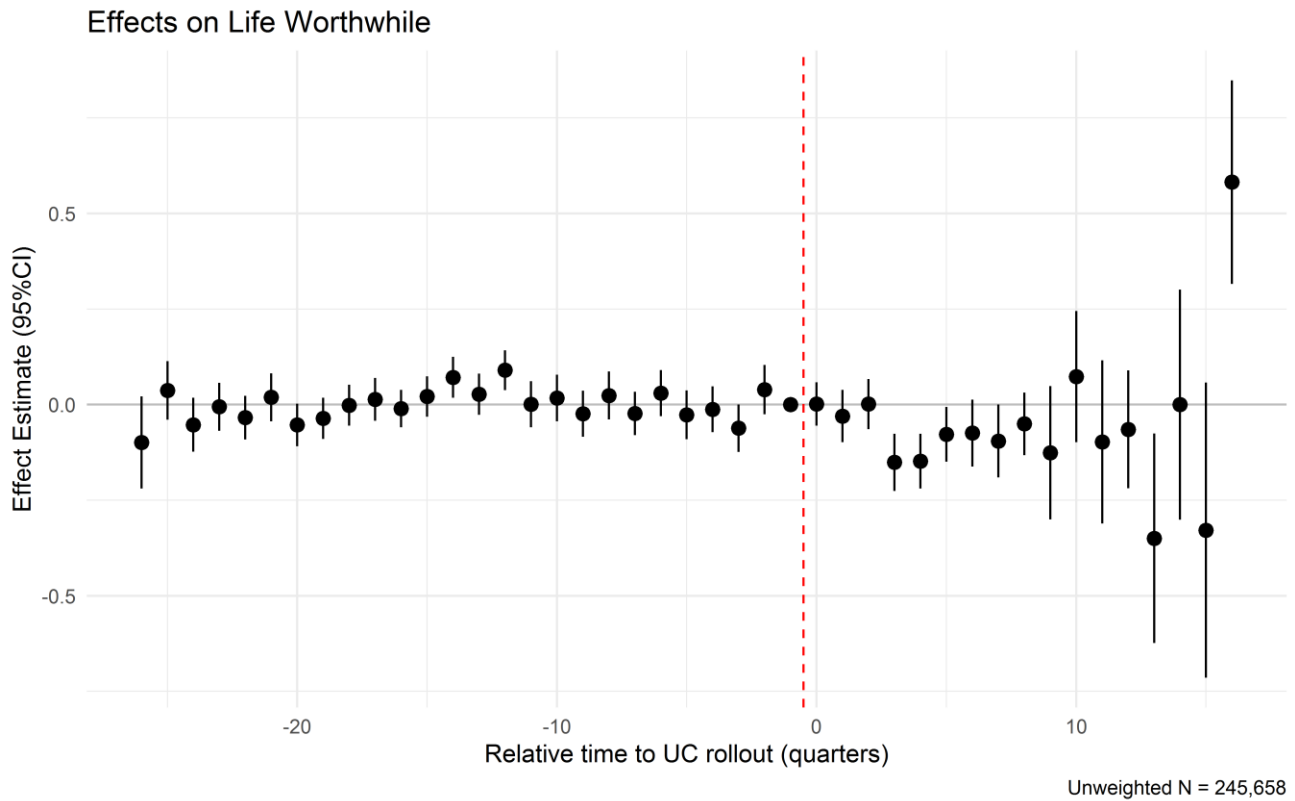


Figure B-5 Event-study plot of two-stage DiD Life Worthwhile model

B.3.2.2 Truncated time period

Table B-12: Static effects of UC on Life Worthwhile (Two-stage model)

Coefficient	Estimate	Standard Error	95%CI
UC exposure	-0.0559	0.0154	-0.0861, -0.0257

Unweighted N = 213,829

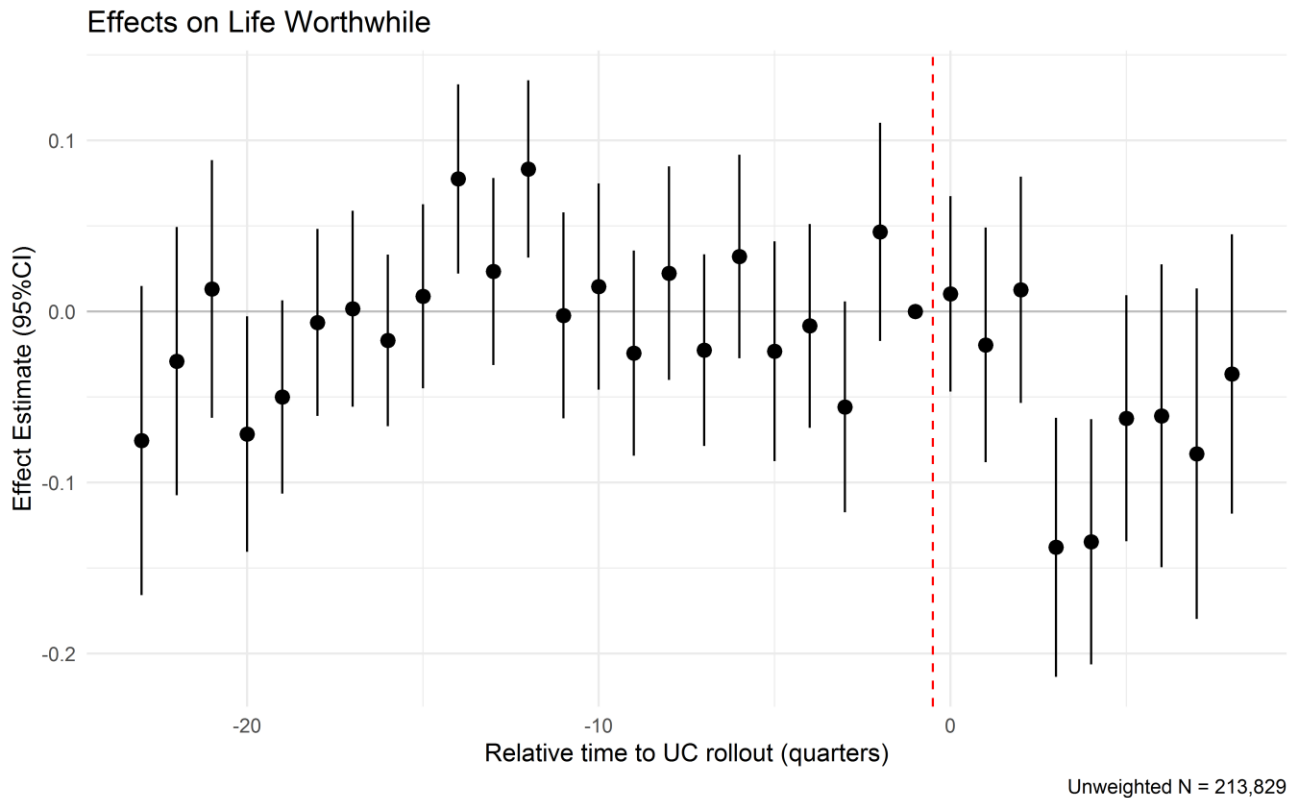


Figure B-6 Event-study plot of two-stage DiD Life Worthwhile model across time-truncated population

B.4 Anxiety

B.4.1 TWFE models

B.4.1.1 In first year of rollout

Table B-13: Unadjusted and fully adjusted differences in 'Anxiety' across 1st year

term	Unadjusted		Fully adjusted	
	Estimate	95%CI	Estimate	95%CI
UC rollout	0.1014	0.0679, 0.1350	0.0646	0.0015, 0.1278

Unweighted N = 245,658

B.4.1.2 Observations at 1-year and 2-years

Table B-14: Adjusted differences in 'Anxiety' at 1 year and 2 years post-UC

term	1 year post-UC		2 years post-UC	
	Estimate	95%CI	Estimate	95%CI
UC rollout	0.1213	0.0206, 0.2220	0.0467	-0.1604, 0.2538

Unweighted N = 245,658

B.4.2 Two-stage models

B.4.2.1 All observations

Table B-15: Static effects of UC on Anxiety (Two-stage model)

Coefficient	Estimate	Standard Error	95%CI
UC exposure	0.0739	0.0232	0.0283, 0.1194

