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# The financial support for long-term elderly care and household saving behaviour

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## Abstract

We analyse how the financial support for long-term elderly care affects the household's propensity to save. Using the difference-in-differences estimator, we investigate the 2002 Scottish reform, which introduced free formal personal care for all the Scottish elderly aged 65 and above. We find that the policy reduced the household saving rate by 1.9 percentage points. This amounts to an annual reduction in the flow of saving of £503. Moreover, the estimated effect is heterogeneous across the age of the head of household. The largest effect is observed when the household head is in his/her 40s, with the reduction in the saving rate of 3.5 percentage points or £1,213 per year.

**Keywords:** Long-term elderly care; ageing; means tested financial support; saving rate; difference-in-differences.

**JEL classification codes:** C21, D14, I18, J14

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# 1 Introduction

The cost of long-term formal elderly care, offered to individuals aged 65 and above, is often covered entirely by patients. Such costs pose significant financial uncertainties towards the elderly, since it is typically very difficult for individuals to predict the types and the duration of care in the future.

How to financially support the elderly and their families during the period of their long-term elderly care needs is a policy question that is often debated in many developed countries. Some countries, such as Germany and Japan, recently implemented long-term elderly healthcare insurance schemes, which partially subsidize the care cost. Other countries like the US and the UK often require substantial portion of the cost to be covered by individual households. Policy makers have the difficult task of striking a balance between ensuring comfort among the elderly by providing sufficient amount of affordable care and limiting the government expenditure. Moreover, the extent of the problem is likely to increase in the next decades due to the ageing population and the low fertility rates faced by many countries.

When designing a policy aimed at financially supporting the elderly with their care cost, it is imperative that one takes account of behavioural changes among the elderly and their families. One potential concern related to the introduction of a more generous system of formal elderly care is that households may reduce the amount of assets over their life-cycle, since they anticipate that they will rely more heavily on public funds.

Several papers estimate structural life-cycle models incorporating uncertainties generated by medical expenses to understand the potential importance of precautionary saving behaviours in the US (Kotlikoff, 1989; Hubbard et al., 1994; Palumbo, 1999; De Nardi et al., 2010; Scholz et al., 2006; Kopecky and Koreshkova, 2014). Hubbard et al. (1994) and Palumbo (1999) report that taking account of medical expenditure uncertainties does not drastically impact the life-cycle saving profiles. Later studies, however, argue that the inclusion of this type of uncertainties in their models do improve their calibration results. De Nardi et al. (2010) suggest that the difference in the conclusions is likely to be due to improved access to more precise data on medical expenditures.<sup>1</sup>

Evidence from outside of the US is virtually non-existent despite the fact that the

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<sup>1</sup> Although not directly related to the long-term elderly care expenses, Gruber and Yelowitz (1999) and Maynard and Qiu (2009) investigate the impacts of the US Medicaid program, which provides health insurance for low income households aged younger than 65, on household wealth. Gruber and Yelowitz (1999) exploits the exogenous variation in Medicaid eligibility condition during the period 1984–1993 and find that Medicaid eligibility is negatively associated with household wealth. Maynard and Qiu (2009) find that the disincentive effect of Medicaid on household wealth is particularly strong among the middle net-worth households.

non-US systems of health care and financial public support often substantially differ from those in the US. [Guariglia and Rossi \(2004\)](#) does investigate the impact of private medical insurance on saving in the UK context. However, their focus is only on younger individuals aged between 25 and 65 and they do not specifically look at long-term care.<sup>2</sup>

Our paper therefore intends to present one of the first studies from outside of the US on the impact of financial support towards the long-term elderly care on the UK household saving behaviour. Moreover, since the aggregate private wealth might play a relevant role in the determination of capital accumulation and, thereby, in future economic growth ([Solow, 1959](#); [Romer, 1986](#); [Lucas, 1988](#)), it is of crucial importance to understand whether and to what extent the introduction of a more generous system of long-term elderly care could have had unintended consequences on household propensities to save over the life-cycle.

We exploit a 2002 Scottish reform, which offers a part of the elderly care free of charge. Before this reform, Scotland and the rest of the UK shared the same public system for the long-term elderly care. Since this policy was introduced only in Scotland, UK households outside of Scotland can be used as a control group to disentangle the impact of such a Scottish reform on the saving behaviour of the Scottish households from any other changes in assets induced by time effects common to all the UK regions. In addition, except for [Kopecky and Koreshkova \(2014\)](#), most existing studies focus either on the elderly population ([Hubbard et al., 1994](#); [Palumbo, 1999](#); [De Nardi et al., 2010](#); [Scholz et al., 2006](#)) or pre-retirement individuals ([Guariglia and Rossi, 2004](#)). In contrast, our paper presents evidence across post-educational age groups.

We find that the Scottish policy reform reduced the average household saving rate by 1.9 percentage points. If we take a Scottish household with the average gross income across the period under analysis as the reference, this effect amounts to an annual reduction in the flow of saving of £503. In addition, the estimated effect is heterogeneous across the age of the head of household. The reform effect is the strongest for households with head aged between 40 and 50, where the reduction in the average household saving rate is 3.5 percentage points, amounting to £1,213 per year.

This article is set-up as follows. Section 2 provides background and institutional information on the 2002 Scottish reform. Section 3 discusses the theoretical predictions of the impact of the reform on saving. Section 4 presents the econometric model, the data, and the assumptions to identify the effects of the reform on household saving behaviour.

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<sup>2</sup>Potential effects arising from long-term care expenditure uncertainties are likely to be different from those of acute medical care expenditure uncertainties. This is because long-term elderly care can be offered by paid caretakers as well as informal family members and friends. In contrast, acute medical care must be offered by medical professionals. This difference in the existence of close substitutes may lead the demand for long-term elderly care to be more elastic compared to acute medical care.

Section 5 reports and comments on the estimation results and on a battery of robustness checks of our benchmark findings. Section 6 concludes.

## 2 Background information

### 2.1 Historical background

Individuals who have difficulties with daily activities receive personal care. Examples of personal care are bathing, toileting, assistance with preparation and eating food, and dressing. Personal care may be informally provided to the elderly by their family members. Paid personal care is also available from social workers administered by local authorities or privately hired caretakers. Paid personal care is referred to as “formal” care.

Prior to 2002, formal personal care cost in UK was paid almost entirely by individuals.<sup>3</sup> Such costs exposed individuals in need of long-term care to significant financial burden. In 2000, an average individual in England required 7.6 hours of personal care per week and the average hourly cost of personal care was approximately £12 ([National Statistics, 2002](#)). Around 39 percent of households benefiting from home care received 6 or more visits and more than 5 hours of care per week. Half of these households required intensive care, defined as more than 10 contact hours and 6 or more visits during the week. In addition to charges for formal personal care, local authorities often charged for meals delivered to home or participating in day care sessions. The financial burden faced by the elderly, therefore, posed concerns among the UK policy makers ([Netten et al., 2003](#)).

The Royal Commission on Long Term Care for the Elderly was set up by the Labour government in December 1997 under the chairmanship of Sir Stewart Sutherland amid growing concerns regarding the financing of the elderly care. The Commission reported back to the UK Parliament in March 1999 (Sutherland report), recommending that for those aged 65 and above, formal personal care should be provided free of charge after rigorous need-based assessment conducted by local authorities.<sup>4</sup>

### 2.2 Devolution and its consequences

At the same time as the publication of the Sutherland report, the UK political system went through significant changes. More specifically, powers were transferred from Westminster

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<sup>3</sup>Stringent means tested subsidies were offered to the elderly once their wealth fell below £18,500 (2001 rate).

<sup>4</sup>The Commission however argued that the hotel costs and costs of meals on wheels or providing personal assistance with shopping should still be paid by individuals.

to devolved governments in Scotland, Wales and the Northern Ireland. The devolved governments were introduced on 1st July 1999 in Scotland and Wales and on 2nd December 1999 in the Northern Ireland. England remained under the direct control of Westminster.

The establishment of devolved governments implied that each government acquired some scope to form its own health care policies although the differential degree of devolution meant that some had more autonomy from Westminster compared to the others. In response to the Sutherland report, Scotland welcomed the idea of state-funded personal care. The Scottish Executive set up the Care Development Group in January 2001, which was aimed at pursuing options on how to implement state-funded personal care and to evaluate the estimated cost of introducing such a policy. After several revisions, the Bill passed and received Royal Assent on 12 March 2002 to become the Community Care and Health (Scotland) Act 2002 (CCHA), which in turn was implemented on 1st July 2002. In contrast to Scotland, England, Wales and Northern Ireland did not follow the Commission's recommendation to make formal personal care free and continue to charge individuals for this type of care to this day.

The CCHA introduced the free formal personal care in Scotland but it distinguished care offered at home from the one received in residential care homes. If an individual received formal personal care at home, all personal care cost was covered as long as the local authority assessed the individual and approved the amount of care.<sup>5</sup> Cost coverage for formal personal care provided in residential care homes was instead fixed at a flat rate.<sup>6</sup>

Table 1 highlights individuals' financial gains due to the reform by care setting and the region of residence. For each group, we calculate the maximum possible amount of weekly allowances given to individuals.<sup>7</sup> This table shows us that the maximum financial gain was experienced by the Scottish individuals, who received personal care at home. In contrast, the changes in the amount of allowances received by those in residential care homes are only marginally heterogeneous across regions. However, the majority of individuals in UK receive care at home: in 2010–2011 approximately 70% of the care recipients in England received care in their own homes ([AgeUK, 2014](#)). Assuming that the UK individuals form expectations on their future care setting based on the current

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<sup>5</sup>On average, individuals received £80 per week for formal personal care received at home ([National Statistics, 2012](#)).

<sup>6</sup>In either case, individuals are still asked to pay other costs such as costs of cleaning, day care, laundry or meals on wheels.

<sup>7</sup>The calculated amounts reflect other policy reforms that were implemented at the same time (see Appendix A for more information on these reforms). However, these reforms either affected all individuals across UK in a uniform manner or affected individuals heterogeneously but with very limited differences from the quantitative point of view. Therefore, our results in this paper are likely to reflect the isolated impact of the free personal care policy.

trend, the Scottish policy is likely to be relevant to the majority of the population. Based on the amount reported in Table 1, computing the difference between the variation in the allowances of care received at home in Scotland and the one in the rest of the UK yields £145 per week,<sup>8</sup> which amounts to £7,540 per year.

