Supplementary materials for paper 2

**Debt questions in the questionnaire**

I would like to ask you about any other financial commitments [^you / [^name]] [^BLANK / or [^your / his / her] [^husband / wife / partner]] may have apart from mortgages or housing related loans. [^Do you / Does [^name]] [^BLANK / or [^your / his / her] [^husband / wife / partner]] currently owe any money on credit or store cards? INTERVIEWER: Record No if respondent pays off the balance on their credit or store cards each month. 1 Yes 2 No

[^Do you / Does [^name]] [^BLANK / or [^your / his / her] [^husband / wife / partner]] currently owe any money to friends, relatives, or other private individuals? 1 Yes 2 No

On which, if any, of these [^do you / does [^name]] [^BLANK / or [^your / his / her] [^husband / wife / partner]] currently owe money? PROBE: What others? CODE ALL THAT APPLY. 1 Hire purchase agreements 2 Personal loans (from bank, building society or other financial institution) 3 Overdraft 4 Catalogue or mail order purchase agreements 5 DWP social fund loan 6 Loan from a money lender or 'tally man' 96 None of these

**Supplementary Table 1. Number of observations per trial. PATE CESD-D sample.**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | **All** | **Employed** | **Retired** | **Not employed/ retired** |
| Trial 1 | 2700 (997) | 1397 (436) | 804 (399) | 499 (162) |
| Trial 2 | 1972 (776) | 930 (331) | 669 (298) | 373 (147) |
| Trial 3 | 1890 (728) | 995 (333) | 571 (279) | 324 (116) |
| Trial 4 | 2141 (818) | 1122 (387) | 700 (320) | 319 (111) |
| Trial 5 | 1712 (688) | 780 (268) | 688 (321) | 244 (99) |
| Trial 6 | 1600 (609) | 766 (263) | 624 (269) | 210 (77) |
| Trial 7 | 1360 (497) | 620 (200) | 587 (245) | 153 (52) |
| Trial 8 | 1190 (516) | 454 (172) | 605 (284) | 131 (60) |
| Total | 14565 (5629) | 7064 (2390) | 5248 (2415) | 2253 (824) |

**Supplementary Table 2. Number of observations per trial. PATE CASP-19 sample.**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | **All** | **Employed** | **Retired** | **Not employed/ retired** |
| Trial 1 | 2113 (777) | 1168 (370) | 588 (295) | 357 (112) |
| Trial 2 | 1481 (584) | 736 (269) | 484 (215) | 261 (100) |
| Trial 3 | 1428 (551) | 759 (257) | 445 (216) | 224 (78) |
| Trial 4 | 1711 (656) | 897 (310) | 582 (267) | 232 (79) |
| Trial 5 | 1375 (534) | 629 (211) | 561 (250) | 185 (73) |
| Trial 6 | 1274 (481) | 616 (217) | 502 (214) | 156 (50) |
| Trial 7 | 1063 (390) | 487 (158) | 466 (200) | 110 (32) |
| Trial 8 | 953 (425) | 371 (147) | 482 (234) | 100 (44) |
| Total | 11398 (4398) | 5663 (1939) | 4110 (1891) | 1625 (568) |

Supplementary Table 3. Balance characteristics before and after weighting. SATE sample shown (the population average treatment effect was not shown given the use of sampling weights). Employed subgroup.