Unweighted N = 245,658

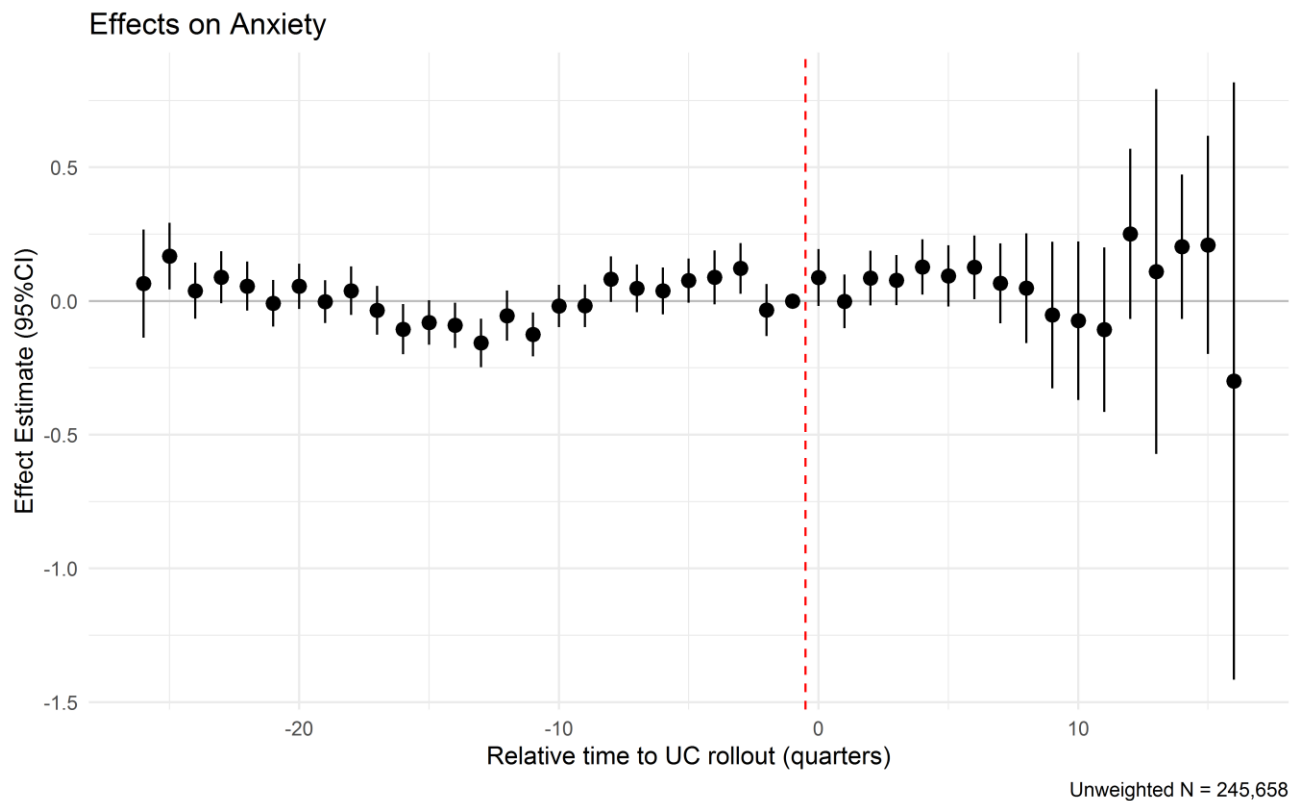


Figure B-7 Event-study plot of two-stage DiD Anxiety model

B.4.2.2 Truncated time period

Table B-16: Static effects of UC on Anxiety (Two-stage model)

Coefficient	Estimate	Standard Error	95%CI
UC exposure	0.0330	0.0237	-0.0135, 0.0795

Unweighted N = 213,829

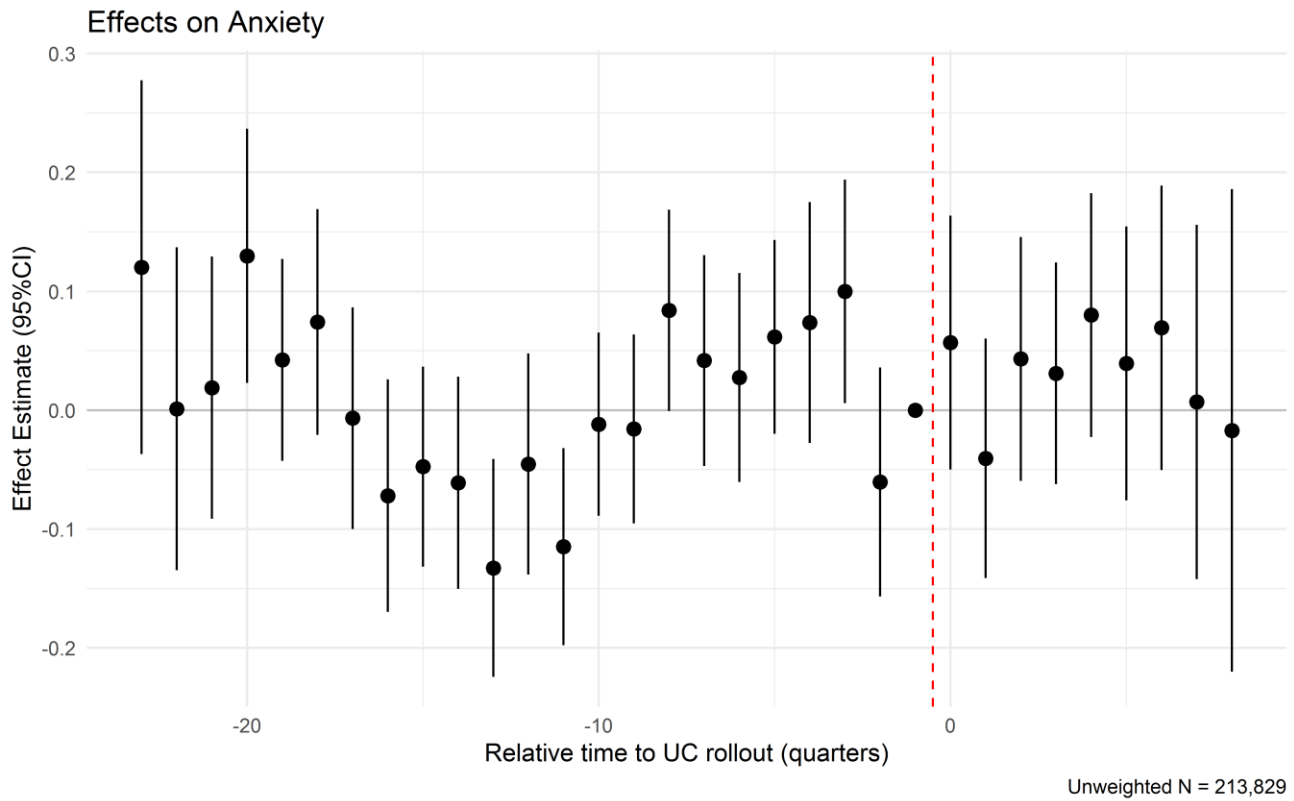


Figure B-8 Event-study plot of two-stage DiD Anxiety model across time-truncated population

B.5 Model summaries

B.5.1 1st year TWFE summary

Well-being effects within one year of UC natural migration

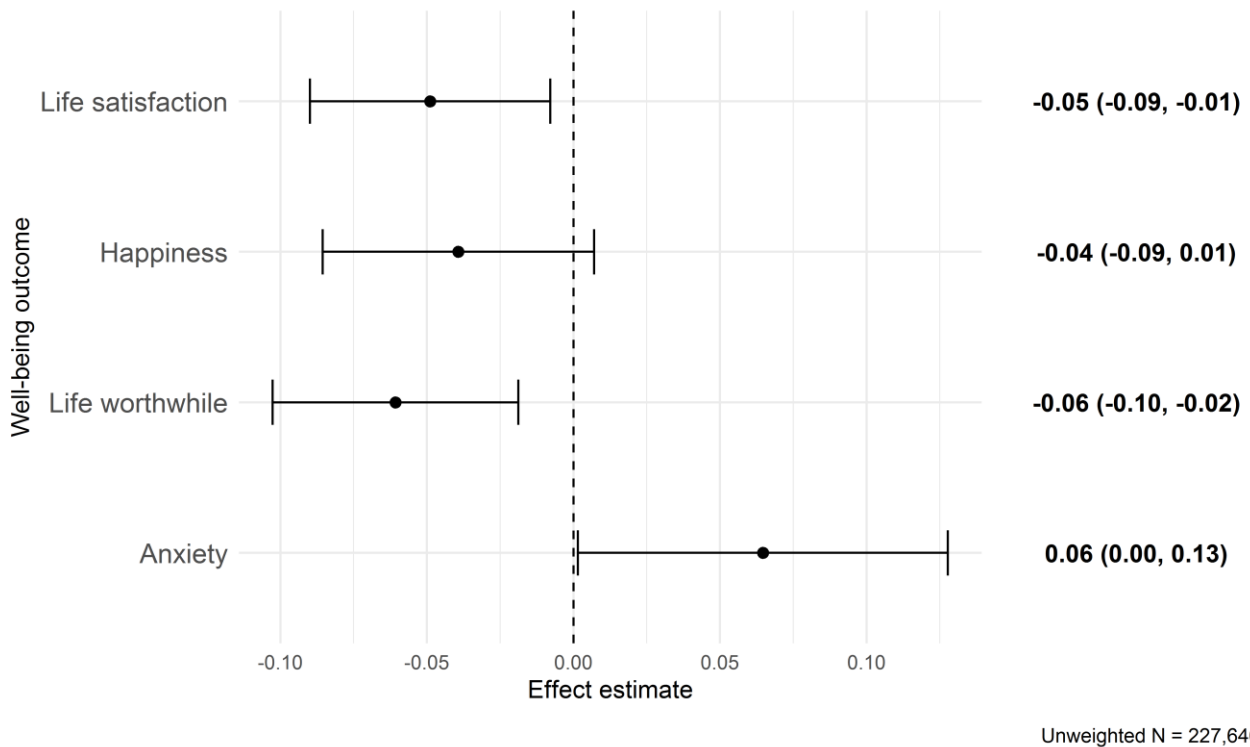
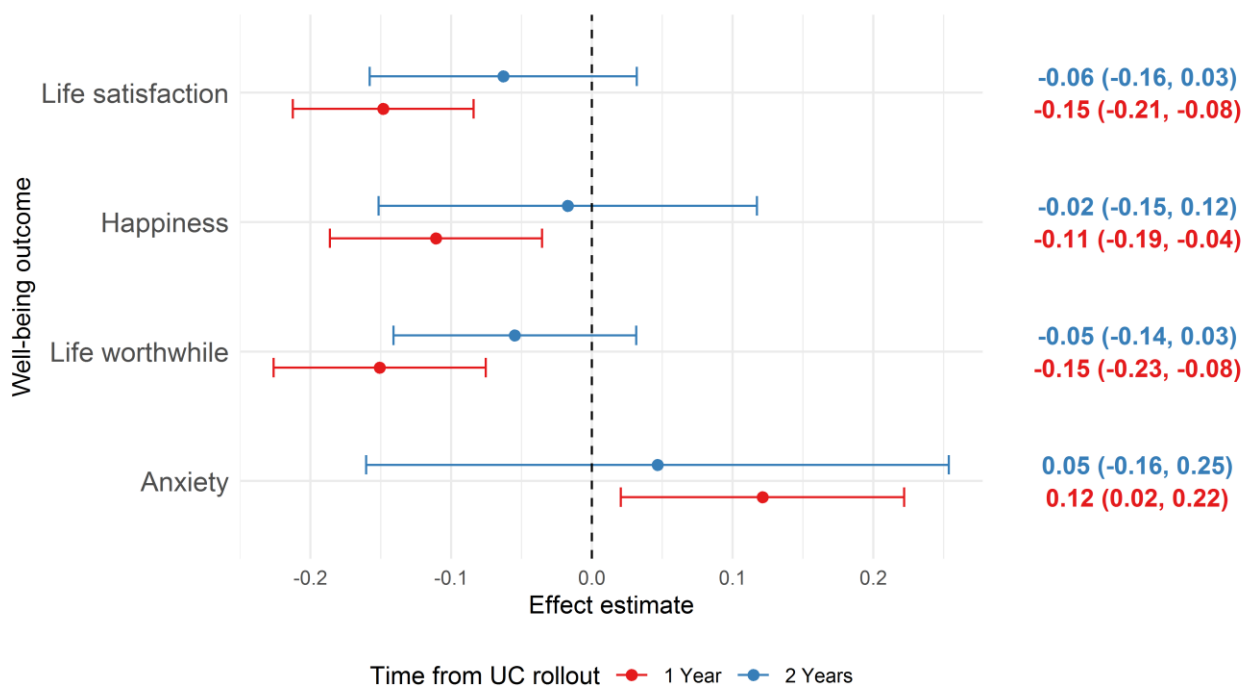