Table 1: Examples of maximum weekly allowance calculations (£ per week)

|                             | Before the reforms (2000 rate) | After the reforms (2003 rate) |
|-----------------------------|--------------------------------|-------------------------------|
| Care received in care homes | £ per week                     | £ per week                    |
| England                     | 53.55                          | 200.00                        |
| Wales                       | 53.55                          | 176.86                        |
| Northern Ireland            | 53.55                          | 157.20                        |
| Scotland                    | 53.55                          | 210.00                        |
| Care received at home       | Before the reforms (2000 rate) | After the reforms (2003 rate) |
|                             | £ per week                     | £ per week                    |
| England                     | 53.55                          | 57.20                         |
| Wales                       | 53.55                          | 57.20                         |
| Northern Ireland            | 53.55                          | 57.20                         |
| Scotland                    | 53.55                          | 202.20                        |

*Notes:* This table illustrates how the maximum amounts of weekly allowances changed before and after the reforms depending on where the elderly reside and where they receive care. The pre-reform amounts are calculated using the 2000 rates whereas the 2003 rates are employed for the calculations of the post-reform amounts. Since the formal personal care allowance in Scotland for those receiving care at home is not fixed, we use the average amount provided to the elderly, i.e. £80 (National Statistics, 2012). These calculations also incorporated the other allowances such as the Attendance Allowances and the nursing care allowances to illustrate the overall changes that individuals experienced over time. Details on these allowances are included in the Appendix A.

### 3 Theoretical predictions

According to the life-cycle theory, agents plan their consumption and saving behaviour over their entire life-cycle on the basis of their wealth, i.e. the discounted sum of expected future income over life. In a permanent income hypothesis model, this implies that marginal utility of consumption is stable over time and is independent of age. However, when agents become aware of an unexpected shock on future income, they update their consumption and saving so as to be located again on an optimal consumption-saving path. As a result, when individuals experience an increase in income, they reduce their saving at all ages in order to smooth their consumption. Krueger and Perri (2010) show that the magnitude of the reduction in saving depends on the length of the time interval between the knowledge of the shock and the effective future income variation. In particular, the model predicts that the farther away the income shock, the smaller the reduction

<sup>8</sup>(£202.20 – £53.55) – (£57.20 – £53.55) = £145.

in saving. Since the free personal care introduced in Scotland affected people who are aged 65 or older, we would expect the magnitude of the effect on household saving to be increasing with age. Moreover, younger households are less likely to respond to the policy introduction since there are significant number of years until they turn 65 and become eligible to receive the benefits of this policy. The long time horizon may lead these households to believe that the new care system would not be in place by the time they are allowed to take advantage of the benefits. Even in the case where the system is in place in the future, these households would have to have financially contributed to the system via general taxation throughout their lives. In other words, following the Ricardian equivalence, the internalization of the budget constraint when individuals plan their life-cycle consumption might make them unresponsive to the expected income shock generated by the policy (Barro, 1989).

Recent empirical papers have shown the importance of precautionary motives in determining households' propensity to save: i.e. the higher the uncertainty, the larger the propensity for saving (see, e.g., Kazarosian, 1997; Guariglia, 2001). The introduction of the free personal care in Scotland for the elderly reduced income uncertainty, but not with the same intensity for everybody. Those who are 65 or older at the time of the reform are likely to be subject to a smaller degree of uncertainty associated with their future income/expenditures, since they can better predict whether and to what extent they will need personal care in the near future. This potentially suggests that the degree of uncertainty and subsequently the dissaving effects decrease with age.

In addition, young households are likely to face credit constraints due to their limited income flows and wealth. If this were the case, these young households that are already spending a significant portion of their income cannot respond to the policy introduction by dissaving further.

These three elements differentially affects households of various age groups. For young households, the predictions from these models are somehow mixed. These households have less incentives to smooth consumption and therefore reduce the amount of saving compared to older households whereas precautionary saving model predicts the reverse. In addition, the fact that they are likely to face borrowing constraint implies that they are limited in their abilities to respond to the policy by reducing their saving. Middle-aged households are instead exposed to stronger incentives to reduce their household saving compared to younger households, since both consumption smoothing and precautionary saving motives predict the reduction of saving: i.e. they are more strongly influenced by the consumption smoothing motive compared to younger households and they are exposed to greater uncertainties than near-retirement households. In addition, they are less likely to be affected by borrowing constraints. Finally, near-retirement households are



under the influence of strong consumption smoothing motive, which generates the incentive to dissave, and the lack of precautionary saving motive and credit constraints suggest that these households are less likely to change their saving behaviour compared to other younger households.

In summary, theoretical models do not offer clear-cut predictions on the overall effects across various age groups, and the identification of the policy effects is left to an empirical investigation. In what follows, we will analyse the effect of the reform of the personal care for the elderly on household propensity to save, measured as the ratio between saving and gross income.

## **4 Data and Econometric specifications**

### **4.1 Data, sample, and variable definition**

This study employs the repeated cross sectional dataset of the UK Expenditure and Food Survey (EFS). EFS is collected by the Office for National Statistics (ONS) on a yearly basis since 2001. Prior to 2001, the EFS was called the Family Expenditure Survey and the same set of information was collected by the ONS since 1961. Every year approximately 10,000 private households are interviewed and information is collected at the household and personal level. The EFS contain extensive information on expenditure and income both at the household and individual levels. Our analysis is carried out at the household level. The final sample we use covers the years from 1998 until 2007. We choose the starting year because the set of variables at regional level, which are used to remove regional heterogeneity, becomes available from 1998. Moreover, data was only included until 2007 so as to avoid the 2008 financial crisis, which may confound the effect of the policy introduction. Northern Ireland is excluded from our sample due to its small sample size. We further restrict the sample to those whose head of household is younger than 30. This is partially due to ensure that the sample is composed to those who are likely to look after the elderly family members but also to minimize the chance of including households whose main bread earner is still in education. Finally, we cut the bottom percentile of the saving rate distribution, which is defined as the ratio between weekly saving and the weekly gross income. This is to prevent our findings to be driven by possible outliers. Our initial sample size was 76,218 households. After applying these selection criteria and dropping observations with missing information on the variables used in the econometric analysis, we are left with a sample of 55,831 households.

We define the after policy period to be from March 2002. Although the policy was actually implemented from July 2002, the bill itself passed on the 12th March 2002.

The progression of the bill was closely followed by the UK media and received a wide coverage. Therefore, it is likely that households in Scotland were aware of the policy even prior to the implementation. In order to test for potential anticipation effects, we conduct a sensitivity analysis by eliminating 2001 observations. This sensitivity analysis is reported in Section 5.2.

The dependent variable in our model is the saving rate, defined as the fraction of the weekly household gross income not spent in goods or services (weekly household expenditures), weekly income taxes, or weekly national insurance employees contributions. In a sensitivity analysis, we use as dependent variable the consumption rate, i.e. the ratio between the weekly household expenditure and the the weekly household gross income.

Table 2 presents descriptive analysis of household saving rate before and after March 2002 for Scotland and the rest of the UK. It also includes the raw double differenced amount in saving, which shows how the difference in the amount of saving between the two regions changed over time. Three points emerging from Table 2 are worthy of mention. First, Scottish households on average have a higher propensity to save (0.93 pp) than those in England and Wales (0.68 pp). Second, the regional difference in saving become negligible after the reform. Third, the overall propensity to save of Scottish households declined over time compared to those in England and Wales. The unconditional difference-in-differences of the average saving rate is equal to  $-0.56$  pp. This figure is not however significantly different from zero.

Table 2: Summary statistics of the saving rate before and after the reform for the treatment and control groups

|                                | Mean    | Std. Dev. (Std. Err.) | Min.    | Max.   | Observations |
|--------------------------------|---------|-----------------------|---------|--------|--------------|
| <i>Scotland</i>                |         |                       |         |        |              |
| Overall, 1998-2007             | 0.0093  | 0.4533                | -3.0669 | 0.6905 | 5,107        |
| Before, 1998-2001              | -0.0042 | 0.4432                | -3.0669 | 0.6905 | 2,196        |
| After, 2002-2007               | 0.0195  | 0.4606                | -2.9300 | 0.6862 | 2,911        |
| Mean difference after — before | 0.0237  | (0.0127)*             |         |        | 5,107        |
| <i>England &amp; Wales</i>     |         |                       |         |        |              |
| Overall, 1998-2007             | 0.0068  | 0.4683                | -3.1746 | 0.6910 | 50,724       |
| Before, 1998-2001              | -0.0098 | 0.4628                | -3.1746 | 0.6903 | 21,957       |
| After, 2002-2007               | 0.0194  | 0.4722                | -3.1743 | 0.6910 | 28,767       |
| Mean difference after — before | 0.0293  | (0.0042)***           |         |        | 50,724       |
| Difference-in-Differences      | -0.0056 | -0.0054               |         |        | 55,831       |

Notes: \*\*\* Significant at 1%; \*\* significant at 5%; \* significant at 10%.

Table 3 reports descriptive statistics of the variables used in the econometric analysis. Overall, the household saving rate amounts to 0.7%, meaning that households were able to save only 0.7% of the gross income on average during the observed time window. The mean age of the head of household is 53.7 years. The head of household is female in

33.4% of the cases and non-white in 5%. The households residing in Scotland are 9.1% of the sample. In the rest of the UK, the most represented region is South East with 14.7%, followed by North West and Merseyside with 11.5%, Eastern with 9.7%, and London with 9.6%; 45.4% of the households reside in the remaining six regions. Almost 3 out of 4 households own the house where they live (41% of the households bought it with mortgage, while 32% purchased it outright). Most of the households, 61.5%, are couples (either married or cohabiting). More than 80% of the household heads, and of the spouses when present, left education between 13 and 18 years of age. The regional unemployment rate was about 5.3% on average over the time window 1998–2007 and the per capita regional gross disposable income and gross value added were £12,221 and £16,196, respectively. The Halifax price index between 1998 and 2007 was about 414 points, with the Halifax price index normalized to 100 in 1983.