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Variable |  | Raw mean not treated | Raw mean treated | Standardized difference | Weighted mean not treated | Weighted mean not treated | Standardized difference |
| Any credit card debt |  |  |  |  |  |  |  |
| No |  | 0.31 | 0.51 | 0.43 | 0.38 | 0.38 | 0.00 |
| Yes |  | 0.69 | 0.49 | -0.43 | 0.62 | 0.62 | -0.00 |
| Whether own home |  |  |  |  |  |  |  |
| No |  | 0.15 | 0.11 | -0.11 | 0.14 | 0.13 | -0.03 |
| Yes |  | 0.85 | 0.89 | 0.11 | 0.86 | 0.87 | 0.03 |
| Number of people in Household |  |  |  |  |  |  |  |
| 1 |  | 0.13 | 0.13 | 0.00 | 0.13 | 0.12 | -0.03 |
| 2 |  | 0.49 | 0.53 | 0.07 | 0.51 | 0.52 | 0.02 |
| 3 |  | 0.21 | 0.20 | -0.04 | 0.20 | 0.20 | -0.01 |
| 4 or more |  | 0.16 | 0.14 | -0.05 | 0.15 | 0.16 | 0.00 |
| Any mortgage debt |  |  |  |  |  |  |  |
| No |  | 0.44 | 0.58 | 0.26 | 0.49 | 0.49 | 0.00 |
| Yes |  | 0.56 | 0.42 | -0.26 | 0.51 | 0.51 | -0.00 |
| Education qualification |  |  |  |  |  |  |  |
| Less than o-level or equiv |  | 0.30 | 0.30 | -0.01 | 0.31 | 0.29 | -0.04 |
| O-level or equivalent |  | 0.35 | 0.33 | -0.05 | 0.34 | 0.35 | 0.01 |
| Higher than a-level |  | 0.35 | 0.37 | 0.06 | 0.35 | 0.36 | 0.02 |
| Place of birth elsewhere outside of UK |  |  |  |  |  |  |  |
| No |  | 0.91 | 0.91 | 0.00 | 0.91 | 0.92 | 0.03 |
| Yes |  | 0.09 | 0.09 | -0.00 | 0.09 | 0.08 | -0.03 |
| Some difficulties in activities of Daily Living |  |  |  |  |  |  |  |
| No |  | 0.93 | 0.93 | -0.02 | 0.93 | 0.93 | -0.02 |
| Yes |  | 0.07 | 0.07 | 0.02 | 0.07 | 0.07 | 0.02 |
| Sex |  |  |  |  |  |  |  |
| Men |  | 0.51 | 0.51 | 0.00 | 0.51 | 0.51 | 0.00 |
| Women |  | 0.49 | 0.49 | -0.00 | 0.49 | 0.49 | -0.00 |
| Ever had arthritis |  |  |  |  |  |  |  |
| No |  | 0.77 | 0.78 | 0.01 | 0.78 | 0.76 | -0.04 |
| Yes |  | 0.23 | 0.22 | -0.01 | 0.22 | 0.24 | 0.04 |
| Ever had cancer |  |  |  |  |  |  |  |
| No |  | 0.94 | 0.95 | 0.01 | 0.94 | 0.95 | 0.02 |
| Yes |  | 0.06 | 0.05 | -0.01 | 0.06 | 0.05 | -0.02 |
| Number of living children |  |  |  |  |  |  |  |
| None |  | 0.12 | 0.12 | 0.01 | 0.12 | 0.11 | -0.02 |
| 1 |  | 0.21 | 0.21 | 0.00 | 0.21 | 0.22 | 0.01 |
| 2 |  | 0.36 | 0.40 | 0.09 | 0.37 | 0.38 | 0.02 |
| 3 or more |  | 0.31 | 0.26 | -0.10 | 0.30 | 0.29 | -0.02 |
| Paying rent |  |  |  |  |  |  |  |
| No |  | 0.87 | 0.91 | 0.13 | 0.88 | 0.89 | 0.04 |
| Yes |  | 0.13 | 0.09 | -0.13 | 0.12 | 0.11 | -0.04 |
| Whether financial respondent |  |  |  |  |  |  |  |
| No |  | 0.26 | 0.27 | 0.02 | 0.26 | 0.27 | 0.02 |
| Yes |  | 0.74 | 0.73 | -0.02 | 0.74 | 0.73 | -0.02 |
| Ever had heart problems |  |  |  |  |  |  |  |
| No |  | 0.91 | 0.89 | -0.06 | 0.91 | 0.90 | -0.04 |
| Yes |  | 0.09 | 0.11 | 0.06 | 0.09 | 0.10 | 0.04 |
| Ever had high blood pressure |  |  |  |  |  |  |  |
| No |  | 0.69 | 0.69 | 0.02 | 0.69 | 0.69 | -0.00 |
| Yes |  | 0.31 | 0.31 | -0.02 | 0.31 | 0.31 | 0.00 |
| Some difficulties with instrumental activities of daily living |  |  |  |  |  |  |  |
| No |  | 0.99 | 0.99 | -0.04 | 0.99 | 0.99 | -0.06 |
| Yes |  | 0.01 | 0.01 | 0.04 | 0.01 | 0.01 | 0.06 |
| Interview year |  |  |  |  |  |  |  |
| 2002 |  | 0.19 | 0.16 | -0.07 | 0.18 | 0.17 | -0.03 |
| 2003 |  | 0.02 | 0.02 | 0.02 | 0.02 | 0.02 | 0.01 |
| 2004 |  | 0.07 | 0.08 | 0.03 | 0.07 | 0.08 | 0.03 |
| 2005 |  | 0.06 | 0.06 | 0.01 | 0.06 | 0.06 | 0.00 |
| 2006 |  | 0.12 | 0.12 | -0.00 | 0.12 | 0.11 | -0.03 |
| 2007 |  | 0.02 | 0.02 | -0.01 | 0.02 | 0.02 | 0.01 |