Figure B-9 Well-being effects within one year of UC natural migration (two-way fixed effects model)

B.5.2 1 vs 2 years TWFE

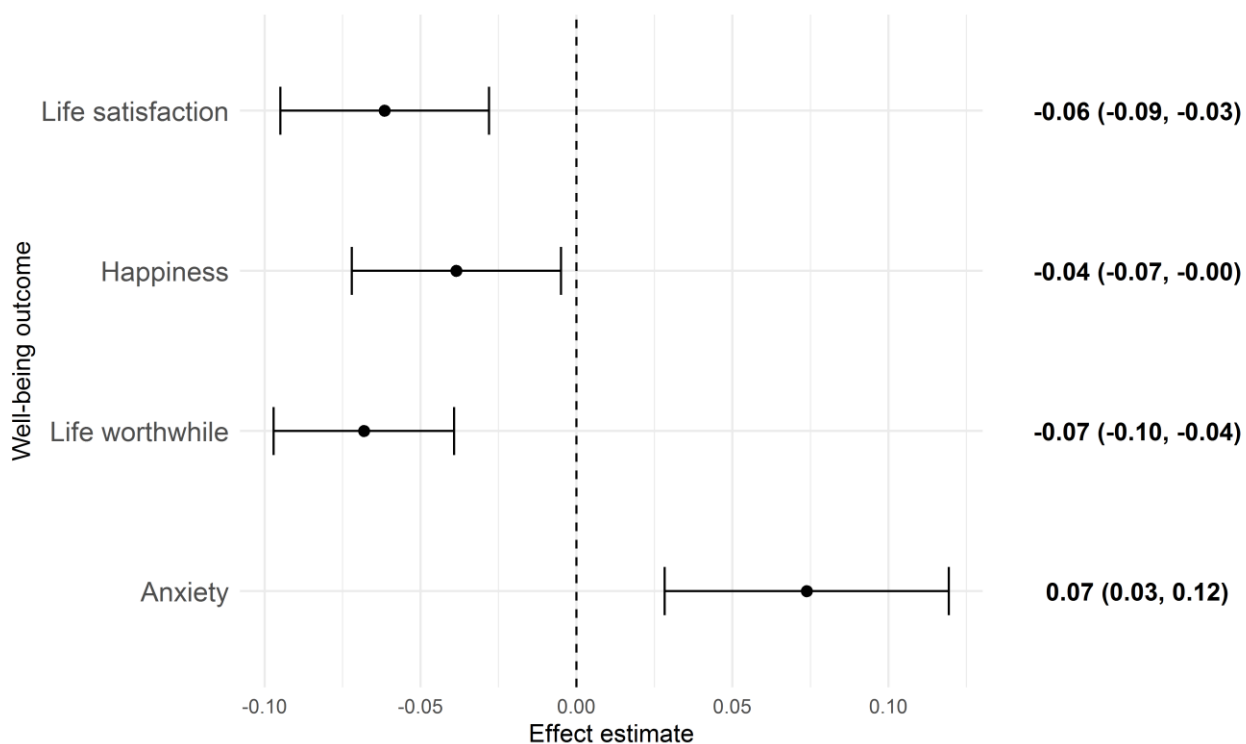
Well-being effects across whole UC exposure period



Unweighted N = 202,860

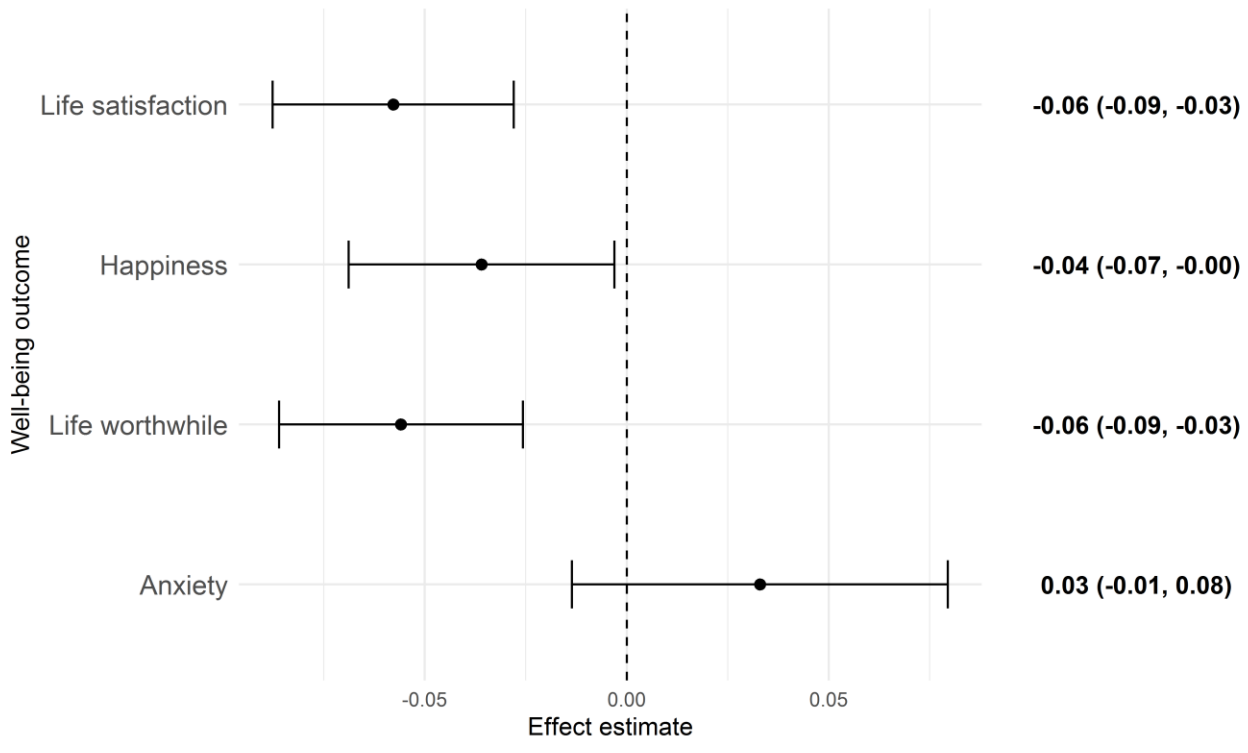
Figure B-10 Well-being effects in population - observations 1 year and 2 years after rollout

B.5.3 Two-stage DiD models



Unweighted N = 245,658

Figure B-11 Well-being effects across UC period (Two-stage model estimations)