Table 3: Summary statistics of the variables used in the econometric analysis

|   | Mean  | Std. Dev. | Minimum | Maximum |
|---|-------|-----------|---------|---------|
| Saving rate                               | 0.007 | 0.467     | -3.175  | 0.691   |
| Age of household head                     | 53.70 | 15.05     | 30.00   | 85.00   |
| Household head is female                  | 0.334 | 0.472     | 0.000   | 1.000   |
| Household head is not white               | 0.050 | 0.218     | 0.000   | 1.000   |
| <i>Region of residence</i>                |       |           |         |         |
| North-East                                | 0.047 | 0.212     | 0.000   | 1.000   |
| North West and Merseyside                 | 0.115 | 0.319     | 0.000   | 1.000   |
| Yorkshire and the Humber                  | 0.090 | 0.286     | 0.000   | 1.000   |
| East Midlands                             | 0.076 | 0.265     | 0.000   | 1.000   |
| West Midlands                             | 0.090 | 0.286     | 0.000   | 1.000   |
| Eastern                                   | 0.097 | 0.296     | 0.000   | 1.000   |
| London                                    | 0.096 | 0.295     | 0.000   | 1.000   |
| South East                                | 0.147 | 0.354     | 0.000   | 1.000   |
| South West                                | 0.098 | 0.298     | 0.000   | 1.000   |
| Wales                                     | 0.052 | 0.223     | 0.000   | 1.000   |
| Scotland                                  | 0.091 | 0.288     | 0.000   | 1.000   |
| <i>Tenure type of the household</i>       |       |           |         |         |
| Local authority rented unfurnished        | 0.130 | 0.336     | 0.000   | 1.000   |
| Housing association                       | 0.059 | 0.236     | 0.000   | 1.000   |
| Other rented unfurnished                  | 0.040 | 0.196     | 0.000   | 1.000   |
| Rented furnished                          | 0.025 | 0.157     | 0.000   | 1.000   |
| Owned with mortgage                       | 0.412 | 0.492     | 0.000   | 1.000   |
| Owned by rental purchase                  | 0.002 | 0.050     | 0.000   | 1.000   |
| Owned outright                            | 0.318 | 0.466     | 0.000   | 1.000   |
| Rent free                                 | 0.013 | 0.113     | 0.000   | 1.000   |
| <i>Civil status of the household head</i> |       |           |         |         |
| Married or in civil partnership           | 0.545 | 0.498     | 0.000   | 1.000   |
| Cohabiting                                | 0.070 | 0.255     | 0.000   | 1.000   |
| Single                                    | 0.109 | 0.311     | 0.000   | 1.000   |
| Widowed                                   | 0.129 | 0.335     | 0.000   | 1.000   |
| Divorced                                  | 0.110 | 0.313     | 0.000   | 1.000   |
| Separated                                 | 0.037 | 0.190     | 0.000   | 1.000   |
| <i>Education of the household head</i>    |       |           |         |         |
| Left education between age 0 and 12       | 0.004 | 0.062     | 0.000   | 1.000   |

Continued on next page

Table 3 – continued from previous page

|   | Mean   | Std. Dev. | Minimum | Maximum |
|---|--------|-----------|---------|---------|
| Left education between age 13 and 15            | 0.373  | 0.484     | 0.000   | 1.000   |
| Left education between age 16 and 18            | 0.452  | 0.498     | 0.000   | 1.000   |
| Left education between age 19 and 21            | 0.085  | 0.279     | 0.000   | 1.000   |
| Left education between age 22 and 23            | 0.056  | 0.229     | 0.000   | 1.000   |
| Left education between age 24 and 27            | 0.026  | 0.158     | 0.000   | 1.000   |
| Left education when 28 years old or older       | 0.004  | 0.064     | 0.000   | 1.000   |
| <i>Education of the spouse (if present)</i>     |        |           |         |         |
| Left education between age 0 and 12             | 0.004  | 0.067     | 0.000   | 1.000   |
| Left education between age 13 and 15            | 0.310  | 0.463     | 0.000   | 1.000   |
| Left education between age 16 and 18            | 0.508  | 0.500     | 0.000   | 1.000   |
| Left education between age 19 and 21            | 0.100  | 0.299     | 0.000   | 1.000   |
| Left education between age 22 and 23            | 0.057  | 0.232     | 0.000   | 1.000   |
| Left education between age 24 and 27            | 0.018  | 0.132     | 0.000   | 1.000   |
| Left education when 28 years old or older       | 0.002  | 0.048     | 0.000   | 1.000   |
| Number of kids [0,2) years                      | 0.047  | 0.220     | 0.000   | 3.000   |
| Number of kids [2,5) years                      | 0.084  | 0.308     | 0.000   | 6.000   |
| Number of kids [5,18) years                     | 0.461  | 0.870     | 0.000   | 9.000   |
| Regional unemployment rate by gender (%)        | 5.347  | 1.499     | 2.900   | 10.500  |
| Per capita regional gross value added (£)       | 16,196 | 4,612     | 9,653   | 34,828  |
| Per capita regional gross disposable income (£) | 12,221 | 1,989     | 8,689   | 18,386  |
| Regional Halifax house price index (1983 = 100) | 413.7  | 147.3     | 209.8   | 777.6   |
| <i>Wave</i>                                     |        |           |         |         |
| 1998  | 0.115  | 0.319     | 0.000   | 1.000   |
| 1999  | 0.099  | 0.299     | 0.000   | 1.000   |
| 2000  | 0.094  | 0.292     | 0.000   | 1.000   |
| 2001  | 0.107  | 0.309     | 0.000   | 1.000   |
| 2002  | 0.099  | 0.298     | 0.000   | 1.000   |
| 2003  | 0.102  | 0.302     | 0.000   | 1.000   |
| 2004  | 0.100  | 0.301     | 0.000   | 1.000   |
| 2005  | 0.076  | 0.265     | 0.000   | 1.000   |
| 2006  | 0.120  | 0.325     | 0.000   | 1.000   |
| 2007  | 0.088  | 0.283     | 0.000   | 1.000   |
| Observations                                    |        |           |         | 55,831  |

## 4.2 Difference-in-differences model

In Subsection 2.2 we mentioned that individuals in Scotland receiving care at home are the major beneficiaries of the CCHA. The Scottish implementation of free formal personal care policy in the second half of 2002 stands out from the rest of the UK. In what follows, we will therefore evaluate the impact of the introduction of free formal personal care in Scotland on household saving behaviour. Identification of the policy effect is attained by exploiting the fact that free personal care was introduced only for a specific group of individuals in the UK and that both the treated population (those in Scotland) and the untreated population (those in the rest of UK) are observed before and after the reform.

Comparing household saving behaviour in Scotland before and after 2002 is problematic since there may have been many economic influences other than the policy introduction that affected household saving rate over time. Similarly, a simple difference

between the average household saving rate in Scotland and in the rest of the UK after 2002 also poses a problem because there might be fundamental differences in the household propensity to save between the two regions. As a result, we employ a difference-in-differences (DD) estimator and estimate changes in the differences of the household saving rate between Scotland and the rest of the UK before and after the reform. As discussed below, the identification of causal effects requires several strong assumptions. In what follows, we conduct statistical tests for each of these assumptions to check whether they are supported by the data.

Our empirical evaluation will be in a repeated cross sections framework. We specify the following model for saving rate  $y$  of household  $i$  living in region  $r$  in tax year  $t$

$$y_{irt} = \mathbf{x}_{irt}'\boldsymbol{\beta} + \gamma_r + \phi_t + \delta_{DD}I_{rt} + \varepsilon_{irt}, \quad (1)$$

where:

- $\mathbf{x}_{irt}$  is the  $K \times 1$  vector of relevant household characteristics and  $\boldsymbol{\beta}$  is the conformable vector of coefficients. The regressors in  $\mathbf{x}_{irt}$  are age (and its square and cube), gender, race, and marital status of the head of household, the tenure type of the household, the education of the head of household and of the spouse (if present), the number of kids of different ages, and a set of controls for time-varying regional heterogeneity and regional specific trends: the regional unemployment rate by the gender of the household head, the per capita gross value added, the per capita gross disposable income, and the Halifax house price index.
- $\gamma_r$  is a set of regional fixed effects (regional dummies).
- $\phi_t$  is a set of time fixed effects (tax year dummies).
- $I_{rt}$  is the regressor of interest. It is an indicator variable equal to 1 if the household resides in Scotland after the reform, i.e. after March 2002. The corresponding parameter  $\delta_{DD}$  is the effect of the introduction of free personal care in Scotland on saving rate.
- $\varepsilon_{irt}$  is the error term at household level.

The parameters of Equation (1) are estimated using Ordinary Least Squares (OLS). Inference is problematic. In our DD application the identification of the policy effect is based on variations across regions and years. The regressor of principal interest, i.e. the treatment dummy after 2002, is therefore correlated within cluster (i.e. region) and inference should take this into account. The cluster-robust variance estimator (CRVE) is a simple way to deal with correlation within-groups ([Liang and Zeger, 1986](#)). However, this approach is unbiased only when the number of clusters is large enough and the asymptotic

results can be safely invoked. In our application, the number of clusters (i.e. regions) is just 11 and therefore the cluster-robust standard errors is likely to suffer from a small sample bias, resulting in a type I error.<sup>9</sup> [Cameron et al. \(2008\)](#) propose a wild cluster bootstrap- $t$  procedure to get critical values when the number of clusters is small. However, [MacKinnon and Webb \(2016\)](#) show that with unbalanced clusters and a small number of treated clusters (only one in our analysis), the wild cluster bootstrap fails: the wild cluster bootstrap based on unrestricted residuals, as well as the CRVE  $t$  statistics, tends to over-reject, also resulting in type I errors; the wild cluster bootstrap based on restricted residuals tends instead to under-reject just as severely, resulting in type II errors.<sup>10</sup> To the best of our knowledge there is currently no method to safely obtain critical values in a DD model with a small number of untreated clusters and one treated cluster. Due to this problem with the inferences, we report  $p$ -values based on the CRVE  $t$  statistics<sup>11</sup> and the wild cluster bootstrap procedure by [Cameron et al. \(2008\)](#) with both unrestricted and restricted residuals.<sup>12</sup>

Following the discussion in Section 3, we are interested in estimating potentially heterogeneous effects of the policy across age of the head of household. We therefore also estimate a more general version of Equation (1)

$$y_{irt} = \mathbf{x}'_{irt}\beta + \gamma_r(\text{age}_{irt}) + \phi_t(\text{age}_{irt}) + \delta_{DD}(\text{age}_{irt})I_{rt} + \varepsilon_{irt}, \quad (2)$$

where:

- $\gamma_r(\text{age}_{irt})$  is the regional fixed effects are interacted with a flexible function of age, so that each region could potentially be characterized by its own flexible relationship between age and saving rate.
- $\phi_t(\text{age}_{irt})$  is the time fixed effects are interacted with a flexible function of age, so that the flexible effects of age on saving rate is allowed to potentially vary each year.
- $\delta_{DD}(\text{age}_{irt})$  is the effect of the reform which is allowed to flexibly vary across age.