| 2008 |  | 0.10 | 0.10 | -0.01 | 0.10 | 0.11 | 0.03 |
| 2009 |  | 0.06 | 0.06 | 0.03 | 0.06 | 0.05 | -0.02 |
| 2010 |  | 0.07 | 0.08 | 0.01 | 0.08 | 0.07 | -0.04 |
| 2011 |  | 0.04 | 0.04 | 0.00 | 0.03 | 0.04 | 0.01 |
| 2012 |  | 0.09 | 0.09 | 0.01 | 0.09 | 0.09 | 0.02 |
| 2013 |  | 0.02 | 0.02 | -0.00 | 0.02 | 0.02 | 0.01 |
| 2014 |  | 0.07 | 0.07 | 0.00 | 0.06 | 0.07 | 0.02 |
| 2015 |  | 0.02 | 0.02 | -0.04 | 0.02 | 0.02 | -0.02 |
| 2016 |  | 0.04 | 0.05 | 0.02 | 0.04 | 0.05 | 0.02 |
| 2017 |  | 0.02 | 0.02 | 0.05 | 0.02 | 0.02 | 0.01 |
| Freq light physical activity |  |  |  |  |  |  |  |
| > 1 per week |  | 0.83 | 0.83 | 0.01 | 0.82 | 0.83 | 0.02 |
| 1 per week |  | 0.09 | 0.09 | -0.02 | 0.09 | 0.09 | 0.01 |
| 1-3 per month |  | 0.03 | 0.03 | 0.01 | 0.03 | 0.03 | -0.00 |
| Hardly ever or never |  | 0.05 | 0.05 | -0.01 | 0.05 | 0.04 | -0.05 |
| Ever had lung disease |  |  |  |  |  |  |  |
| No |  | 0.97 | 0.97 | -0.00 | 0.97 | 0.97 | 0.01 |
| Yes |  | 0.03 | 0.03 | 0.00 | 0.03 | 0.03 | -0.01 |
| Marital status |  |  |  |  |  |  |  |
| Married |  | 0.73 | 0.75 | 0.03 | 0.74 | 0.74 | 0.01 |
| Partnered |  | 0.06 | 0.06 | -0.02 | 0.06 | 0.06 | 0.02 |
| Seperated |  | 0.02 | 0.01 | -0.04 | 0.02 | 0.01 | -0.03 |
| Divorced |  | 0.12 | 0.11 | -0.03 | 0.11 | 0.11 | 0.01 |
| Widowed |  | 0.03 | 0.03 | 0.05 | 0.03 | 0.02 | -0.03 |
| Never married |  | 0.04 | 0.04 | -0.01 | 0.04 | 0.04 | -0.01 |
| Ever had stroke |  |  |  |  |  |  |  |
| No |  | 0.99 | 0.99 | 0.04 | 0.99 | 0.99 | 0.05 |
| Yes |  | 0.01 | 0.01 | -0.04 | 0.01 | 0.01 | -0.05 |
| Spouse's labour market status |  |  |  |  |  |  |  |
| Employed |  | 0.49 | 0.47 | -0.04 | 0.48 | 0.48 | 0.01 |
| Self-employed |  | 0.09 | 0.09 | -0.00 | 0.09 | 0.09 | 0.00 |
| Retired |  | 0.08 | 0.11 | 0.11 | 0.09 | 0.09 | -0.01 |
| Disabled |  | 0.04 | 0.03 | -0.04 | 0.03 | 0.04 | 0.01 |
| Unemployed/ looking after home or family |  | 0.06 | 0.07 | 0.02 | 0.07 | 0.07 | 0.02 |
| No spouse |  | 0.25 | 0.24 | -0.02 | 0.25 | 0.23 | -0.03 |
| Self reported employment status |  |  |  |  |  |  |  |
| employee |  | 0.83 | 0.82 | -0.04 | 0.83 | 0.83 | 0.01 |
| self\_emp |  | 0.17 | 0.18 | 0.04 | 0.17 | 0.17 | -0.01 |
| Continuous variables |  |  |  |  |  |  |  |
| Number of depressive symptoms at time t |  | 1.17 | 1.21 | 0.02 | 1.19 | 1.20 | 0.01 |
| OUTCOME (not included in weigthing): number of depressive symptoms at t+1 |  | 1.20 | 1.12 | -0.05 | 1.19 | 1.17 | -0.02 |
| OUTCOME (not in weigthing): Quality of life score (CASP-19) at t+1 |  | 4.18 | 4.33 | 0.17 | 4.20 | 4.32 | 0.15 |
| Quality of life score (CASP-19) at t |  | 4.21 | 4.31 | 0.12 | 4.22 | 4.27 | 0.06 |
| Non-mortgage debt to gross wealth (log) |  | -0.23 | -1.77 | -0.47 | -0.72 | -0.61 | 0.03 |
| Household weekly income (log) |  | 6.22 | 6.27 | 0.06 | 6.21 | 6.24 | 0.04 |
| Gross wealth (log) |  | 11.67 | 12.05 | 0.17 | 11.75 | 11.76 | 0.00 |
| Gross non-housing wealth (log) |  | 8.49 | 9.31 | 0.29 | 8.73 | 8.64 | -0.03 |
| Mortgage debt amount (log) |  | 5.72 | 4.28 | -0.28 | 5.21 | 5.18 | -0.01 |
| Spouse's age if no data |  | 54.40 | 55.52 | 0.17 | 54.81 | 54.86 | 0.01 |
| Age |  | 57.23 | 58.15 | 0.19 | 57.58 | 57.60 | 0.00 |
| Total Recall Summary Score |  | 11.55 | 11.54 | -0.00 | 11.48 | 11.55 | 0.02 |
| Credit card debt amount (log) |  | 5.22 | 3.34 | -0.52 | 4.58 | 4.61 | 0.01 |
| Non-mortgage debt amount (log) |  | 8.26 | 7.54 | -0.45 | 8.02 | 8.03 | 0.01 |