Unweighted N = 213,829

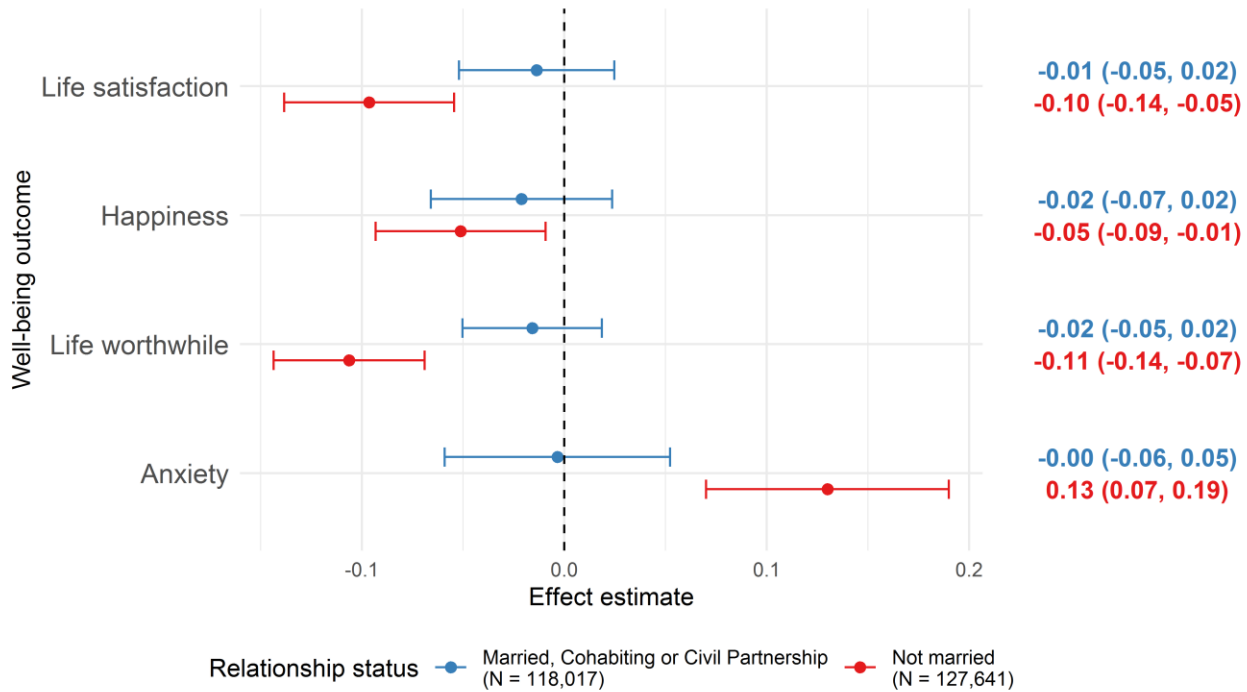
Figure B-12 Wellbeing effects across truncated UC period (2013 to 2-years post-UC; Two-stage model estimations)

Supplement C - Subgroup outcomes

C.1 Relationship status

C.1.1 Subgroup effects

Effects of UC rollout on wellbeing. Subgrouped by Relationship status



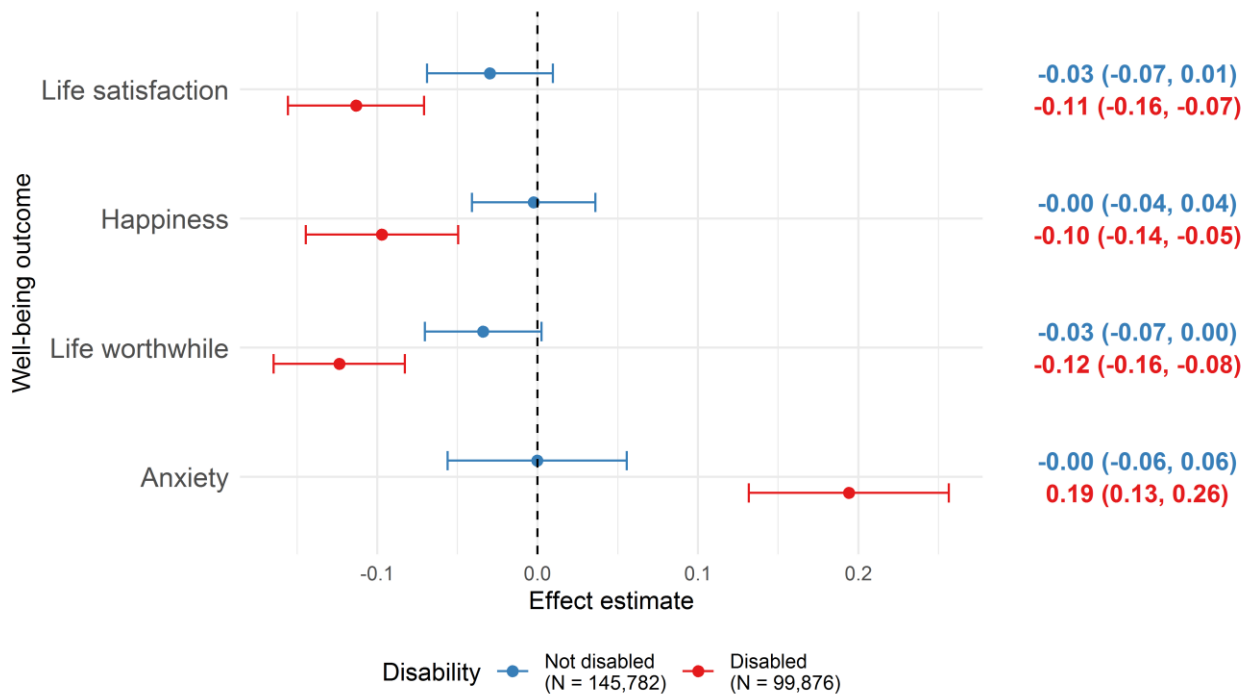
Unweighted N = 245,658

Figure C-1: Within-subgroup effects of Universal Credit on wellbeing; subgroup by Relationship status

C.2 Disability

C.2.1 Subgroup effects

Effects of UC rollout on wellbeing. Subgrouped by Disability



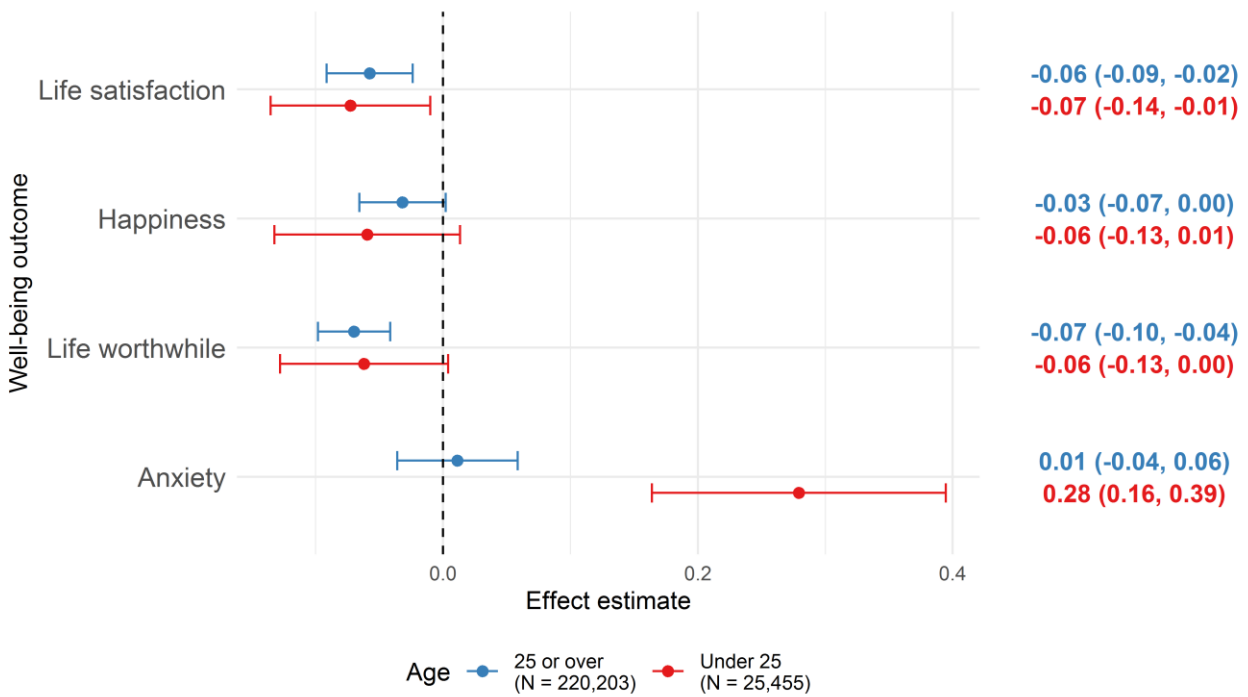
Unweighted N = 245,658

Figure C-2: Within-subgroup effects of Universal Credit on wellbeing; subgroup by Disability