To reduce the number of parameters to be estimated and to avoid model over-specifica-

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<sup>9</sup>See [Cameron and Miller \(2015\)](#) for an overview of the problems in doing inference when the number of clusters is small.

<sup>10</sup>In [MacKinnon and Webb \(2016\)](#), the wild cluster bootstrap based on restricted residuals is the procedure in which the model is re-estimated under the null hypothesis of no treatment effect in the bootstrap algorithm. When the procedure is based on the unrestricted residuals, the null hypothesis is instead not imposed.

<sup>11</sup>More specifically, given  $R$  the number of regions, we will compute  $\sqrt{R/(R-1)}$ -clustered robust standard errors and  $t_{R-1}$  critical values as suggested in [Brewer et al. \(2013\)](#).

<sup>12</sup>We bootstrapped the residuals 2,500 times using the Webb six-point distribution as weights ([Webb, 2014](#)).

tion, we specify the age functions in  $\gamma_r(\text{age}_{irt})$ ,  $\phi_t(\text{age}_{irt})$ , and  $\delta_{DD}(\text{age}_{irt})$  as piecewise constant with cut-off points at 40, 50, and 65 year of age and constrain  $\gamma_r(\text{age}_{irt})$  and  $\phi_t(\text{age}_{irt})$  so that the age profile of the saving rate is: i) common across all the untreated regions (all the regions but Scotland); ii) constant over time in the years before and in the years after the reform, but allowed to suddenly vary when the reform is introduced in 2002.

The identification of the policy effects through a DD approach is based on some underlying assumptions.

*Assumption 1 (Parallel trend assumption):* Conditional on observables, households residing in Scotland experience similar trends in the saving rate as those in the rest of the UK in the absence of the 2002 reform.

We test the validity of Assumption 1 by comparing the trends in household saving rates of England-Wales and Scotland. Figure 1 shows the trends of the saving rate in Scotland and England-Wales. If the saving behaviour in Scotland followed the same trend as the one in England and Wales, the two lines depicted in Figure 1 should be parallel. Eyeballing the graph, they look parallel to each other. We also conduct a formal test by first regressing household saving rate on a full set of tax year dummies, their interactions to the indicator for Scotland, and all the covariates in Equation (1). We then test the joint equality of interaction terms between the Scotland indicator dummy and the tax year dummies before 2002. The coefficients of these interactions represent the distance between the Scottish trend and the one of England and Wales. Testing their joint equality before 2002, we evaluate whether the distance between the two trends is constant from 1998 until 2001. If we fail to reject the null, this indicates that the two trends are parallel before the reform. Our results indicate that the null hypothesis cannot be rejected and thus the parallel trend assumption seems to be fulfilled.<sup>13</sup>

*Assumption 2 (Exogeneity of the intervention):* Conditional on observables, the Scottish free personal care reform is exogenous and not motivated by demand for personal care in Scotland but rather it is politically determined.

If Scotland implemented the 2002 free personal care policy in response to an increasingly stronger demand for formal personal care, we would have an endogeneity problem, as the policy variable after 2002 would capture the effect of both the reform and of the differential trends in the demand for personal care. This would then translate into potentially diverging trends in saving rates between the two groups of regions not because of

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<sup>13</sup>The  $p$ -values were: 0.614 from the CRVE  $t$  statistic, 0.742 from the wild cluster bootstrap based on unrestricted residuals, and 0.833 from the wild cluster bootstrap based on unrestricted residuals.

Figure 1: The parallel trend assumption in saving rate



*Notes:* We formally test whether the distance between the saving rates of Scotland and England and Wales was constant between 1998 and 2001, i.e. before the policy reform of the elderly care system, by regressing household saving rate on all the observables in Equation (1) and testing the joint equality of coefficients of the interactions between the Scotland indicator and the tax year dummies before 2002. We cannot reject the null hypothesis of parallel trends before the reform with the following  $p$ -values: 0.614 from the CRVE  $t$  statistic, 0.742 from the wild cluster bootstrap based on unrestricted residuals, and 0.833 from the wild cluster bootstrap based on unrestricted residuals.



the policy introduction but rather due to differential underlying demand for formal elderly care. Figure 2 presents the trends of the demand for personal care in England and Scotland.<sup>14</sup> The left and right panels of Figure 2 illustrate the trends of, respectively, 1–5 hours and 6 or more hours of personal care usage per week. Although the aggregated data used to plot these graphs does not allow us to formally test whether these lines are parallel to each other, the plotted trends suggest that these two regions did not experience differential trends. Figure 3 instead focuses on the supply side, by reporting the evolution over time of the probability of supplying informal personal care to another adult (i.e. family members or friends). These trends are estimated using the Family Resources Survey and by regressing a dummy indicator equal to one if the individual gave care to some adults on a full set of tax year dummies, their interactions to the indicator variable for Scotland, and a set of individual characteristics. Before the elderly personal care reform, the difference between the trend of Scotland and the one of England and Wales is constant ( $p$ -value from the CRVE equal to 0.362). This is a further piece of evidence suggesting that the policy introduction was not in response to a differential demand for formal personal care across regions.

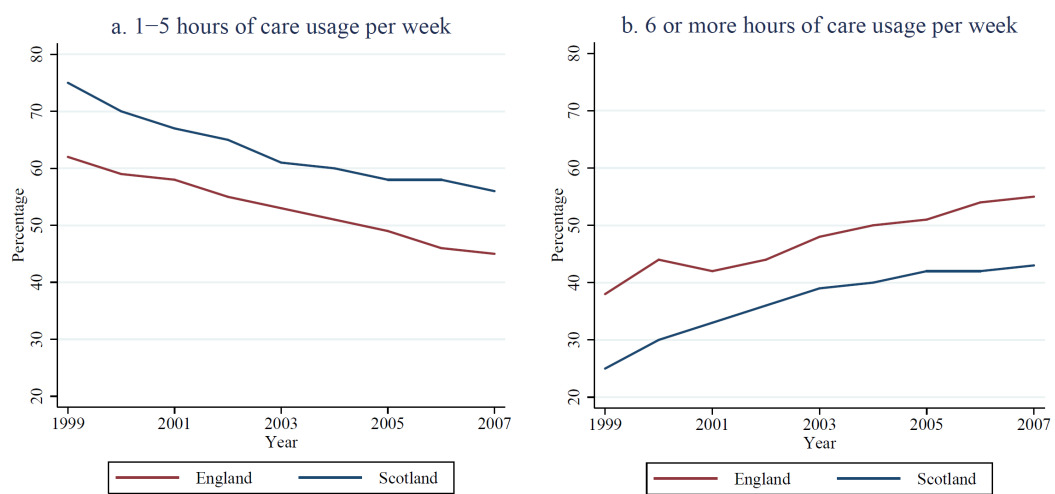
*Assumption 3 (Stable sample composition):* Conditional on observables, the composition of the treated and control groups is assumed to be stable before and after the policy.

Assumption 3 requires that the composition of the households residing in Scotland, England, and Wales is stable over the observation years, conditional on observed covariates. Our findings would be biased if, for example, those who anticipate greater needs for formal personal care and those without much saving move to Scotland from England or Wales due to the 2002 policy. Using the 1999–2007 British Household Panel Survey (BHPS), we analyse if individuals’ moving behaviour changed before and after the policy introduction.<sup>15</sup> Table 4 presents estimates from a linear probability model, where the dependent variable equals to 1 if individuals moved to Scotland from England or Wales. It is regressed on a dummy indicator noting if each individual moved in Scotland after 2002 and 0 otherwise. In all cases but for age groups 45–54 and 65–85, we find that the policy introduction did not result in significant effect of individuals moving into Scotland. However, even for the two age groups 45–54 and 65–85, we conclude that we do not find any evidence to suggest that individuals moved into Scotland in response to the policy introduction. This is because (1) the signs are negative suggesting that individuals are

<sup>14</sup>Statistics for Wales is not available and thus is not included in the calculation of this figure.

<sup>15</sup>BHPS is a UK longitudinal survey, which began in 1991. It collects approximately 5,500 households and 10,300 individuals drawn from 250 areas of the UK. It records detailed information on whether and when individuals moved to different parts of the UK.

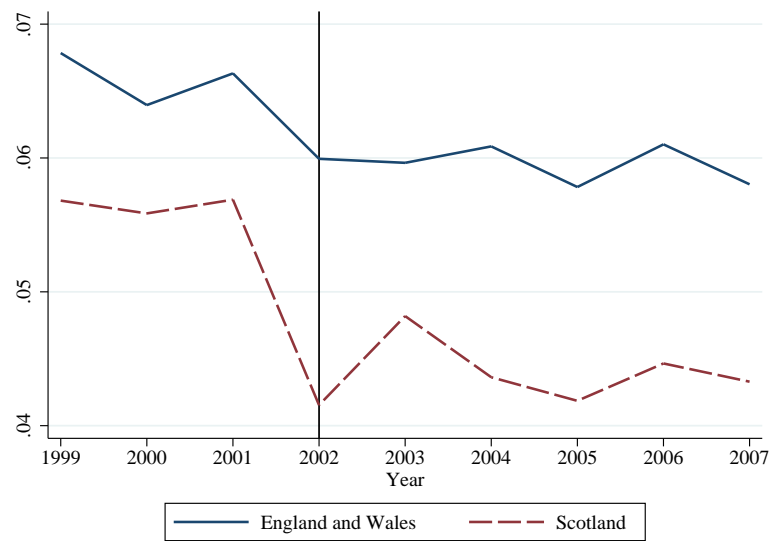
Figure 2: The trends in the demand for personal care in Scotland and England



*Notes:* We plot the trends in the demand for personal care in Scotland and England. The left-hand side figure shows the trends in the fraction of households using 1–5 hours of care at home per week. The right-hand side figure reports the trends for the fraction of households using 6 or more hours of care per week. Statistics for Wales is not available, since data is not in the same format as those in England and Scotland. However, given that the population of Wales represents less than 5% of the UK population, the exclusion of Wales should not affect much the calculated trends.

*Sources:* Community Care Statistics 1999, 2000, 2001, 2002, 2003, 2004, 2005, 2006, and 2007. Home Care Services, Scotland 2000, 2004, 2007, and Social Care Statistics 2014.