Supplementary Table 4. Balance characteristics before and after weighting. SATE sample shown (the population average treatment effect was not shown given the use of sampling weights). Retired subgroup.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Variable | Raw mean not treated | Raw mean treated | Standardized difference | Weighted mean not treated | Weighted mean not treated | Standardized difference |
| Any credit card debt |  |  |  |  |  |  |
| No | 0.38 | 0.53 | 0.30 | 0.46 | 0.45 | -0.01 |
| Yes | 0.62 | 0.47 | -0.30 | 0.54 | 0.55 | 0.01 |
| Whether own home |  |  |  |  |  |  |
| No | 0.25 | 0.19 | -0.14 | 0.21 | 0.24 | 0.06 |
| Yes | 0.75 | 0.81 | 0.14 | 0.79 | 0.76 | -0.06 |
| Number of people in Household |  |  |  |  |  |  |
| 1 | 0.27 | 0.27 | -0.02 | 0.27 | 0.26 | -0.01 |
| 2 | 0.60 | 0.63 | 0.06 | 0.62 | 0.62 | 0.00 |
| 3 | 0.09 | 0.07 | -0.06 | 0.08 | 0.08 | -0.00 |
| 4 or more | 0.04 | 0.03 | -0.02 | 0.03 | 0.04 | 0.03 |
| Any mortgage debt |  |  |  |  |  |  |
| No | 0.83 | 0.89 | 0.19 | 0.85 | 0.86 | 0.01 |
| Yes | 0.17 | 0.11 | -0.19 | 0.15 | 0.14 | -0.01 |
| Education qualification |  |  |  |  |  |  |
| Less than o-level or equiv | 0.45 | 0.46 | 0.01 | 0.45 | 0.47 | 0.03 |
| O-level or equivalent | 0.28 | 0.25 | -0.07 | 0.27 | 0.25 | -0.05 |
| Higher than a-level | 0.27 | 0.29 | 0.05 | 0.28 | 0.28 | 0.01 |
| Place of birth elsewhere outside of UK |  |  |  |  |  |  |
| No | 0.93 | 0.93 | 0.02 | 0.93 | 0.93 | 0.01 |
| Yes | 0.07 | 0.07 | -0.02 | 0.07 | 0.07 | -0.01 |
| Some difficulties in activities of Daily Living |  |  |  |  |  |  |
| No | 0.76 | 0.80 | 0.10 | 0.77 | 0.79 | 0.04 |
| Yes | 0.24 | 0.20 | -0.10 | 0.23 | 0.21 | -0.04 |
| Sex |  |  |  |  |  |  |
| Men | 0.44 | 0.45 | 0.02 | 0.44 | 0.45 | 0.01 |
| Women | 0.56 | 0.55 | -0.02 | 0.56 | 0.55 | -0.01 |
| Ever had arthritis |  |  |  |  |  |  |
| No | 0.51 | 0.58 | 0.13 | 0.54 | 0.55 | 0.01 |
| Yes | 0.49 | 0.42 | -0.13 | 0.46 | 0.45 | -0.01 |
| Ever had cancer |  |  |  |  |  |  |
| No | 0.87 | 0.89 | 0.06 | 0.88 | 0.89 | 0.02 |
| Yes | 0.13 | 0.11 | -0.06 | 0.12 | 0.11 | -0.02 |
| Number of living children |  |  |  |  |  |  |
| None | 0.11 | 0.11 | 0.00 | 0.11 | 0.11 | -0.02 |
| 1 | 0.16 | 0.14 | -0.04 | 0.15 | 0.14 | -0.03 |
| 2 | 0.33 | 0.37 | 0.09 | 0.35 | 0.35 | -0.01 |
| 3 or more | 0.40 | 0.37 | -0.06 | 0.38 | 0.40 | 0.04 |
| Paying rent |  |  |  |  |  |  |
| No | 0.82 | 0.87 | 0.13 | 0.85 | 0.83 | -0.05 |
| Yes | 0.17 | 0.13 | -0.13 | 0.14 | 0.16 | 0.04 |
| Whether financial respondent |  |  |  |  |  |  |
| No | 0.24 | 0.26 | 0.04 | 0.24 | 0.25 | 0.03 |
| Yes | 0.76 | 0.74 | -0.04 | 0.76 | 0.75 | -0.03 |
| Ever had heart problems |  |  |  |  |  |  |
| No | 0.80 | 0.80 | 0.01 | 0.80 | 0.79 | -0.01 |
| Yes | 0.20 | 0.20 | -0.01 | 0.20 | 0.21 | 0.01 |
| Ever had high blood pressure |  |  |  |  |  |  |
| No | 0.51 | 0.53 | 0.04 | 0.52 | 0.51 | -0.00 |
| Yes | 0.49 | 0.47 | -0.04 | 0.48 | 0.49 | 0.00 |
| Some difficulties with instrumental activities of daily living |  |  |  |  |  |  |
| No | 0.96 | 0.96 | 0.02 | 0.96 | 0.96 | -0.00 |
| Yes | 0.04 | 0.04 | -0.02 | 0.04 | 0.04 | 0.00 |
| Interview year |  |  |  |  |  |  |
| 2002 | 0.13 | 0.15 | 0.05 | 0.12 | 0.15 | 0.08 |
| 2003 | 0.01 | 0.02 | 0.04 | 0.02 | 0.02 | 0.01 |
| 2004 | 0.08 | 0.07 | -0.04 | 0.09 | 0.07 | -0.06 |
| 2005 | 0.05 | 0.05 | 0.01 | 0.05 | 0.05 | 0.01 |