C.3 Aged under 25

C.3.1 Subgroup effects

Effects of UC rollout on wellbeing. Subgrouped by Age



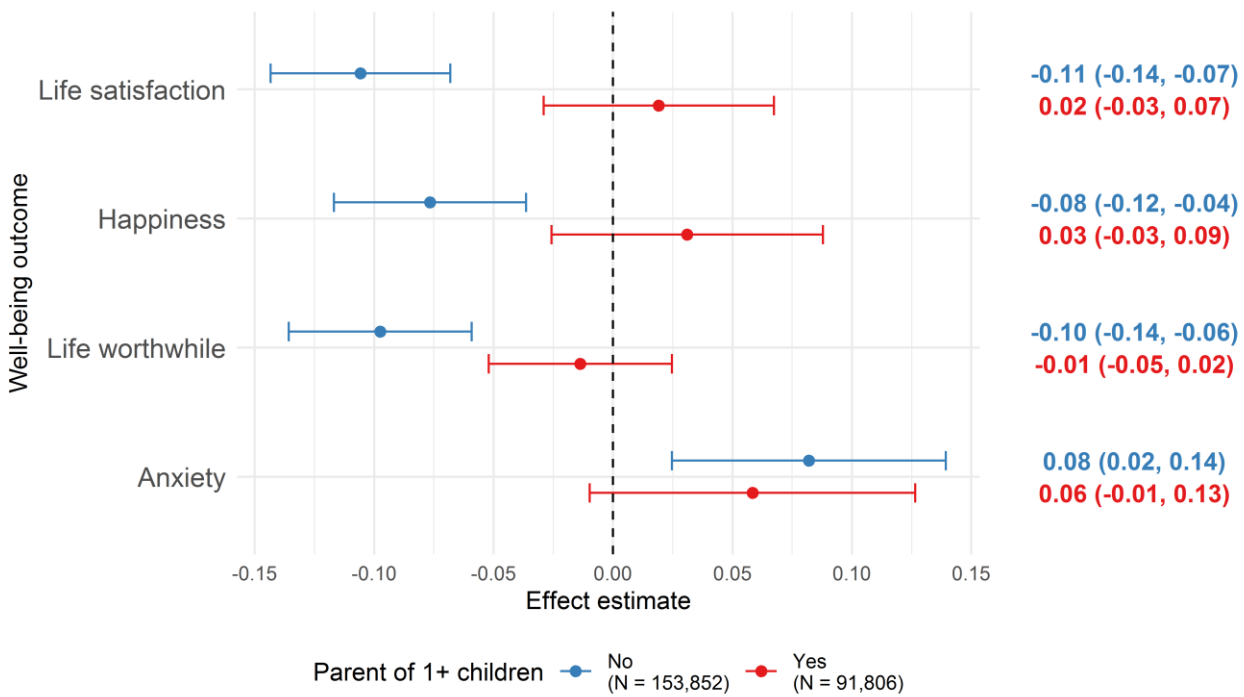
Unweighted N = 245,658

Figure C-3: Within-subgroup effects of Universal Credit on wellbeing; subgroup by Age

C.4 Parent of 1+ children

C.4.1 Subgroup effects

Effects of UC rollout on wellbeing. Subgrouped by Parent of 1+ children



Unweighted N = 245,658

Figure C-4: Within-subgroup effects of Universal Credit on wellbeing; subgroup by Parent of 1+ children

C.5 Caring responsibilities

C.5.1 Subgroup effects

Effects of UC rollout on wellbeing. Subgrouped by Caring responsibilities

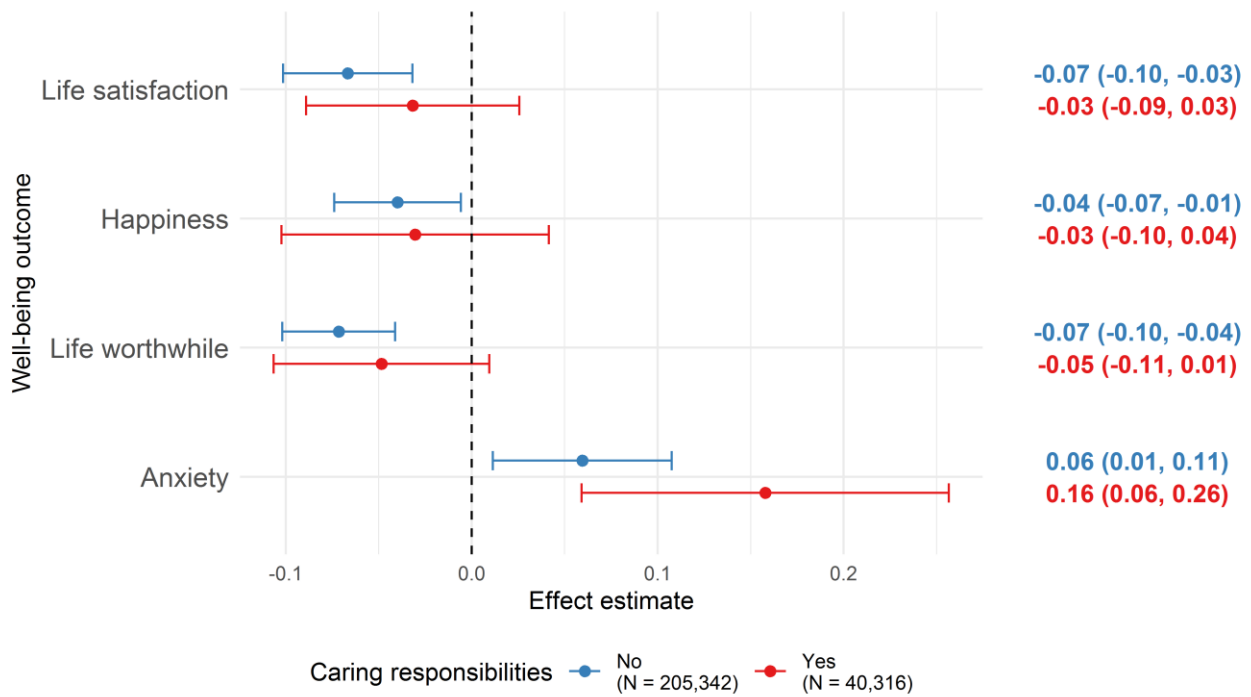
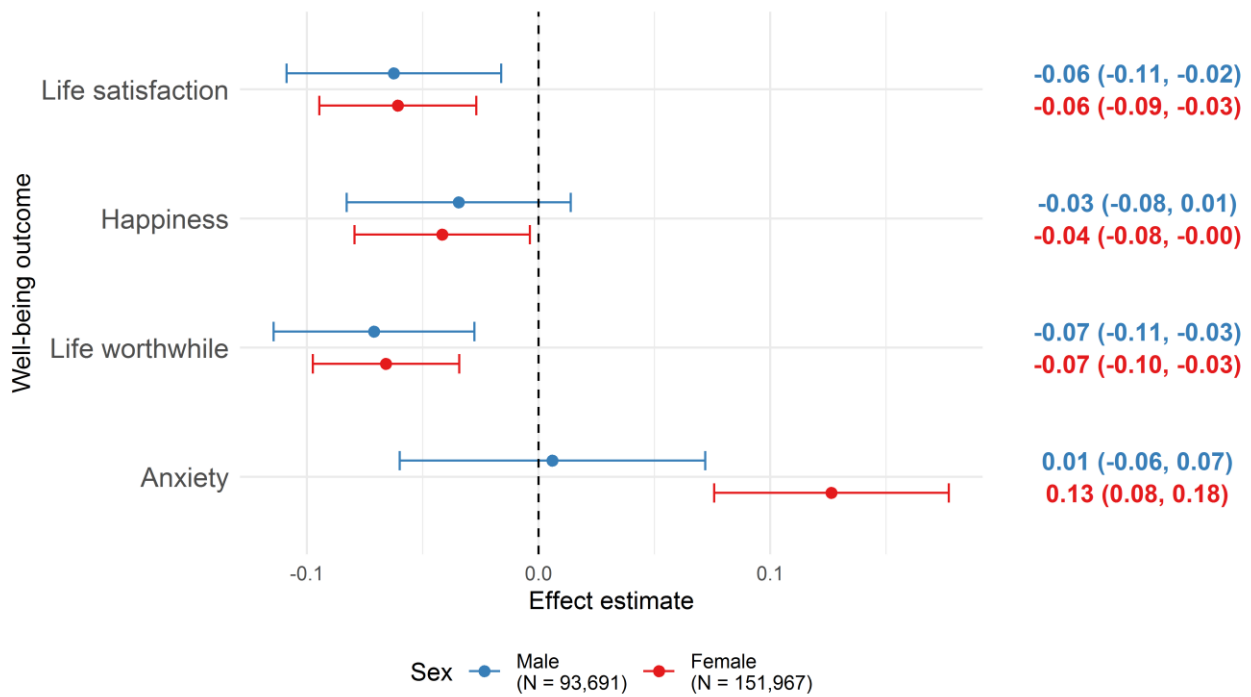


Figure C-5: Within-subgroup effects of Universal Credit on wellbeing; subgroup by Caring responsibilities