Figure 3: The trends in the probability of supplying informal personal care to adults in Scotland and England and Wales



*Notes:* We plot the trends in the probability of supplying personal care to adults in Scotland and England and Wales. These trends are estimated by regressing a dummy indicator equal to one if the individual gave care to some adults on a full set of tax year dummies, their interactions to an indicator for Scotland, and a set of individual characteristics. We formally test whether the difference between the probability of giving care in Scotland and in England and Wales was constant between 1999 and 2001, i.e. before the policy reform of the elderly care system. We cannot reject the null hypothesis ( $p$ -value from the CRVE equal to 0.362) of parallel trends before the reform. After the reform, the trends are no longer parallel in 2002 and 2003: the distance between the plotted lines becomes significantly large in 2002 and 2003 ( $p$ -value = 0.006). However, between 2004 and 2007 the distance between the two trends becomes constant again ( $p$ -value = 0.804).

less likely to move into Scotland after the policy introduction (2) the sizes of these effects are very small.

Table 4: Linear probability model regression estimates to test whether individuals moved to Scotland in response to the introduction of the free formal personal care policy

| Dependent variable: 1 if moved to Scotland | Age 25–34          | Age 35–44          | Age 45–54           | Age 55–64           | Age 65–85           |
|--|--------------------|--------------------|---------------------|---------------------|---------------------|
| 1 if observed after 2002                   | 0.0003<br>(0.0004) | 0.0003<br>(0.0002) | -0.0003<br>(0.0002) | -0.0002<br>(0.0003) | -0.0003<br>(0.0002) |
| Observations                               | 29,064             | 31,852             | 26,971              | 22,769              | 28,197              |

*Notes:* We used the 1998–2007 British Household Panel Survey (BHPS) and estimated separate linear probability regressions by the age of individuals. Standard errors are in parenthesis and are robust to heteroskedasticity.

*Assumption 4 (No anticipation):* Scottish households were not able to anticipate the introduction of the personal care reform.

The Scottish government’s decision to take up the recommendation received wide media coverage as early as January 2002. For example, BBC announced that the free personal care for Scotland would be introduced in July of the same year on 15 January 2002. Similarly, the Guardian published an article after one of the Bills passed in the Scottish Parliament (Inman, 2002). As a result of this wide media coverage and considering that we have information on saving rates on the basis of tax years (which start in April), households could have anticipated the introduction of the policy. The Scottish individuals might then have faced the incentives to alter their consumption and saving decisions before April 2002. If this were the case, the estimated effects would be biased towards zero. In order to test for this identification assumption, we run a robustness analysis in Section 5.2 by eliminating observations in tax year 2001. As we will see, we find that removing this year from our sample does little to our findings.

## 5 Estimation results

### 5.1 Baseline parameter estimates

The OLS baseline estimation results of policy effect from Eq. (1) and Eq. (2) are reported in Table 5. The full set of estimation results are reported instead in Appendix B, Table B.3. The estimated coefficient of  $I_{rt}$  in panel a) of Table 5, i.e. the indicator for living

in Scotland after the reform, suggests that the introduction of the 2002 Scottish policy has importantly reduced the propensity to save for Scottish households. The saving rate decrease by 1.9 percentage points. Provided that the average weekly gross income of Scottish households in our sample is £506.09, the estimated reduction in the amount of saving is approximately £9.67 per week or £503 per year. In terms of statistical significance, we get different outcomes depending on the approach we employ to obtain the  $t$  statistic. The  $t$ -statistics based on the CRVE and on the wild cluster bootstrap with unrestricted residuals (WCBUR) point to a significance level of 5% and 10%, respectively. With the wild cluster bootstrap with restricted residuals (WCBRR), we find that the policy effect is instead not significantly different from zero.

Figure 4 shows the predicted saving profile across the age of the head of household, which was obtained after estimating Eq. (1). This figure shows that the household propensity to save is not constant across the age of the head of household.<sup>16</sup> It is very flat up to the mid 60s and then it rises steeply. The profile of the saving rate up to the mid 60s is consistent with the predictions of the life-cycle theory (Ando and Modigliani, 1957, 1963). According to this theory, individuals maximize their utility by taking into account the expected lifetime stream of earnings, so as to have a smooth consumption profile and therefore a smooth saving rate over time. However, in contrast to this theory, we find that the saving rate increases sharply for the eldest. This increasing profile can however be explained by the intergenerational altruism hypothesis, according to which people might save also for bequests (Kotlikoff, 1989), and with the precautionary motive for saving (Leland, 1968; Sandmo, 1970; Kimball, 1990), given that the eldest face a high and increasing risk of incurring in health expenditures.

As mentioned in Subsection 3, the policy effects on household propensity to save may vary with age, proxied by the age of the head of household. Panel b) of Table 5 displays the heterogeneous effect of the 2002 policy reform by the age of the head of household. We find that the policy effect indeed varies across the age of the head of household. When the head of household is between 30 and 50 years old, we find the strongest negative effect:  $-3.4$  and  $-3.5$  percentage points when the household head is between 30 and 40 and between 40 and 50, respectively. Given that the average weekly gross income of Scottish households is £581.66 when the head is between 30 and 40 years of age and £662.70 when the head is between 40 and 50, the magnitude of the estimated effects is non-negligible, amounting to an annual reduction in the flow of saving of about £1,034

<sup>16</sup>In the OLS estimation of Eq. (1), we impose a cubic relation between the age of household head and the saving rate. We also tried with more flexible specifications, like a fractional polynomial with powers  $\{-3, -2, -1, 0, 1, 2, 3\}$ . We obtained a relation between age and saving rate very close to the one depicted in Figure 4 and decided therefore to stick to the cubic specification, as it is more parsimonious in the number of parameters.

Table 5: The effect of the personal care reform on household saving rates from the OLS estimation of Eqs. (1) and (2)

|  |         | <i>p</i> -values  |                    |                    |
|--|---------|-------------------|--------------------|--------------------|
|  | Coeff.  | CRVE <sup>§</sup> | WCBUR <sup>†</sup> | WCBRR <sup>‡</sup> |
| <i>a) Homogeneous effect across age</i>                  |         |                   |                    |                    |
| Scotland * After ( $I_{rt}$ )                            | −0.0191 | 0.039**           | 0.084*             | 0.368              |
| <i>b) Heterogeneous effect across age</i>                |         |                   |                    |                    |
| Scotland * After * $\mathbb{1}(\text{Age} \in [30, 39))$ | −0.0342 | 0.017**           | 0.034**            | 0.424              |
| Scotland * After * $\mathbb{1}(\text{Age} \in [40, 49))$ | −0.0352 | 0.003***          | 0.004***           | 0.338              |
| Scotland * After * $\mathbb{1}(\text{Age} \in [50, 64))$ | 0.0062  | 0.608             | 0.611              | 0.694              |
| Scotland * After * $\mathbb{1}(\text{Age} > 64)$         | −0.0156 | 0.197             | 0.228              | 0.375              |
| Observations   |         | 55,831            |                    |                    |

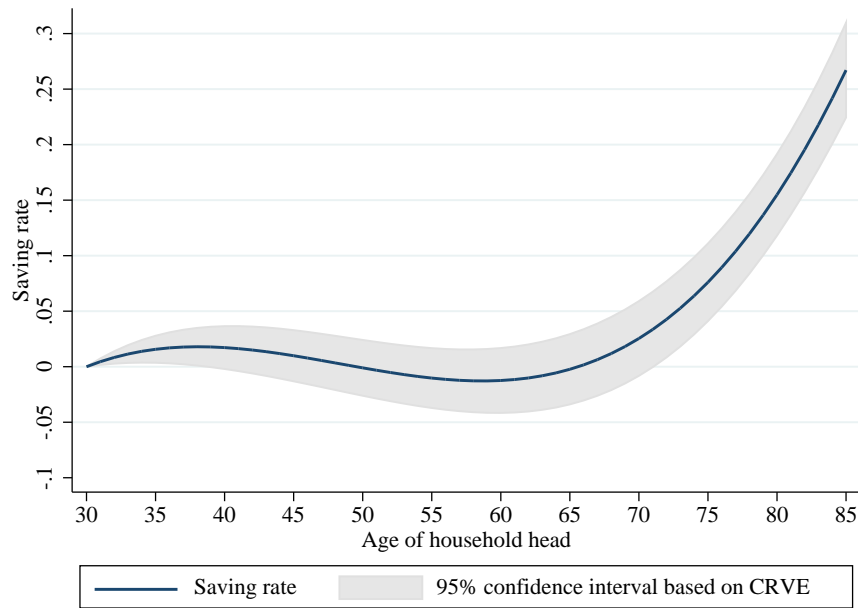
Notes: \*\*\* Significant at 1%; \*\* significant at 5%; \* significant at 10%.  $\mathbb{1}(\cdot)$  denotes the indicator function, which is equal to 1 if the argument is true. After is equal to 1 if the observation is collected after 2002 and 0 otherwise. Scotland is equal to 1 if the household resides in Scotland and 0 otherwise. The estimated parameters of all the other regressors are reported in Appendix B, Table B.3.

<sup>§</sup> CRVE indicates that the *p*-values come from the CRVE *t* statistics.

<sup>†</sup> WCBUR indicates that the *p*-values come from the wild cluster bootstrap-*t* statistics based on unrestricted residuals and 2,500 replications using the Webb six-point distribution as weights.

<sup>‡</sup> WCBRR indicates that the *p*-values come from the wild cluster bootstrap-*t* statistics based on restricted residuals and 2,500 replications using the Webb six-point distribution as weights.

Figure 4: The relation between the age of the household head and household saving rate



Notes: Household saving rate is normalized to zero at 30 years of age of the head of household.

and £1,213, respectively. For households with older heads, the effect is instead close to zero. Interpreting these results in light of the theoretical discussions in Section 3, the three channels seem to offset each other for the eldest and near retirement households, leaving them to change their saving behaviour in a limited manner. Prime aged households were instead predicted to be exposed to the strongest incentive to reduce saving and this is in line with what we observe here.

## 5.2 Robustness checks

We conduct various sensitivity analyses in order to test the robustness of our baseline findings. First, we run a placebo test by including among the regressors the lags of order one, two, and three of the policy indicator  $I_{rt}$  and testing the significance of the associated coefficients, i.e. these are indicator variables that equal to 1 for Scottish individuals observed after 1999, 2000, 2001.<sup>17</sup> This is another way to test if the trends in the two regions are parallel. After controlling for  $I_{rt}$ , these additional lagged terms pick up any differences in saving rates 1, 2 and 3 years prior to the actual policy introduction. Failure to reject the null of the joint significance test implies absence of differential trends prior to 2002. In addition, failure to reject the null from individual test also implies that there was no differential trend immediately before the introduction of the policy. Therefore, this test also rules out the potential existence of the policy anticipation effect. Table 6 reports the estimated parameters. We reject the null hypothesis of joint significance of these lagged policy indicators. Our conclusion is unchanged even when we use the CRVE or the WCBUR t-statistics. This supports the validity of the parallel trend as well as the no anticipation assumption.