| 2006 | 0.09 | 0.10 | 0.03 | 0.10 | 0.10 | -0.01 |
| 2007 | 0.01 | 0.01 | 0.02 | 0.01 | 0.01 | 0.04 |
| 2008 | 0.10 | 0.09 | -0.02 | 0.09 | 0.09 | 0.01 |
| 2009 | 0.04 | 0.04 | 0.02 | 0.04 | 0.04 | 0.00 |
| 2010 | 0.09 | 0.10 | 0.02 | 0.09 | 0.10 | 0.02 |
| 2011 | 0.04 | 0.03 | -0.02 | 0.03 | 0.04 | 0.02 |
| 2012 | 0.11 | 0.10 | -0.03 | 0.10 | 0.10 | 0.01 |
| 2013 | 0.02 | 0.01 | -0.04 | 0.02 | 0.01 | -0.05 |
| 2014 | 0.10 | 0.09 | -0.04 | 0.10 | 0.09 | -0.02 |
| 2015 | 0.02 | 0.01 | -0.05 | 0.02 | 0.02 | -0.02 |
| 2016 | 0.09 | 0.09 | 0.00 | 0.10 | 0.09 | -0.04 |
| 2017 | 0.02 | 0.03 | 0.02 | 0.03 | 0.02 | -0.01 |
| Freq light physical activity |  |  |  |  |  |  |
| > 1 per week | 0.80 | 0.79 | -0.01 | 0.80 | 0.79 | -0.01 |
| 1 per week | 0.10 | 0.09 | -0.02 | 0.09 | 0.10 | 0.01 |
| 1-3 per month | 0.04 | 0.03 | -0.01 | 0.04 | 0.04 | -0.00 |
| Hardly ever or never | 0.07 | 0.08 | 0.03 | 0.08 | 0.08 | 0.01 |
| Ever had lung disease |  |  |  |  |  |  |
| No | 0.90 | 0.92 | 0.05 | 0.91 | 0.91 | 0.01 |
| Yes | 0.10 | 0.08 | -0.05 | 0.09 | 0.09 | -0.01 |
| Marital status |  |  |  |  |  |  |
| Married | 0.64 | 0.67 | 0.05 | 0.66 | 0.66 | 0.01 |
| Partnered | 0.03 | 0.02 | -0.02 | 0.03 | 0.03 | -0.01 |
| Seperated | 0.02 | 0.01 | -0.09 | 0.02 | 0.01 | -0.05 |
| Divorced | 0.14 | 0.10 | -0.11 | 0.12 | 0.12 | -0.00 |
| Widowed | 0.13 | 0.15 | 0.08 | 0.13 | 0.14 | 0.01 |
| Never married | 0.05 | 0.04 | -0.02 | 0.04 | 0.04 | 0.01 |
| Ever had stroke |  |  |  |  |  |  |
| No | 0.96 | 0.96 | 0.01 | 0.96 | 0.96 | -0.03 |
| Yes | 0.04 | 0.04 | -0.01 | 0.04 | 0.04 | 0.03 |
| Spouse's labour market status |  |  |  |  |  |  |
| Employed | 0.12 | 0.10 | -0.06 | 0.11 | 0.12 | 0.01 |
| Self-employed | 0.03 | 0.02 | -0.05 | 0.03 | 0.03 | -0.01 |
| Retired | 0.41 | 0.47 | 0.12 | 0.43 | 0.44 | 0.01 |
| Disabled | 0.03 | 0.02 | -0.05 | 0.02 | 0.03 | 0.02 |
| Unemployed/ looking after home or family | 0.06 | 0.06 | -0.00 | 0.06 | 0.05 | -0.04 |
| No spouse | 0.36 | 0.33 | -0.06 | 0.34 | 0.34 | -0.00 |
| Self reported employment status |  |  |  |  |  |  |
| retired | 1.00 | 1.00 | . | 1.00 | 1.00 | . |
| Continuous variables |  |  |  |  |  |  |
| Number of depressive symptoms at time t | 1.62 | 1.43 | -0.09 | 1.53 | 1.55 | 0.01 |
| OUTCOME (not included in weigthing): number of depressive symptoms at t+1 | 1.61 | 1.47 | -0.07 | 1.55 | 1.55 | -0.00 |
| OUTCOME (not in weigthing): Quality of life score (CASP-19) at t+1 | 3.99 | 4.16 | 0.18 | 4.03 | 4.11 | 0.10 |
| Quality of life score (CASP-19) at t | 4.04 | 4.18 | 0.15 | 4.09 | 4.12 | 0.03 |
| Non-mortgage debt to gross wealth (log) | -0.55 | -2.47 | -0.53 | -1.39 | -1.40 | -0.00 |
| Household weekly income (log) | 5.85 | 5.87 | 0.04 | 5.86 | 5.85 | -0.02 |
| Gross wealth (log) | 10.64 | 11.35 | 0.21 | 11.02 | 10.86 | -0.05 |
| Gross non-housing wealth (log) | 8.07 | 9.19 | 0.34 | 8.54 | 8.55 | 0.00 |
| Mortgage debt amount (log) | 1.72 | 1.05 | -0.19 | 1.43 | 1.41 | -0.01 |
| Spouse's age if no data | 60.21 | 61.19 | 0.10 | 60.78 | 60.54 | -0.02 |
| Age | 67.63 | 68.33 | 0.12 | 67.95 | 67.84 | -0.02 |
| Total Recall Summary Score | 10.43 | 10.39 | -0.01 | 10.41 | 10.45 | 0.01 |
| Credit card debt amount (log) | 4.36 | 2.93 | -0.42 | 3.67 | 3.68 | 0.01 |
| Non-mortgage debt amount (log) | 7.52 | 6.72 | -0.46 | 7.15 | 7.14 | -0.01 |