C.6 Sex

C.6.1 Subgroup effects

Effects of UC rollout on wellbeing. Subgrouped by Sex



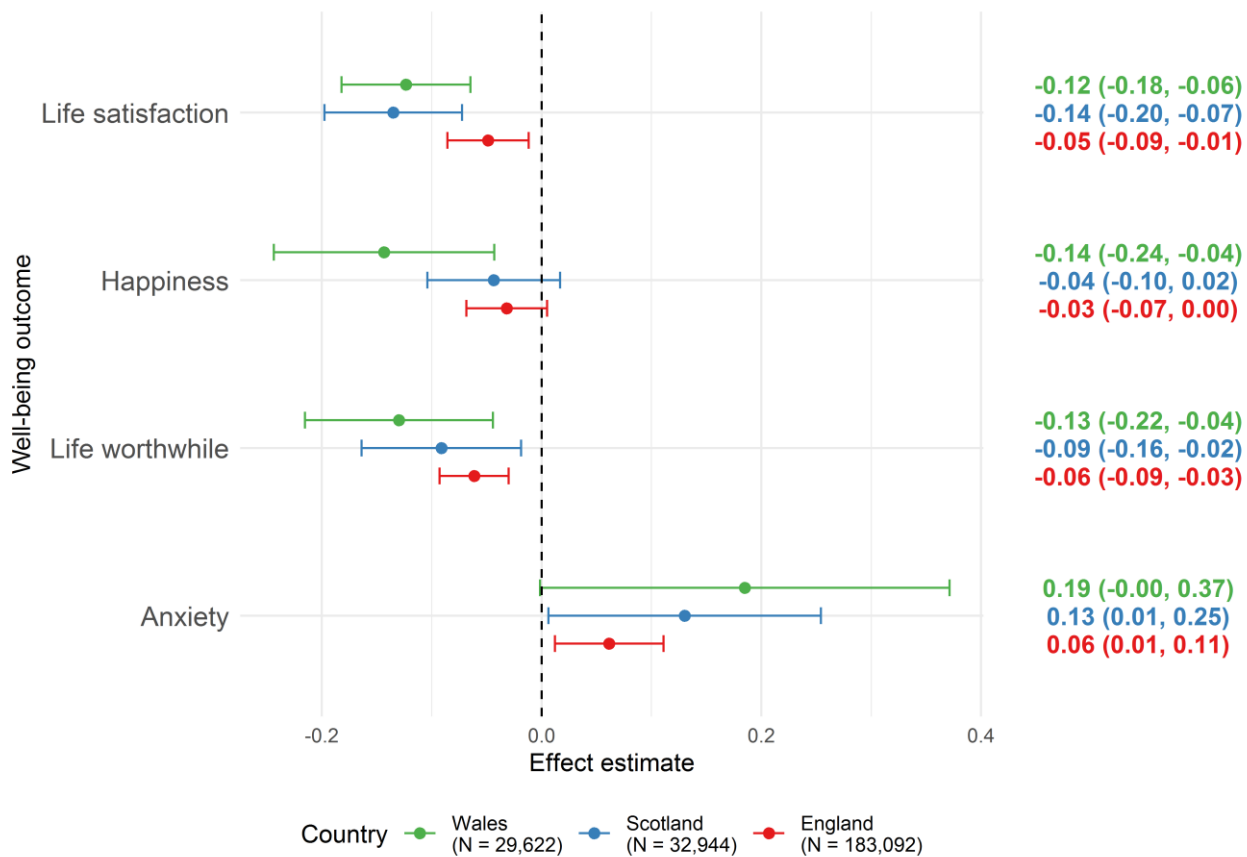
Unweighted N = 245,658

Figure C-6: Within-subgroup effects of Universal Credit on wellbeing; subgroup by Sex

C.7 Country

C.7.1 Subgroup effects

Effects of UC rollout on wellbeing. Subgrouped by Country



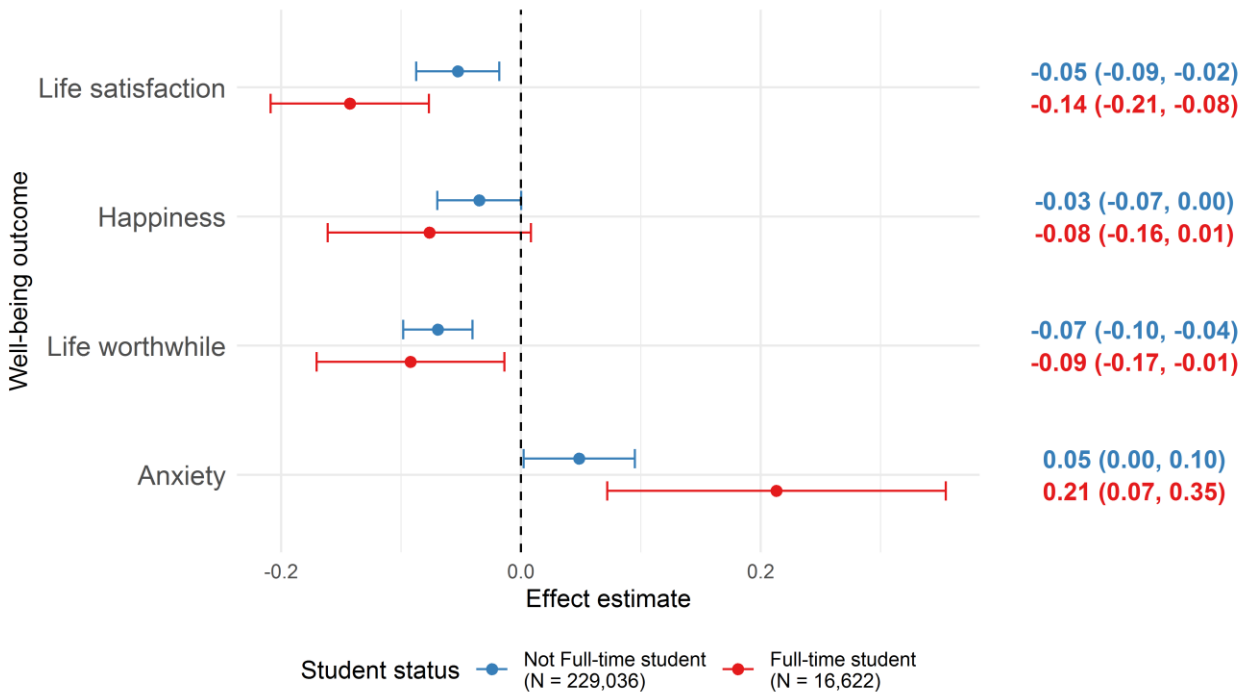
Unweighted N = 245,658

Figure C-7: Within-subgroup effects of Universal Credit on wellbeing; subgroup by Country

C.8 Student status

C.8.1 Subgroup effects

Effects of UC rollout on wellbeing. Subgrouped by Student status



Unweighted N = 245,658

Figure C-8: Within-subgroup effects of Universal Credit on wellbeing; subgroup by Student status