Second, we run a further set of placebo tests by pretending that the policy reform took place in other regions of the UK. We remove Scotland from the sample and, in separate regressions, we estimate Eq. (1) as if the policy were introduced in 2002 alternatively: i) in the North (i.e. North-East, North-West and Merseyside, and Yorkshire and the Humber), ii) in the Centre (i.e. East Midlands, West Midlands, and Wales), iii) in the South (i.e. South East, South West, and Eastern), iv) and in London. Table 7 report the estimation results of these placebo checks. We could not detect systematic problems from this robustness check.

In a third sensitivity analysis, we excluded families with children from our sample. Scotland followed a separate path from England and Wales with regards to the issue of the university tuition fees. In 1998, tuition fees were introduced across the UK. At this point, £1,000 per year was charged as a tuition fee for all students. Whilst England and

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<sup>17</sup>Since we have four periods before the reform, we cannot include further lags.

Table 6: Placebo test over time

|   |         | <i>p</i> -values  |                    |                    |
|---|---------|-------------------|--------------------|--------------------|
|   | Coeff.  | CRVE <sup>§</sup> | WCBUR <sup>†</sup> | WCBRR <sup>‡</sup> |
| <i>Placebo test over time</i>                         |         |                   |                    |                    |
| Scotland * After <sub>-1</sub> ( $I_{rt-1}$ )         | -0.0053 | 0.645             | 0.682              | 0.711              |
| Scotland * After <sub>-2</sub> ( $I_{rt-2}$ )         | 0.0113  | 0.215             | 0.212              | 0.458              |
| Scotland * After <sub>-3</sub> ( $I_{rt-3}$ )         | -0.0065 | 0.538             | 0.525              | 0.609              |
| Joint significance test of the 3 placebo coefficients |         | 0.629             | 0.753              | 0.832              |
| Observations  |         | 55,831            |                    |                    |

*Notes:* \*\*\* Significant at 1%; \*\* significant at 5%; \* significant at 10%.  $\mathbb{1}(\cdot)$  denotes the indicator function, which is equal to 1 if the argument is true. After is equal to 1 if the observation is collected after 2002 and 0 otherwise. Scotland is equal to 1 if the household resides in Scotland and 0 otherwise. The estimated parameters of all the other regressors are not reported for the sake of brevity. They are available from the authors upon request.

<sup>§</sup> CRVE indicates that the *p*-values come from the CRVE *t* statistics.

<sup>†</sup> WCBUR indicates that the *p*-values come from the wild cluster bootstrap-*t* statistics based on unrestricted residuals and 2,500 replications using the Webb six-point distribution as weights.

<sup>‡</sup> WCBRR indicates that the *p*-values come from the wild cluster bootstrap-*t* statistics based on restricted residuals and 2,500 replications using the Webb six-point distribution as weights.

Table 7: Placebo test across regions

|                | Coeff.  | <i>p</i> -values  |                    |                    | Observations |
|----------------|---------|-------------------|--------------------|--------------------|--------------|
|                |         | CRVE <sup>§</sup> | WCBUR <sup>†</sup> | WCBRR <sup>‡</sup> |              |
| North * After  | -0.0121 | 0.345             | 0.440              | 0.417              | 50,724       |
| Centre * After | 0.0117  | 0.255             | 0.349              | 0.335              | 50,724       |
| South * After  | -0.0145 | 0.081*            | 0.123              | 0.179              | 50,724       |
| London * After | 0.0234  | 0.179             | 0.401              | 0.128              | 50,724       |

*Notes:* \* Significant at 10%. The estimated parameters of all the other regressors are not reported for the sake of brevity. They are available from the authors upon request.

<sup>§</sup> CRVE indicates that the *p*-values come from the CRVE *t* statistics.

<sup>†</sup> WCBUR indicates that the *p*-values come from the wild cluster bootstrap-*t* statistics based on unrestricted residuals and 2,500 replications using the Webb six-point distribution as weights.

<sup>‡</sup> WCBRR indicates that the *p*-values come from the wild cluster bootstrap-*t* statistics based on restricted residuals and 2,500 replications using the Webb six-point distribution as weights.



Wales subsequently increased their university tuition fees to £3,000 in 2004 and £9,000 in 2009, Scotland abolished tuition fees in 2001 for Scottish students who chose to study in Scotland.<sup>18</sup> Instead of charging tuition fees, Scottish students were asked to repay £2,000 after they graduate and start earning at least £10,000 a year. The cheaper university tuition fees in Scotland compared to those in England and Wales may have further reduced the incentives to save for the Scottish families with children, introducing a confounding effect in the interpretation of our findings. As a result, we checked whether the results are stable after removing families with children.<sup>19</sup> Panel a) in Table 8 report the policy effects, both homogeneous and heterogeneous across age, after removing families with children. We found estimation results that are very much in line with those of the benchmark model and somewhat larger in size.

In a fourth sensitivity analysis, we exclude year 2001 from our sample. This is partially due to eliminating any policy anticipation effect. From the time the Sutherland Commission was set up, the entire process until the enactment of the Scottish CCHA was highly publicized by the media. Moreover, the Scottish government's decision to take up the recommendation received wide media coverage as early as January 2002. For example, the BBC announced that the free personal care for Scotland would be introduced in July of the same year on 15 January 2002. Similarly, the Guardian also published an article after one of the Bills passed in the Scottish Parliament (Inman, 2002). As a result of this wide media coverage, households may have anticipated the introduction of the policy. If this were the case, including the observations from 2001 would positively bias our results. However, panel b) of Table 8 indicates that excluding 2001 from our sample does not affect the estimated policy effects.<sup>20</sup>

Fifth, we modified the baseline model by allowing the coefficients of  $x$ ,  $\beta$ , to vary over time, allowing thereby the use of covariates to capture heterogeneity in the dynamic over time of the outcome variable (Abadie, 2005). Operationally, we interact all the observables  $x$  with the indicator for the period after the policy and include this new set of regressors in the model specification. Panel c) of Table 8 reports the estimated policy effects: they are very much in line with those of the baseline models.

Finally, we used the consumption rate, defined as the ratio between the weekly household expenditure and the the weekly household gross income, as an alternative dependent variable. Given that our results so far indicate that households reduced the flow of saving, it would be interesting to see if this is also reflected by changes in the amount of consumption. Panel d) of Table 8 displays the estimation results of the impact of the personal care

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<sup>18</sup>If the student is English, (s)he would still have to pay the tuition fees even if studying in Scotland.

<sup>19</sup>The sample size shrank to 38,035 households, of which 3,557 were Scottish.

<sup>20</sup>After eliminating 2001 observations, we were left with 49,854 households, of which 4,583 are Scottish.

Table 8: Robustness checks

|  |         | <i>p</i> -values  |                    |                    |
|--|---------|-------------------|--------------------|--------------------|
|  | Coeff.  | CRVE <sup>§</sup> | WCBUR <sup>†</sup> | WCBRR <sup>‡</sup> |
| <i>a) Excluding families with children (38,035 observations)</i>                                 |         |                   |                    |                    |
| Homogeneous effect across age  |         |                   |                    |                    |
| Scotland * After ( $I_{rt}$ )  | −0.0246 | 0.024**           | 0.042**            | 0.354              |
| Heterogeneous effect across age  |         |                   |                    |                    |
| Scotland * After * $\mathbb{1}(\text{Age} \in [30, 39])$   | −0.1277 | 0.000***          | 0.000***           | 0.367              |
| Scotland * After * $\mathbb{1}(\text{Age} \in [40, 49])$   | −0.0405 | 0.020**           | 0.023**            | 0.340              |
| Scotland * After * $\mathbb{1}(\text{Age} \in [50, 64])$   | 0.0115  | 0.328             | 0.346              | 0.608              |
| Scotland * After * $\mathbb{1}(\text{Age} > 64)$   | −0.0232 | 0.072*            | 0.095*             | 0.320              |
| <i>b) Excluding 2001 (49,854 observations)</i>   |         |                   |                    |                    |
| Homogeneous effect across age  |         |                   |                    |                    |
| Scotland * After ( $I_{rt}$ )  | −0.0197 | 0.033**           | 0.080*             | 0.388              |
| Heterogeneous effect across age  |         |                   |                    |                    |
| Scotland * After * $\mathbb{1}(\text{Age} \in [30, 39])$   | −0.0113 | 0.395             | 0.433              | 0.496              |
| Scotland * After * $\mathbb{1}(\text{Age} \in [40, 49])$   | −0.0527 | 0.000***          | 0.001***           | 0.376              |
| Scotland * After * $\mathbb{1}(\text{Age} \in [50, 64])$   | 0.0039  | 0.754             | 0.762              | 0.790              |
| Scotland * After * $\mathbb{1}(\text{Age} > 64)$   | −0.0195 | 0.129             | 0.156              | 0.369              |
| <i>c) Including interactions between control variables and After dummy (55,831 observations)</i> |         |                   |                    |                    |
| Homogeneous effect across age  |         |                   |                    |                    |
| Scotland * After ( $I_{rt}$ )  | −0.0250 | 0.047**           | 0.166              | 0.416              |
| Heterogeneous effect across age  |         |                   |                    |                    |
| Scotland * After * $\mathbb{1}(\text{Age} \in [30, 39])$   | −0.0388 | 0.011**           | 0.028**            | 0.461              |
| Scotland * After * $\mathbb{1}(\text{Age} \in [40, 49])$   | −0.0426 | 0.002***          | 0.036**            | 0.462              |
| Scotland * After * $\mathbb{1}(\text{Age} \in [50, 64])$   | −0.0039 | 0.790             | 0.814              | 0.806              |
| Scotland * After * $\mathbb{1}(\text{Age} > 64)$   | −0.0232 | 0.163             | 0.232              | 0.473              |
| <i>d) Consumption rate as dependent variable (55,831 observations)</i>                           |         |                   |                    |                    |
| Homogeneous effect across age  |         |                   |                    |                    |
| Scotland * After ( $I_{rt}$ )  | 0.0243  | 0.016**           | 0.049**            | 0.369              |
| Heterogeneous effect across age  |         |                   |                    |                    |
| Scotland * After * $\mathbb{1}(\text{Age} \in [30, 39])$   | 0.0442  | 0.005***          | 0.010**            | 0.422              |
| Scotland * After * $\mathbb{1}(\text{Age} \in [40, 49])$   | 0.0396  | 0.002***          | 0.001***           | 0.336              |
| Scotland * After * $\mathbb{1}(\text{Age} \in [50, 64])$   | −0.0011 | 0.932             | 0.932              | 0.939              |
| Scotland * After * $\mathbb{1}(\text{Age} > 64)$   | 0.0189  | 0.142             | 0.167              | 0.369              |

Notes: \*\*\* Significant at 1%; \*\* significant at 5%; \* significant at 10%.  $\mathbb{1}(\cdot)$  denotes the indicator function, which is equal to 1 if the argument is true. After is equal to 1 if the observation is collected after 2002 and 0 otherwise. Scotland is equal to 1 if the household resides in Scotland and 0 otherwise. The estimated parameters of all the other regressors are not reported for the sake of brevity. They are available from the authors upon request.