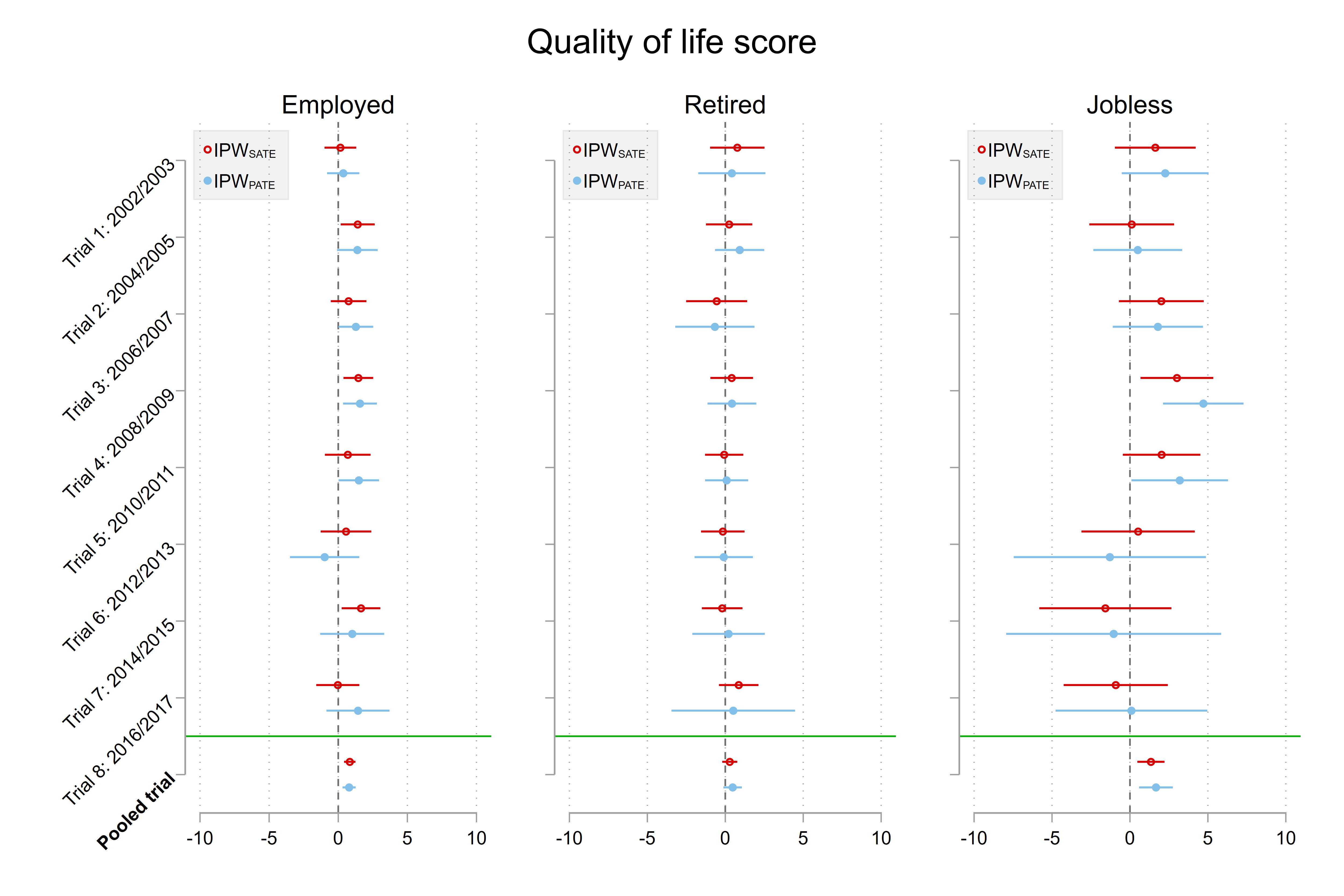
Supplementary Table 5. Balance characteristics before and after weighting. SATE sample shown (the population average treatment effect was not shown given the use of sampling weights). Jobless subgroup.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Variable | Raw mean not treated | Raw mean treated | Standardized difference | Weighted mean not treated | Weighted mean not treated | Standardized difference |
| Any credit card debt |  |  |  |  |  |  |
| No | 0.42 | 0.54 | 0.23 | 0.48 | 0.48 | 0.01 |
| Yes | 0.58 | 0.46 | -0.23 | 0.52 | 0.52 | -0.01 |
| Whether own home |  |  |  |  |  |  |
| No | 0.42 | 0.34 | -0.17 | 0.40 | 0.39 | -0.01 |
| Yes | 0.58 | 0.66 | 0.17 | 0.60 | 0.61 | 0.01 |
| Number of people in Household |  |  |  |  |  |  |
| 1 | 0.21 | 0.20 | -0.01 | 0.20 | 0.21 | 0.02 |
| 2 | 0.50 | 0.51 | 0.02 | 0.51 | 0.50 | -0.03 |
| 3 | 0.17 | 0.17 | 0.02 | 0.16 | 0.17 | 0.02 |
| 4 or more | 0.12 | 0.11 | -0.05 | 0.12 | 0.11 | -0.01 |
| Any mortgage debt |  |  |  |  |  |  |
| No | 0.71 | 0.79 | 0.19 | 0.74 | 0.74 | 0.00 |
| Yes | 0.29 | 0.21 | -0.19 | 0.26 | 0.26 | -0.00 |
| Education qualification |  |  |  |  |  |  |
| Less than o-level or equiv | 0.51 | 0.52 | 0.02 | 0.52 | 0.51 | -0.02 |
| O-level or equivalent | 0.32 | 0.31 | -0.02 | 0.32 | 0.34 | 0.05 |
| Higher than a-level | 0.16 | 0.17 | 0.00 | 0.17 | 0.16 | -0.02 |
| Place of birth elsewhere outside of UK |  |  |  |  |  |  |
| No | 0.93 | 0.90 | -0.11 | 0.93 | 0.91 | -0.05 |
| Yes | 0.07 | 0.10 | 0.11 | 0.07 | 0.09 | 0.05 |
| Some difficulties in activities of Daily Living |  |  |  |  |  |  |
| No | 0.59 | 0.64 | 0.12 | 0.61 | 0.61 | 0.00 |
| Yes | 0.41 | 0.36 | -0.12 | 0.39 | 0.39 | -0.00 |
| Sex |  |  |  |  |  |  |
| Men | 0.35 | 0.34 | -0.01 | 0.34 | 0.35 | 0.03 |
| Women | 0.65 | 0.66 | 0.01 | 0.66 | 0.65 | -0.03 |
| Ever had arthritis |  |  |  |  |  |  |
| No | 0.50 | 0.53 | 0.07 | 0.51 | 0.50 | -0.02 |
| Yes | 0.50 | 0.47 | -0.07 | 0.49 | 0.50 | 0.02 |
| Ever had cancer |  |  |  |  |  |  |
| No | 0.93 | 0.92 | -0.04 | 0.93 | 0.92 | -0.03 |
| Yes | 0.07 | 0.08 | 0.04 | 0.07 | 0.08 | 0.03 |
| Number of living children |  |  |  |  |  |  |
| None | 0.13 | 0.14 | 0.02 | 0.13 | 0.13 | 0.00 |
| 1 | 0.17 | 0.16 | -0.04 | 0.17 | 0.16 | -0.00 |
| 2 | 0.30 | 0.31 | 0.02 | 0.31 | 0.29 | -0.05 |
| 3 or more | 0.40 | 0.40 | 0.00 | 0.39 | 0.41 | 0.05 |
| Paying rent |  |  |  |  |  |  |
| No | 0.74 | 0.79 | 0.12 | 0.75 | 0.76 | 0.00 |
| Yes | 0.26 | 0.20 | -0.13 | 0.24 | 0.23 | -0.02 |
| Whether financial respondent |  |  |  |  |  |  |
| No | 0.28 | 0.30 | 0.03 | 0.29 | 0.28 | -0.02 |
| Yes | 0.72 | 0.70 | -0.03 | 0.71 | 0.72 | 0.02 |
| Ever had heart problems |  |  |  |  |  |  |
| No | 0.80 | 0.84 | 0.10 | 0.80 | 0.83 | 0.10 |
| Yes | 0.20 | 0.16 | -0.10 | 0.20 | 0.17 | -0.10 |
| Ever had high blood pressure |  |  |  |  |  |  |
| No | 0.54 | 0.55 | 0.01 | 0.54 | 0.54 | -0.01 |
| Yes | 0.46 | 0.45 | -0.01 | 0.46 | 0.46 | 0.01 |
| Some difficulties with instrumental activities of daily living |  |  |  |  |  |  |
| No | 0.86 | 0.90 | 0.11 | 0.87 | 0.88 | 0.05 |
| Yes | 0.14 | 0.10 | -0.11 | 0.13 | 0.12 | -0.05 |
| Interview year |  |  |  |  |  |  |
| 2002 | 0.21 | 0.17 | -0.10 | 0.20 | 0.18 | -0.06 |
| 2003 | 0.03 | 0.02 | -0.01 | 0.03 | 0.02 | -0.06 |
| 2004 | 0.08 | 0.10 | 0.05 | 0.08 | 0.09 | 0.03 |
| 2005 | 0.07 | 0.08 | 0.02 | 0.08 | 0.07 | -0.02 |