C.9 Ethnicity

C.9.1 Subgroup effects

Effects of UC rollout on wellbeing. Subgrouped by Ethnicity

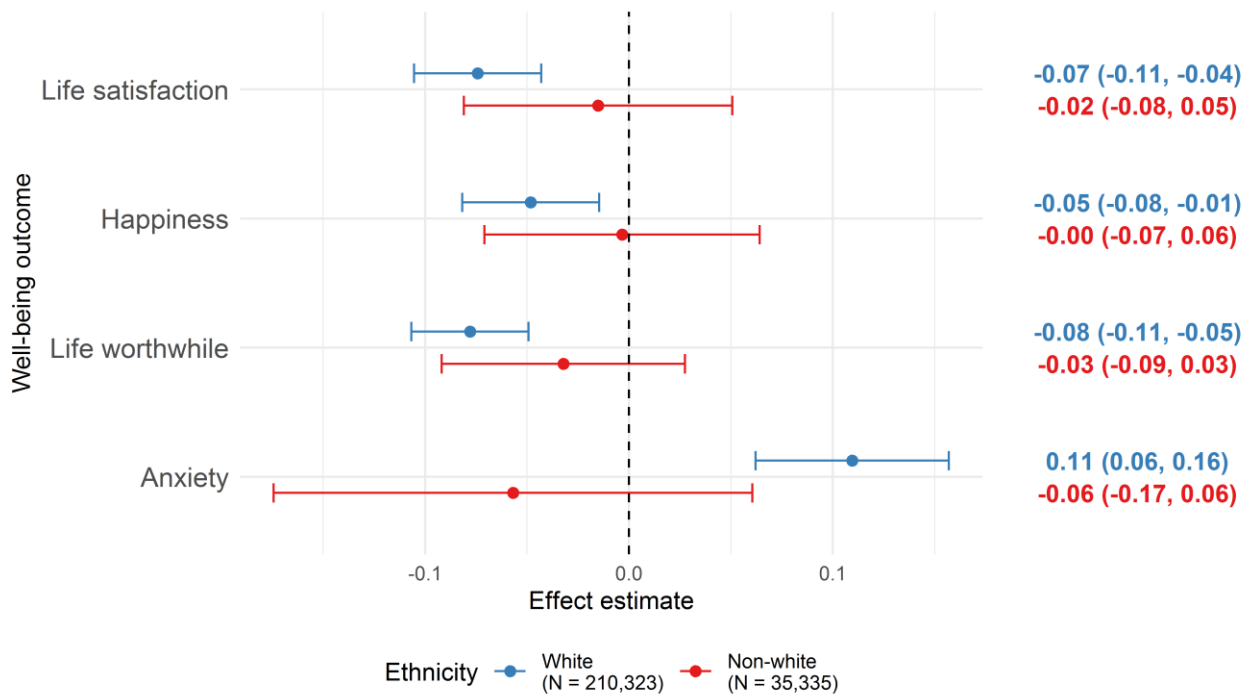
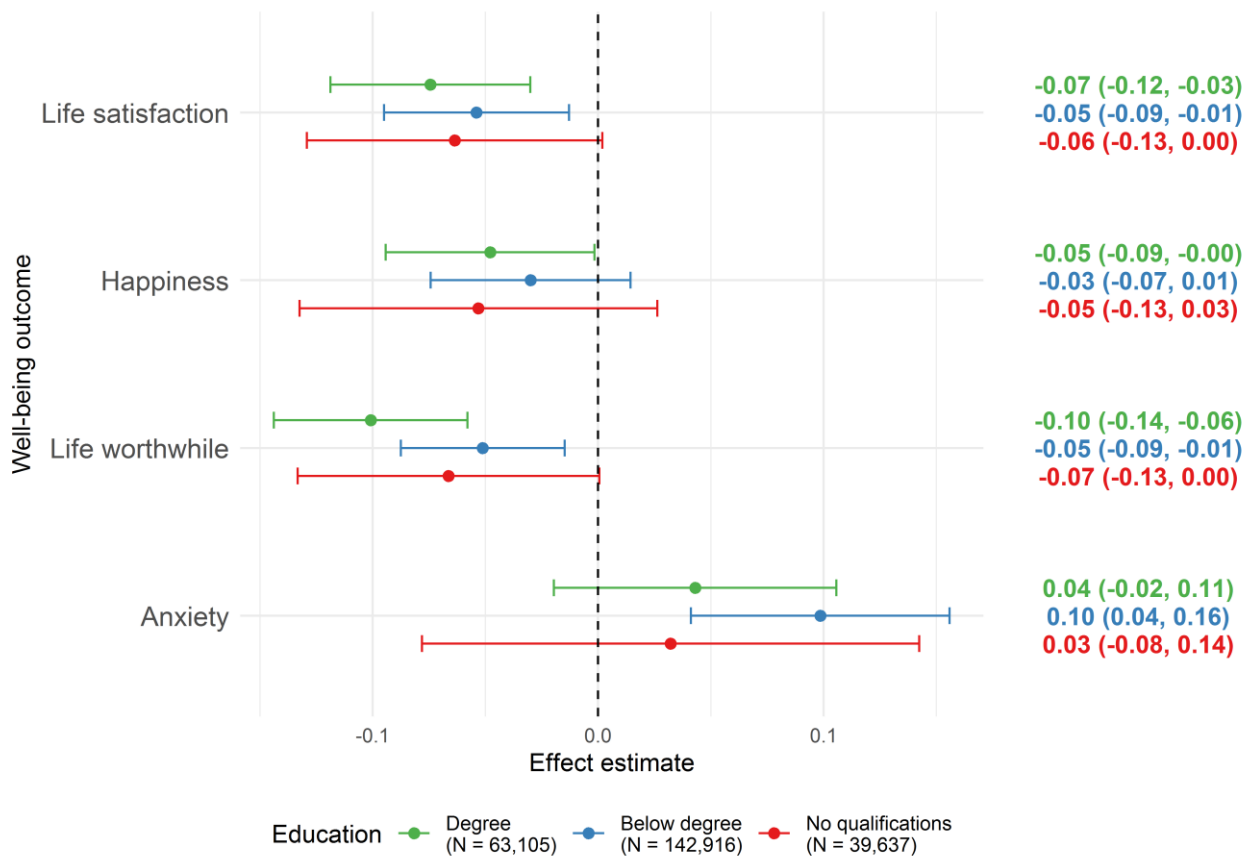


Figure C-9: Within-subgroup effects of Universal Credit on wellbeing; subgroup by Ethnicity

C.10 Education

C.10.1 Subgroup effects

Effects of UC rollout on wellbeing. Subgrouped by Education



Unweighted N = 245,658

Figure C-10: Within-subgroup effects of Universal Credit on wellbeing; subgroup by Education

C.11 Single parents - 3-way interaction

C.11.1 Subgroup effects

Effects of UC rollout on wellbeing. Subgrouped by Relationship and parenthood

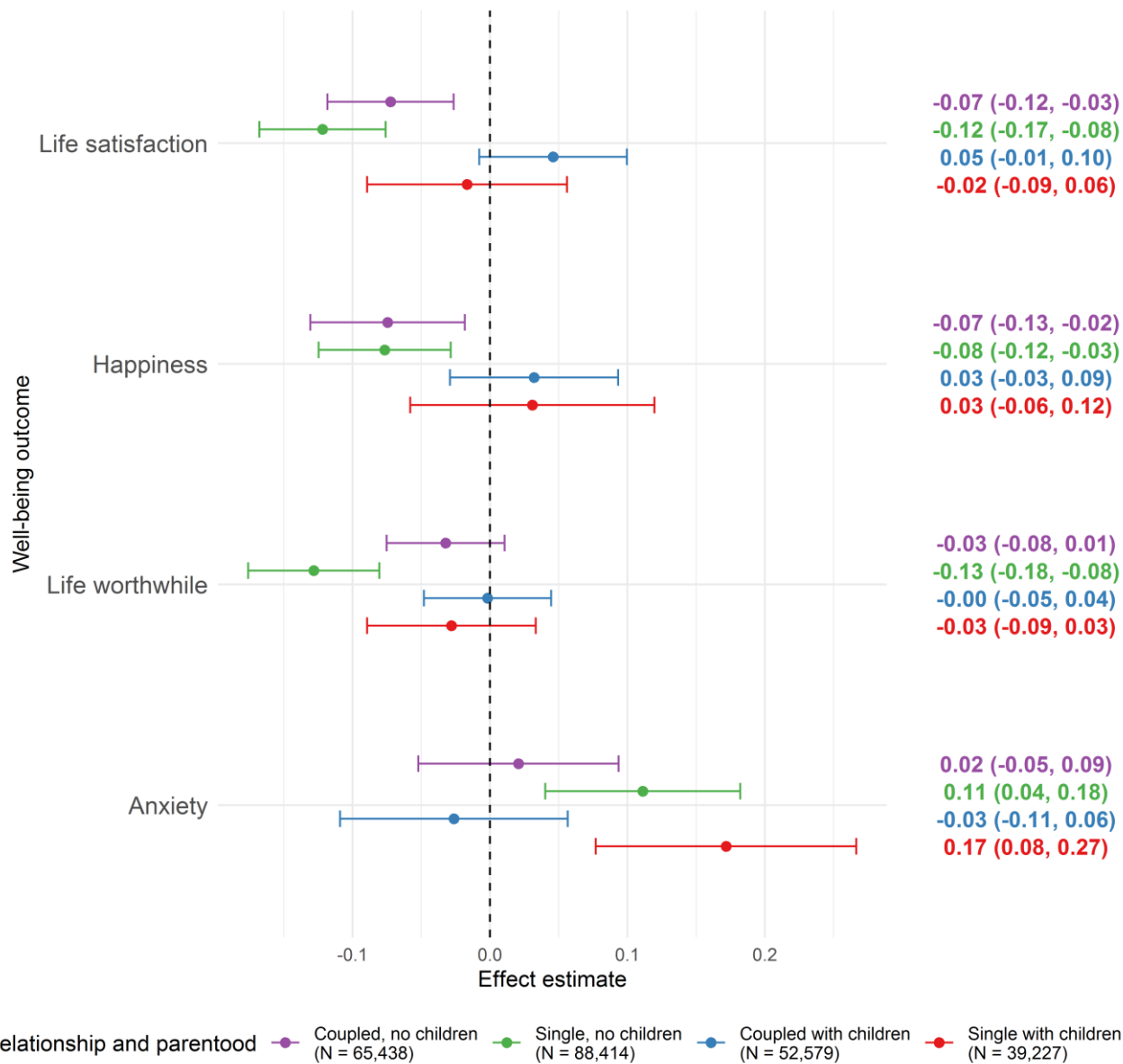


Figure C-11: Within-subgroup effects of Universal Credit on wellbeing; subgroup by Relationship and parenthood

C.12 Overall Interaction effects

Table C-1: Collated interaction effects across all subgroup analyses

Comparison	Life satisfaction		Happiness		Life worthwhile		Anxiety	
	estimate	95% CI	estimate	95% CI	estimate	95% CI	estimate	95% CI
Relationship status								
`Not married` -	-0.083	-0.129	-0.030	-0.085	-0.090	-0.135	0.133	0.060
`Married,		to	to	to	to	to	to	to
Cohabiting or		-0.037	0.025	-0.046	0.207			