<sup>§</sup> CRVE indicates that the *p*-values come from the CRVE *t* statistics.

<sup>†</sup> WCBUR indicates that the *p*-values come from the wild cluster bootstrap-*t* statistics based on unrestricted residuals and 2,500 replications using the Webb six-point distribution as weights.

<sup>‡</sup> WCBRR indicates that the *p*-values come from the wild cluster bootstrap-*t* statistics based on restricted residuals and 2,500 replications using the Webb six-point distribution as weights.

reform on the consumption rate. The propensity to consume of Scottish households increased by 2.4%. The heterogeneity of the effect across age is confirmed and the findings are consistent with those from the baseline model.

## 6 Conclusions

This paper studies the impact of the Scottish Care and Health Act 2002 on the propensity to save of UK household. The Scottish policy legislated that formal personal care be offered to the elderly free of charge. In contrast, the rest of UK have continued to charge the elderly for service. If households save to prepare for the future elderly care expenditure, such a reduction in the care price may have led the households to respond by reducing their propensity to save. This paper, therefore, studies an unintended consequence of the policy introduction and evaluate if and to what extent it crowded out private saving.

By using the households in England and Wales as a control group, we investigate how the Scottish household saving rate responded to the policy introduction of free personal care for the elderly by using a difference-in-differences estimator. We also study how the effect differs across age.

We find that the Scottish policy reform reduced the flow of average household saving rate by about 1.9 percentage points or approximately £503 per year. In addition, we find that the policy effect varies across the age of the head of household. The estimated negative effect is particularly strong among households aged between 30 and 50. The largest effect is observed for those households with the heads aged between 40 and 50, with a negative effect on the saving rate of 3.5 percentage points or £1,213 per year. Our findings are in line with the existing literature for the US, which also suggests the importance of medical expenditure uncertainties on household saving behaviour ([Gruber and Yelowitz, 1999](#); [Maynard and Qiu, 2009](#)). However, our findings differ from those presented by [Guariglia and Rossi \(2004\)](#), who instead found that British individuals do not make use of precautionary saving against the risk of facing unexpected private health care expenditures. This may be due to the fact that UK individuals have access to universal health care coverage through the NHS. Hence, the health insurance coverage that [Guariglia and Rossi \(2004\)](#) investigated had limited impacts on individuals' behaviour. In contrast, our policy offered a substantial long-term care cost reduction under the environment where this type of cost was almost exclusively paid by patients. In order to ensure that our estimates uncover causal relationships, we conduct several identification tests as well as sensitivity analyses. Our findings from various tests and the sensitivity analyses strongly indicate the robustness of our conclusions from the estimates of the benchmark

model.

Given the sizeable effect on the propensity to save, especially for prime and middle aged households, one may wonder if households over-estimated the benefits introduced by the free personal care reform due to a misunderstanding of the policy, as pointed out by [Bell et al. \(2006\)](#). If so, the resulting reduction in precautionary saving might lead to a situation in which there is less than full insurance against long-term care for the elderly. In such a case, universal elderly care insurance schemes introduced in countries such as Japan or Germany may be more effective in addressing the large and volatile risks of long-term care for the elderly. These questions are left to be investigated in future studies.

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## Appendix

### A Other policy reforms

In addition to the 2002 Scottish CCHA, there were other reforms that influenced the elderly care cost, which contributed to the changes in the amount of allowances individuals received. As stated below, however, these policies were implemented throughout the UK and it is the free personal care element of the 2002 CCHA reform that contributed to the substantially larger increase in the amount of allowances Scottish individuals received compared to those living elsewhere in UK.

#### A.1 Nursing care cost

Nursing care is the type of care that involves medical care provided by registered nurses. Prior to 2001, nursing care provided in UK care homes was maintained by social services administered by each local authority. Financial support for nursing care was only offered on stringent means-tested basis. In contrast, nursing care offered at home or in hospitals was organized by the National Health Service (NHS) and, therefore, was free of charge at the point of delivery.

In response to the 1999 Sutherland report, which recommended that both personal and nursing care be offered free of charge regardless of care settings, England and Wales each implemented their free nursing care policy in October and December 2001. Scotland and Northern Ireland introduced their policy in June and October 2002, respectively. They paid allowances directly to care homes where the individual is receiving nursing care. The policy change, therefore, was aimed at correcting the unequal cost treatment for patients receiving nursing care in care homes compared to those receiving free nursing care either at home or in hospitals.

## A.2 Attendance Allowances

The Attendance Allowance (AA) is a non-means tested weekly benefit for severely disabled people aged 65 or over who need help with personal care. It is paid out to all UK individuals in need. The amount of AA depends on the severity of the elderly's disability. After local authorities assess the elderly's condition, allowances are paid out in two levels depending on the elderly's condition.

After the 2002 CCHA reform, Scottish individuals receiving free personal care in care homes no longer qualified to receive AA. In contrast, those Scottish individuals receiving care in their own homes continued to receive AA.

## A.3 Summary of all policies

Table A.1 summarises which allowances were given out to the elderly before and after the policy changes in 2001 and 2002. Since the amounts of allowances differed depending on the care settings, the table separately list the available allowances by where the elderly received care. There are two groups of individuals who benefited from the reforms: i) those receiving nursing care in care homes in all the regions of the UK; ii) the Scottish individuals receiving formal personal care.

In Table A.2, we illustrate how the maximum amounts of weekly allowances changed before and after the reforms depending on where the elderly reside and where they receive care. The pre-reform amounts are calculated using the 2000 rates whereas the 2003 rates are employed for the calculations of the post-reform amounts. The table highlights that the changes in the nursing care allowances only applied to those who receive care in residential care homes and the increase experienced by these individuals are comparable across regions. Scottish individuals receiving care at home however saw a large increase in their care allowances due to the 2002 policy reform. This implies two things. Firstly, it is the 2002 Scottish policy to offer free personal care that induced the major care price variation. Secondly, since the majority of individuals receive care in their own homes, the price variation is likely to induce behavioural responses among all Scottish individuals.

Table A.1: Availability of allowances before and after the 2001–2002 reforms

|                              | Scotland |           | England, Wales, and Northern Ireland |           |
|------------------------------|----------|-----------|--------------------------------------|-----------|
|                              | At home  | Care home | At home                              | Care home |
| Before the 2001–2002 reforms |          |           |                                      |           |
| Nursing care cost covered    | Yes      | No        | Yes                                  | No        |
| Personal care allowance      | No       | No        | No                                   | No        |
| Attendance allowance         | Yes      | Yes       | Yes                                  | Yes       |
| After the 2001–2002 reforms  |          |           |                                      |           |
| Nursing care allowance       | Yes      | Yes       | Yes                                  | Yes       |
| Personal care allowance      | Yes      | Yes       | No                                   | No        |
| Attendance allowance         | Yes      | No        | Yes                                  | Yes       |

*Notes:* This table summarises the availability of various allowances in Scotland, England, Wales, and Northern Ireland before and after the 2001–2002 reforms. Regardless of the regions, the amount of nursing care allowance is fixed only for those receiving nursing care in care homes. In contrast, those receiving nursing care at home or in NHS hospitals receive the care free of charge.

Table A.2: Maximum weekly allowance calculations (£ per week)

|                             | Before the reforms (2000 rate) | After the reforms (2003 rate)      |
|-----------------------------|--------------------------------|------------------------------------|
| Care received in care homes | £ per week                     | £ per week                         |
| England                     | 53.55 (AA)                     | 57.20 (AA) + 142.80 (NC) = 200.00  |
| Wales                       | 53.55 (AA)                     | 57.20 (AA) + 119.66 (NC) = 176.86  |
| Northern Ireland            | 53.55 (AA)                     | 57.20 (AA) + 100.00 (NC) = 157.20  |
| Scotland                    | 53.55 (AA)                     | 145.00 (FPC) + 65.00 (NC) = 210.00 |
|                             | Before the reforms (2000 rate) | After the reforms (2003 rate)      |
| Care received at home       | £ per week                     | £ per week                         |
| England                     | 53.55 (AA)                     | 57.20 (AA)                         |
| Wales                       | 53.55 (AA)                     | 57.20 (AA)                         |
| Northern Ireland            | 53.55 (AA)                     | 57.20 (AA)                         |
| Scotland                    | 53.55 (AA)                     | 57.20 (AA) + 145 (FPC) = 202.20    |

*Notes:* This table illustrates how the maximum amounts of weekly allowances changed before and after the reforms depending on where the elderly reside and where they receive care. The pre-reform amounts are calculated using the 2000 rates whereas the 2003 rates are employed for the calculations of the post-reform amounts. AA stands for Attendance Allowance; FPC means Formal Personal Care allowance; NC is the Nursing Care allowance. Since in Scotland the formal personal care allowance for those receiving care at home is not fixed, we use the maximum amount provided to the elderly in residential care homes, i.e. £145. Note that the nursing care provided in the elderly's home is offered for free at the point of delivery. As a result, nursing care allowance is only given to the elderly receiving care in care homes. In addition, it is worth noting that the attendance allowance is not provided to the Scottish elderly receiving care in care homes after the 2002 reform.