| 2006 | 0.12 | 0.13 | 0.03 | 0.13 | 0.13 | 0.01 |
| 2007 | 0.02 | 0.01 | -0.11 | 0.02 | 0.01 | -0.08 |
| 2008 | 0.10 | 0.09 | -0.02 | 0.09 | 0.10 | 0.03 |
| 2009 | 0.05 | 0.04 | -0.03 | 0.05 | 0.04 | -0.06 |
| 2010 | 0.07 | 0.09 | 0.11 | 0.07 | 0.08 | 0.06 |
| 2011 | 0.04 | 0.03 | -0.06 | 0.04 | 0.03 | -0.04 |
| 2012 | 0.08 | 0.08 | -0.01 | 0.08 | 0.09 | 0.02 |
| 2013 | 0.01 | 0.01 | 0.02 | 0.01 | 0.01 | 0.03 |
| 2014 | 0.06 | 0.05 | -0.07 | 0.06 | 0.06 | -0.02 |
| 2015 | 0.01 | 0.02 | 0.07 | 0.01 | 0.02 | 0.07 |
| 2016 | 0.04 | 0.05 | 0.06 | 0.03 | 0.05 | 0.06 |
| 2017 | 0.01 | 0.02 | 0.08 | 0.02 | 0.03 | 0.05 |
| Freq light physical activity |  |  |  |  |  |  |
| > 1 per week | 0.74 | 0.72 | -0.04 | 0.74 | 0.69 | -0.10 |
| 1 per week | 0.11 | 0.09 | -0.06 | 0.10 | 0.11 | 0.03 |
| 1-3 per month | 0.04 | 0.04 | -0.02 | 0.04 | 0.05 | 0.04 |
| Hardly ever or never | 0.11 | 0.16 | 0.12 | 0.12 | 0.15 | 0.07 |
| Ever had lung disease |  |  |  |  |  |  |
| No | 0.91 | 0.90 | -0.03 | 0.91 | 0.90 | -0.04 |
| Yes | 0.09 | 0.10 | 0.03 | 0.09 | 0.10 | 0.04 |
| Marital status |  |  |  |  |  |  |
| Married | 0.62 | 0.66 | 0.07 | 0.63 | 0.63 | -0.00 |
| Partnered | 0.05 | 0.05 | -0.02 | 0.05 | 0.05 | 0.03 |
| Seperated | 0.02 | 0.02 | 0.01 | 0.02 | 0.03 | 0.07 |
| Divorced | 0.18 | 0.14 | -0.12 | 0.17 | 0.17 | -0.01 |
| Widowed | 0.05 | 0.07 | 0.07 | 0.07 | 0.05 | -0.05 |
| Never married | 0.07 | 0.06 | -0.01 | 0.06 | 0.06 | 0.00 |
| Ever had stroke |  |  |  |  |  |  |
| No | 0.95 | 0.95 | -0.01 | 0.95 | 0.95 | -0.03 |
| Yes | 0.05 | 0.05 | 0.01 | 0.05 | 0.05 | 0.03 |
| Spouse's labour market status |  |  |  |  |  |  |
| Employed | 0.24 | 0.22 | -0.04 | 0.23 | 0.25 | 0.04 |
| Self-employed | 0.05 | 0.05 | -0.02 | 0.05 | 0.05 | -0.03 |
| Retired | 0.16 | 0.21 | 0.13 | 0.19 | 0.17 | -0.04 |
| Disabled | 0.10 | 0.08 | -0.07 | 0.10 | 0.09 | -0.02 |
| Unemployed/ looking after home or family | 0.08 | 0.09 | 0.06 | 0.08 | 0.09 | 0.05 |
| No spouse | 0.36 | 0.33 | -0.06 | 0.36 | 0.35 | -0.01 |
| Self reported employment status |  |  |  |  |  |  |
| unemployed | 0.09 | 0.09 | 0.02 | 0.09 | 0.09 | 0.00 |
| lt\_sick | 0.48 | 0.38 | -0.20 | 0.44 | 0.45 | 0.01 |
| other | 0.43 | 0.53 | 0.19 | 0.47 | 0.46 | -0.01 |
| Continuous variables |  |  |  |  |  |  |
| Number of depressive symptoms at time t | 3.03 | 2.63 | -0.16 | 2.90 | 2.83 | -0.03 |
| OUTCOME (not included in weigthing): number of depressive symptoms at t+1 | 2.95 | 2.43 | -0.21 | 2.84 | 2.59 | -0.10 |
| OUTCOME (not in weigthing): Quality of life score (CASP-19) at t+1 | 3.44 | 3.75 | 0.29 | 3.49 | 3.67 | 0.17 |
| Quality of life score (CASP-19) at t | 3.43 | 3.66 | 0.22 | 3.49 | 3.54 | 0.05 |
| Non-mortgage debt to gross wealth (log) | 1.32 | -0.53 | -0.44 | 0.68 | 0.56 | -0.03 |
| Household weekly income (log) | 5.62 | 5.58 | -0.04 | 5.63 | 5.57 | -0.05 |
| Gross wealth (log) | 8.71 | 9.65 | 0.20 | 9.04 | 9.04 | 0.00 |
| Gross non-housing wealth (log) | 6.26 | 7.38 | 0.28 | 6.61 | 6.72 | 0.03 |
| Mortgage debt amount (log) | 2.93 | 2.06 | -0.20 | 2.61 | 2.59 | -0.00 |
| Spouse's age if no data | 55.79 | 57.84 | 0.24 | 56.43 | 56.68 | 0.03 |
| Age | 58.86 | 60.79 | 0.31 | 59.54 | 59.68 | 0.02 |
| Total Recall Summary Score | 10.55 | 10.31 | -0.07 | 10.47 | 10.47 | -0.00 |
| Credit card debt amount (log) | 4.20 | 3.06 | -0.31 | 3.74 | 3.69 | -0.01 |
| Non-mortgage debt amount (log) | 7.57 | 6.86 | -0.41 | 7.29 | 7.28 | -0.01 |