Comparison	Life satisfaction		Happiness		Life worthwhile		Anxiety	
	estimate	95% CI	estimate	95% CI	estimate	95% CI	estimate	95% CI
Civil Partnership`								
Disability								
`Disabled` - `Not disabled`	-0.083	-0.131 to -0.036	-0.095	-0.147 to -0.042	-0.090	-0.140 to -0.039	0.194	0.118 to 0.271
Aged under 25								
`Under 25` - `25 or over`	-0.015	-0.076 to 0.046	-0.028	-0.101 to 0.046	0.008	-0.058 to 0.074	0.268	0.146 to 0.390
Parent of 1+ children								
`Yes` - `No`	0.125	0.072 to 0.178	0.108	0.039 to 0.176	0.084	0.031 to 0.136	-0.024	-0.110 to 0.062
Caring responsibilities								
`Yes` - `No`	0.035	-0.021 to 0.091	0.009	-0.061 to 0.080	0.023	-0.036 to 0.082	0.098	-0.005 to 0.202
Sex								
`Female` - `Male`	0.002	-0.042 to 0.045	-0.007	-0.061 to 0.046	0.005	-0.042 to 0.052	0.120	0.048 to 0.193
Country								
`Wales` - `England`	-0.075	-0.142 to -0.007	-0.112	-0.216 to -0.007	-0.068	-0.157 to 0.020	0.124	-0.067 to 0.314
`Scotland` - `England`	-0.086	-0.157 to -0.015	-0.012	-0.080 to 0.057	-0.030	-0.108 to 0.048	0.069	-0.067 to 0.204
`Scotland` - `Wales`	-0.012	-0.095 to 0.072	0.100	-0.015 to 0.215	0.039	-0.072 to 0.149	-0.055	-0.277 to 0.167
Student status								
`Full-time student` - `Not Full-time student`	-0.090	-0.158 to -0.022	-0.042	-0.131 to 0.047	-0.023	-0.101 to 0.055	0.165	0.019 to 0.310
Ethnicity								
`Non-white` - `White`	0.059	-0.001 to 0.119	0.045	-0.022 to 0.112	0.046	-0.012 to 0.104	-0.166	-0.295 to -0.038

Comparison	Life satisfaction		Happiness		Life worthwhile		Anxiety	
	estimate	95% CI	estimate	95% CI	estimate	95% CI	estimate	95% CI
Education								
`Below degree` - `Degree`	0.020	-0.026 to 0.067	0.018	-0.038 to 0.074	0.050	0.001 to 0.098	0.056	-0.020 to 0.131
`No qualifications` - `Degree`	0.011	-0.062 to 0.083	-0.005	-0.094 to 0.084	0.035	-0.046 to 0.115	-0.011	-0.130 to 0.108
`No qualifications` - `Below degree`	-0.010	-0.084 to 0.065	-0.023	-0.114 to 0.068	-0.015	-0.088 to 0.058	-0.066	-0.186 to 0.053
Relationship and parenthood								
`Single, no children` - `Coupled, no children`	-0.049	-0.106 to 0.007	-0.002	-0.069 to 0.064	-0.096	-0.152 to -0.040	0.090	-0.001 to 0.182
`Coupled with children` - `Coupled, no children`	0.118	0.055 to 0.182	0.107	0.030 to 0.183	0.031	-0.026 to 0.087	-0.047	-0.155 to 0.061
`Single with children` - `Coupled, no children`	0.056	-0.026 to 0.138	0.105	-0.005 to 0.216	0.004	-0.073 to 0.081	0.151	0.028 to 0.274
`Coupled with children` - `Single, no children`	0.168	0.104 to 0.232	0.109	0.034 to 0.183	0.126	0.065 to 0.188	-0.137	-0.242 to -0.033
`Single with children` - `Single, no children`	0.105	0.026 to 0.184	0.107	0.005 to 0.210	0.100	0.020 to 0.181	0.061	-0.053 to 0.174
`Single with children` - `Coupled with children`	-0.063	-0.143 to 0.017	-0.001	-0.098 to 0.095	-0.026	-0.100 to 0.048	0.198	0.086 to 0.310

Supplement D - Sensitivity analysis – population observed receiving benefits

Level	Removed	Population
All observations	-	921,139

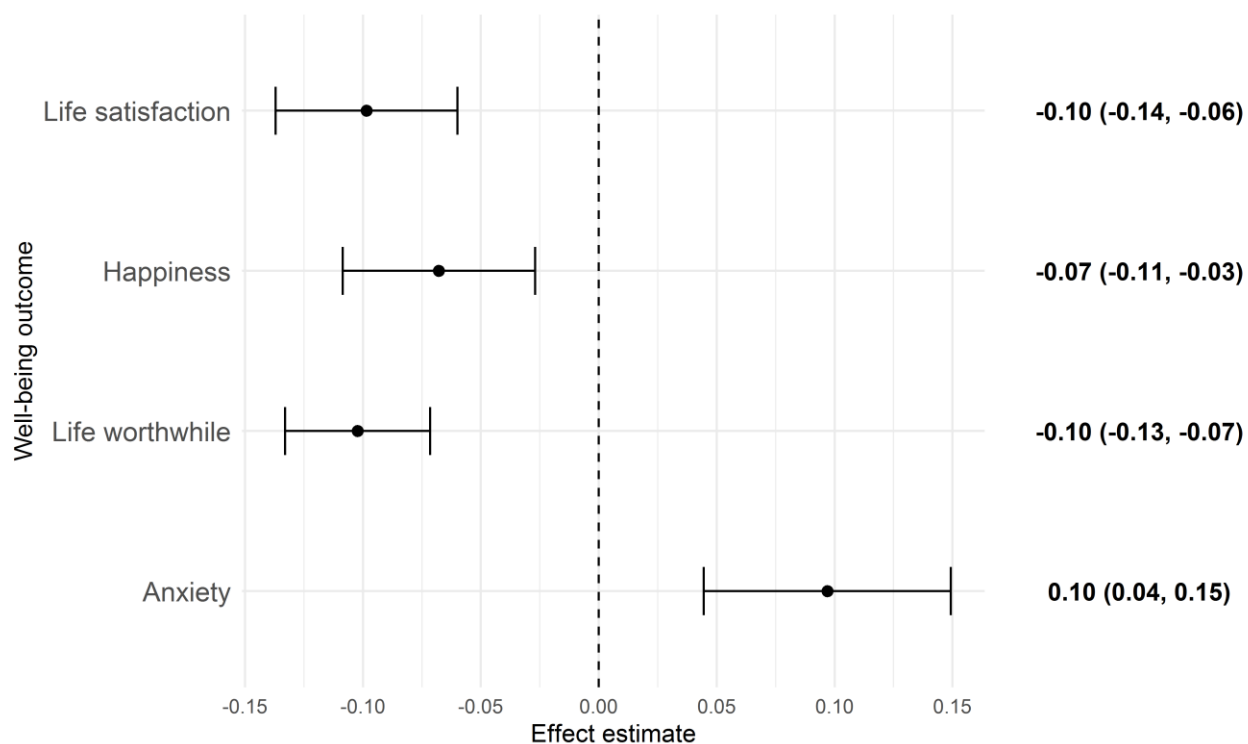
No missing data	14,745	906,394
Sufficient pre-post data	8,290	898,104
Over 18 and pre-2020	83,317	814,787
Report claiming UC or Legacy Benefit	624,943	189,844

Table D-1 – Population inclusion by criteria

An average of 12.2% (N = 2574) of respondents in benefit claiming households reported receiving Universal Credit across the first year following UC rollout.

18.1% (N = 5792) reported receiving UC across all years where UC was available in their Local Authority (85.9%, N = 33027 claimed legacy benefits).

At 1 year, 21.3% (N = 872) of surveyed respondents in benefit claiming households reported receiving UC. At 2 years, 29.5% (N = 466) reported receiving UC.



Unweighted N = 189,844

Figure D-1 Well-being effects across UC period (Two-stage model estimations)

Supplement E - Deviations from analysis protocol

The analysis plan was published alongside other study documentation at <https://osf.io/knajb/>.

The following deviations from the overall protocol are noted:

- Research questions looking at mediating factors of changes in employment and income were not addressed in this analysis (p7)

- Two methods for determining eligible population were described in the protocol: marking all benefit receipt as criteria for inclusion and predicting probability of receipt using a statistical model trained on observed data (p11). These were deemed insufficient for having necessary specificity and sensitivity and creating comparable populations across states of rollout. They also made effect estimates hard to interpret. We opted to set an equivalised income threshold as a marker of inclusion as a more manageable method and use observed benefit receipt as a marker in sensitivity analyses.
- A sensitivity analysis treating restricted-rollout-eligible respondents in the pre-natural-migration period as 'exposed' was not carried out. We did not have sufficient data to reliably identify this sub-population (p27).
- In subgroup analyses:
 - We did not test for differential effects by pre-UC employment. This data was not available for almost all participants.
 - We added education as a marker of vulnerability to test over.
 - We had specified running stratified subgroup analyses alongside interaction models. To produce estimates of subgroups which were comparable with interaction effects we calculated stratified differences in one model per subgroup and compared these using the `marginaleffects` package.
- We added a set of area-wide confounder variables to better account for wider determinants of health not captured in individual responses (p19)
- Missing data was deemed to be sufficiently low that multiple imputation was not needed over complete-case analysis (p23)
- In fitting models to account for effect heterogeneity, we were unable to generate effect estimates using the `did` package or the other suggested methods. Several of these are built for balanced panel data and did not function for our cross-sectional dataset (p24).