## B Full set of estimation results of the baseline model

Table B.3: Full set of OLS estimation results of Eq. (1) and Eq. (2) for household saving rate

| Variable   | Homogeneous effect<br>across age |           | Heterogeneous effect<br>across age |           |
|--|----------------------------------|-----------|------------------------------------|-----------|
|  | Coeff.                           | Std. Err. | Coeff.                             | Std. Err. |
| Scotland * After ( $I_{rt}$ )  | -0.0191 **                       | 0.0080    | —                                  | —         |
| <i>Age categories interacted with the indicators for Scotland and for after the reform</i>   |                                  |           |                                    |           |
| Scotland * After * $\mathbb{1}(\text{Age} \in [30, 39])$   | —                                | —         | -0.0342 **                         | 0.0119    |
| Scotland * After * $\mathbb{1}(\text{Age} \in [40, 49])$   | —                                | —         | -0.0352 ***                        | 0.0092    |
| Scotland * After * $\mathbb{1}(\text{Age} \in [50, 64])$   | —                                | —         | 0.0062                             | 0.0117    |
| Scotland * After * $\mathbb{1}(\text{Age} > 64)$   | —                                | —         | -0.0156                            | 0.0113    |
| <i>Age categories interacted with the indicator for Scotland: Reference: (Scotland * <math>\mathbb{1}(\text{Age} \in [30, 39])</math>)</i> |                                  |           |                                    |           |
| Scotland * $\mathbb{1}(\text{Age} \in [40, 49])$   | —                                | —         | -0.0030                            | 0.0098    |
| Scotland * $\mathbb{1}(\text{Age} \in [50, 64])$   | —                                | —         | -0.0129                            | 0.0110    |
| Scotland * $\mathbb{1}(\text{Age} > 64)$   | —                                | —         | 0.0304 **                          | 0.0098    |
| <i>Age categories interacted with the indicator for after the reform</i>   |                                  |           |                                    |           |
| After * $\mathbb{1}(\text{Age} \in [30, 39])$  | —                                | —         | -0.0238                            | 0.0221    |
| After * $\mathbb{1}(\text{Age} \in [40, 49])$  | —                                | —         | -0.0381 *                          | 0.0186    |
| After * $\mathbb{1}(\text{Age} \in [50, 64])$  | —                                | —         | -0.0334 *                          | 0.0183    |
| After * $\mathbb{1}(\text{Age} > 64)$  | —                                | —         | -0.0213                            | 0.0167    |
| <i>Age categories - Reference: [30 - 39) years</i>   |                                  |           |                                    |           |
| [40 - 49) years  | —                                | —         | 0.0271                             | 0.0151    |
| [50 - 64) years  | —                                | —         | 0.0463 **                          | 0.0166    |
| 65 or more   | —                                | —         | 0.0473 **                          | 0.0202    |
| Age of household head  | 0.0491 ***                       | 0.0137    | 0.0326 *                           | 0.0173    |

Continued on next page



Table B.3 – continued from previous page

| Variable  | Homogeneous effect<br>across age |     |           | Heterogeneous effect<br>across age |     |           |
|---|----------------------------------|-----|-----------|------------------------------------|-----|-----------|
|   | Coeff.                           |     | Std. Err. | Coeff.                             |     | Std. Err. |
| Age of household head squared   | -0.0389                          | *** | 0.0065    | -0.0406                            | *** | 0.0074    |
| Age of household head cubic   | 0.0071                           | *** | 0.0008    | 0.0076                             | *** | 0.0010    |
| Household head is female  | -0.0211                          | **  | 0.0088    | -0.0208                            | **  | 0.0088    |
| Household head is not white   | -0.0129                          |     | 0.0085    | -0.0132                            |     | 0.0085    |
| <i>Region of residence - Reference: North-East</i>  |                                  |     |           |                                    |     |           |
| North West and Merseyside   | -0.0398                          | *** | 0.0108    | -0.0391                            | *** | 0.0112    |
| Yorkshire and the Humber  | -0.0323                          | **  | 0.0109    | -0.0316                            | **  | 0.0113    |
| East Midlands   | -0.0322                          | *   | 0.0157    | -0.0309                            | *   | 0.0163    |
| West Midlands   | -0.0338                          | **  | 0.0135    | -0.0329                            | **  | 0.0140    |
| Eastern   | -0.0637                          | **  | 0.0240    | -0.0617                            | **  | 0.0253    |
| London  | -0.1423                          | **  | 0.0469    | -0.1403                            | **  | 0.0470    |
| South East  | -0.0769                          | **  | 0.0279    | -0.0746                            | **  | 0.0297    |
| South West  | -0.0635                          | **  | 0.0217    | -0.0617                            | **  | 0.0230    |
| Wales   | -0.0474                          | **  | 0.0181    | -0.0465                            | **  | 0.0186    |
| Scotland  | -0.0364                          | *** | 0.0082    | -0.0407                            | *** | 0.0081    |
| <i>Tenure type of the household - Reference: Rent free</i>                                    |                                  |     |           |                                    |     |           |
| Local authority rented unfurnished  | -0.0271                          |     | 0.0234    | -0.0262                            |     | 0.0237    |
| Housing association   | -0.0646                          | *** | 0.0190    | -0.0639                            | *** | 0.0191    |
| Other rented unfurnished  | -0.1604                          | *** | 0.0216    | -0.1601                            | *** | 0.0219    |
| Rented furnished  | -0.0920                          | *** | 0.0238    | -0.0913                            | *** | 0.0238    |
| Owned with mortgage   | -0.0277                          |     | 0.0205    | -0.0272                            |     | 0.0207    |
| Owned by rental purchase  | -0.0122                          |     | 0.0496    | -0.0119                            |     | 0.0502    |
| Owned outright  | -0.0721                          | *** | 0.0169    | -0.0710                            | *** | 0.0171    |
| <i>Civil status of the household head - Reference: Divorced</i>                               |                                  |     |           |                                    |     |           |
| Married or in civil partnership   | -0.2902                          |     | 0.1883    | -0.2945                            |     | 0.1866    |
| Cohabiting  | -0.2999                          |     | 0.1897    | -0.3041                            |     | 0.1881    |
| Single  | 0.1001                           | *** | 0.0159    | 0.0998                             | *** | 0.0154    |
| Widowed   | 0.0925                           | *** | 0.0179    | 0.0917                             | *** | 0.0173    |
| Divorced  | 0.0485                           | **  | 0.0160    | 0.0479                             | **  | 0.0157    |
| <i>Education of the household head - Reference: Left education when 28 years old or older</i> |                                  |     |           |                                    |     |           |
| Left education between age 0 and 12   | -0.0005                          |     | 0.0484    | 0.0006                             |     | 0.0486    |
| Left education between age 13 and 15  | 0.0058                           |     | 0.0295    | 0.0062                             |     | 0.0296    |
| Left education between age 16 and 18  | -0.0148                          |     | 0.0314    | -0.0139                            |     | 0.0318    |
| Left education between age 19 and 21  | 0.0024                           |     | 0.0312    | 0.0029                             |     | 0.0314    |
| Left education between age 22 and 23  | 0.0343                           |     | 0.0308    | 0.0342                             |     | 0.0309    |
| Left education between age 24 and 27  | 0.0389                           |     | 0.0313    | 0.0388                             |     | 0.0315    |
| <i>Education of the spouse - Reference: Single</i>  |                                  |     |           |                                    |     |           |
| Left education between age 0 and 12   | 0.3920                           | *   | 0.1943    | 0.3947                             | *   | 0.1930    |
| Left education between age 13 and 15  | 0.3812                           | *   | 0.1881    | 0.3847                             | *   | 0.1866    |
| Left education between age 16 and 18  | 0.4039                           | *   | 0.1891    | 0.4078                             | *   | 0.1876    |
| Left education between age 19 and 21  | 0.4357                           | **  | 0.1849    | 0.4393                             | **  | 0.1835    |
| Left education between age 22 and 23  | 0.4382                           | **  | 0.1876    | 0.4419                             | **  | 0.1860    |
| Left education between age 24 and 27  | 0.4696                           | **  | 0.1852    | 0.4734                             | **  | 0.1836    |
| Left education when 28 years old or older   | 0.3861                           | **  | 0.1689    | 0.3912                             | **  | 0.1670    |
| Number of kids [0,2) years  | -0.0461                          | *** | 0.0066    | -0.0459                            | *** | 0.0067    |
| Number of kids [2,5) years  | -0.0225                          | **  | 0.0072    | -0.0220                            | **  | 0.0071    |
| Number of kids [5,18) years   | -0.0328                          | *** | 0.0036    | -0.0324                            | *** | 0.0035    |
| Regional unemployment rate by gender (%)  | -0.0065                          |     | 0.0056    | -0.0062                            |     | 0.0057    |
| Per capita regional gross value added (£)   | 0.0000                           |     | 0.0000    | 0.0000                             |     | 0.0000    |
| Per capita regional gross disposable income (£)   | -0.0000                          |     | 0.0000    | -0.0000                            |     | 0.0000    |
| Regional Halifax house price index (1983 = 100)   | 0.0002                           | *   | 0.0001    | 0.0002                             | *   | 0.0001    |
| <i>Wave dummies - Reference: 1998</i>   |                                  |     |           |                                    |     |           |
| 1999  | -0.0224                          | **  | 0.0087    | -0.0221                            | **  | 0.0088    |
| 2000  | -0.0407                          | *** | 0.0127    | -0.0399                            | **  | 0.0130    |

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Table B.3 – continued from previous page

| Variable     | Homogeneous effect<br>across age |           | Heterogeneous effect<br>across age |           |
|--------------|----------------------------------|-----------|------------------------------------|-----------|
|              | Coeff.                           | Std. Err. | Coeff.                             | Std. Err. |
| 2001         | -0.0119                          | 0.0174    | -0.0110                            | 0.0180    |
| 2002         | -0.0171                          | 0.0201    | 0.0082                             | 0.0263    |
| 2003         | -0.0374                          | 0.0324    | -0.0063                            | 0.0358    |
| 2004         | -0.0634                          | 0.0358    | -0.0318                            | 0.0404    |
| 2005         | -0.0783 *                        | 0.0419    | -0.0465                            | 0.0441    |
| 2006         | -0.0817                          | 0.0512    | -0.0493                            | 0.0517    |
| 2007         | -0.0941                          | 0.0527    | -0.0614                            | 0.0542    |
| Constant     | 0.0665                           | 0.0483    | 0.0665                             | 0.0481    |
| Observations | 55,831                           |           | 55,831                             |           |
| $R^2$        | 0.0270                           |           | 0.0274                             |           |

Notes: \*\*\* Significant at 1%; \*\* significant at 5%; \* significant at 10%. OLS with  $\sqrt{R/(R-1)}$ -clustered robust standard errors and  $t_{R-1}$  critical values as suggested in [Brewer et al. \(2013\)](#).  $\mathbb{1}(\cdot)$  denotes the indicator function, which is equal to 1 if the argument is true. After is equal to 1 if the observation is collected after 2002 and 0 otherwise.