Chart

Description automatically generated

Supplementary Figure 1. **Results from IPTW for the population (PATE, IPTW multiplied by cross-sectional weights at time t and attrition weights) and the sample (SATE). Number of depressive symptoms (CES-D 8) is the continuous outcome. Mean differences in the outcome between the treated and comparison groups in each trial and the pooled summary estimate. Normal confidence intervals are calculated using bootstrapping (1000 replications).**



Supplementary Figure 2. **Results from IPTW for the population (PATE, IPTW multiplied by cross-sectional weights at time t and attrition weights) and the sample (SATE). Quality of life score (CASP-19) is the continuous outcome. Mean differences in the outcome between the treated and comparison groups in each trial and the pooled summary estimate. Normal confidence intervals are calculated using bootstrapping (1000 replications).**

Technical appendix

This technical appendix describes the populations and variables of interest, parameters of interest, measures of moderation, and their estimation.

***Variables and populations***

For the analysis of population associations between holding debt and mental wellbeing, let denote the current value of a measure of mental wellbeing (depression or quality of life) for each individual in the population of interest, that is, the persons aged 50 and over living in England. The value of is observed for a sample of n members of the population in the ELSA survey. Each individual is also characterised by whether they hold debt ( for no and yes respectively) and their labour market status ( for employed, retired and jobless respectively).

For the causal analysis, now consider the subset of the population above who are aged between 50 and 80 and who hold debt at a given time t, which corresponds to one of the ELSA waves 1-8 or the pooled sample. The data for this analysis is the corresponding subset of the ELSA sample. Here each individual's labour market status at time t is again considered a fixed characteristic, but for debt, now denotes if an individual got rid of their debt by time t + 1 and D = 0 if they did not. For the people in the sample, we observe either or , the value realised for them. However, the definitions of causal effects need to consider both possibilities for every individual in the sample and, when population causal effects are of interest, in the population, and the values of Y, potential outcomes, under both of the treatment values. Thus, potential outcome framework is needed (Rubin 1974).

Two potential outcomes , for are defined to each individual, so that denotes the (real or counterfactual) value of Y for individual i had they got rid of their debts and the value of Y had they not got rid of their debts. The value of is observed for members of the sample. However, the other potential outcome for them, and both potential outcomes for the rest of the population of interest not sampled, are unobserved.

***Parameters of interest***

The study is interested in two types of parameters – population associations and causal effects – and similar moderation measures derived from them.

For the population associations, let denote the average of among the members of the population who have debt status and labour market status M =m, for the six subsets of individuals which are defined by the combinations of d=0,1 and m=0,1,2. Associations between D and Y in the population, separately in each category of M, can be quantified by comparisons of the averages E\_1m and E:0m, in particular by their differences E\_1m-E\_0m and their ratio E1m/E0m.

For the causal effects, let now denote the average of the potential outcome among the members of the population who have labour market status , for . Here one can consider defined both for all members of the population and for the individuals i who are observed in the sample. In both cases, the averaging for both, and , is over all members of the population or the sample. A causal effect on mental wellbeing of an individual with labour market status m of getting rid of their debts vs. not doing so can be quantified by the difference of the averages of the two potential outcomes or their ratio . This is referred to (especially with reference to the difference) as the “population average treatment effect” (PATE) when defined with the averages across all members of the population, and as the “sample average treatment effect” (SATE) when limited to the average of potential outcomes of the members of the sample.

***Measures of moderation***

Let denote either of the quantities defined above, for population associations or for causal effects. Consider how an association or causal effect is moderated for individuals with labour market status 1 (retired) or 2 (jobless), compared to those with status 0 (employed).

A measure of moderation on an additive scale is

(1)

separately for m= 1,2. The first expression in (1) shows that this is the difference between the association or effect when both D and M are changed, and the sum of the two associations or effects when just one of them is changed. The second expression in (1) shows that this is also simply the difference of the associations or effects between D and Y, on an additive scale, among those with vs. those with .

With a similar logic, measures of moderation on a multiplicative scale are defined as

(2)

separately for . As in the additive association, the second expression in (2) shows that this is the difference, in ratio scale, of the association or effects between D and Y, measured now on a ratio scale, among those with vs. those with .

***Estimation***

The parameters introduced above are estimated using three types of weights:

1. Survey weights , which are used to account for imbalances between the characteristics of the individuals who are included in the ELSA sample and of individuals in the whole target population. These combine weighting elements for the sampling design, nonresponse and further calibration to known population distributions. The survey weights of the ELSA data are described in detail in the ELSA documentation (Banks, Batty et al. 2014). The survey weights are multiplied by attrition weights between t and t+1 to account for non-random attrition. The same variables and techniques were used in calculating the attrition weights as in the IPTW weights below.
2. Inverse probability treatment weights (IPTWs)) , which are used to account for imbalances in measured pre-treatment characteristics between individuals in the sample who were observed to have got rid of their debts () and those who had not (). Let denote a set of variables which are observed for respondents i in the sample (the selection of these variables in the analysis of this paper is discussed in the main text). Let denote the probability that an individual with characteristics gets rid of their debts between time t and t+ 1. This probability can be modelled using the logit model

, (3)

defined and estimated separately for each time t and the pooled trial, using the data in the sample. The propensity score for individual is then their fitted probability from this estimated model. The IPTW is the inverse of the estimated probability of the treatment value individual was observed in the data

1. Combined weights which account for both the sampling of individuals from the population and the selection of which sampled individuals are observed to have treatment levels and .

The expectation quantities introduced above are then estimated by a weighted sample average of the form

(4)

Where is that set of respondents in the sample for whom and . For population means and associations, the weight is chosen to be , (4) defining an estimate of the population mean of . it defines an estimate of the average of potential outcome among the sample, and with it defines an estimate of the average of potential outcome among the population, each of these for the subset of people with . Estimates of the associations, treatment effects and moderation measures defined above are then obtained by substituting the appropriate version of in their definitions.

**Standard errors**

The standard errors, and the corresponding 95% confidence intervals, for the population associations are calculated using the delta method (Oehlert 1992). The normal-based 95% confidence intervals for the causal analysis are calculated using bootstrapping (Efron and Tibshirani 1994).

Banks, J., B. Batty, J. Nazroo, A. Oskala and A. Steptoe (2014). The dynamics of ageing: Evidence from the English Longitudinal Study of ageing 2002-16 (Wave 8), The Institute for Fiscal Studies

Efron, B. and R. J. Tibshirani (1994). An introduction to the bootstrap, CRC press.

Oehlert, G. W. (1992). "A note on the delta method." The American Statistician **46**(1): 27-29.

Rubin, D. B. (1974). "Estimating causal effects of treatments in randomized and nonrandomized studies." Journal of educational Psychology **66**(5): 688.