**Does public long-term care expenditure improve**

**care-related quality of life of service users in England?**

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# Abstract

Public long-term care (LTC) systems provide services to support people experiencing difficulties with their activities of daily living. This study investigates the marginal effect of changes in public LTC expenditure on care-related quality of life (CRQoL) of existing service users in England. The public LTC programme for people aged 18 or older in England is called Adult Social Care (ASC) and it is provided and managed by local authorities. We collect data on the outcomes and characteristics of public ASC users, on public ASC expenditure, and on the characteristics of local authorities across England in 2017/18. We employ an instrumental variable approach using conditionally exogenous elements of the public funding system to estimate the effect of public ASC expenditure on user CRQoL. Our findings show that by increasing public ASC expenditure by £1,000 per user, on average, local authorities increase user CRQoL by 0.0030. These results suggest that public ASC is effective in increasing users’ quality of life but only to a relatively small extent. When combined with the other potential effects of LTC expenditure (e.g. on informal carers, mortality), this study can inform policy makers in the UK and internationally about whether social care provides good value for money.

Keywords: long-term care; quality of life; public expenditure; cross-section; instrumental variables.

JEL classification: H53; I38; D24; C21; C26.

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# Introduction

Long-term care (LTC) consists of medical and social services for individuals with chronic conditions or disability that have difficulties with their activities of daily living (e.g. Lipszyc et al., 2012, National Institute on Aging, 2017). Public LTC systems are common across countries within the Organisation for Economic Co-operation and Development (OECD) to address the failure of unregulated LTC markets (Forder et al., 1996, Finkelstein and McGarry, 2006), and public spend on LTC in most of these countries is considerable. In 2017, for example, the Netherlands, the Nordic countries and Switzerland were among those spending the most on public LTC, i.e. between 2.5% and 4% of GDP. The provision of public LTC has the primary goal of improving the quality of life of the service user (Fernandez et al., 2011). In addition, LTC aims to support the health care sector in achieving a better allocation of resources by providing less costly alternatives to hospitalisation (Rhee et al., 2015, Villalobos Dintrans, 2018). This implies that LTC may improve health outcomes indirectly by allowing a more cost-effective use of health care resources.

As the primary goal of LTC, quality of life is improved by promoting wellbeing and independence through support in specialised facilities and at home. Improving quality of life confers positive societal value in itself, but it also has wider economic benefits. For example, improving the quality of life of LTC users of working age, or increasing the participation of informal carers in the job market, may improve labour productivity (Rhee et al., 2015, Villalobos Dintrans, 2018). Other benefits may derive from intergenerational transfers when LTC services enable grandparents to provide parenting support (Loury, 2006, Compton and Pollak, 2014, Adermon et al., 2018). Therefore, from a number of perspectives, it is important to address the question of whether and to what extent public LTC expenditure improves quality of life.

Few empirical studies explore the effect of LTC services on the quality of life. Forder et al. (2014b) analyse the effect of English public home care services for users aged 65 or older on care-related quality of life (CRQoL), as measured by the adult social care outcome toolkit (ASCOT), and find a beneficial effect. The focus of their study is narrow since, in England, public expenditure for home care services for users aged 65 or older is a small proportion (8.2% in 2017/18) of all LTC expenditure. The study uses a survey sample of 301 users, and employs an instrumental variable (IV) approach using the type of local authority (LA) as an instrument. The type of LA is argued to capture the eligibility policy across LAs which is assumed to have no direct impact on CRQoL. The follow-up study by Forder et al. (2018a) investigates the effect of formal community care services (e.g. home care, day care) on CRQoL, and also finds a beneficial effect. This study, however, does not distinguish between the effect of public and private LTC expenditure. It builds on the previous study by extending the analysis to all community care services, although this is still a relatively small proportion (34.6% in 2017/18) of all public LTC expenditure in England, and by using a larger survey sample of 622 users. It also relaxes the assumption of no direct effect of the LA eligibility policy on CRQoL, but it makes the implicit assumption of no peer effects among LTC users by using the average level of resource use within each LA as an instrument. In addition, in both studies, the authors use some current LTC outcomes (e.g. activities of daily living, home adaptations) as control variables which may generate a bad control problem (Angrist and Pischke, 2008, p. 47).

Other studies focus on the effects of public LTC on different outcomes including mortality and health care resources. For example, Watkins et al. (2017) suggest that lower public LTC expenditure is associated with higher mortality. Some studies find a substitution effect between social and health care services and that an increase in LTC services, such as nursing homes, may improve hospital outcomes, for example, by reducing delayed discharges (e.g. Fernandez and Forder, 2008, Forder, 2009, Gaughan et al., 2015, Forder et al., 2018a).

This study investigates the extent to which public LTC expenditure in England improves the CRQoL of existing service users. The public LTC programme for people aged 18 or older in England is called Adult Social Care (ASC), and it is provided by LAs to support individuals that meet need and financial eligibility criteria. Public ASC is structured to provide a range of services including: LTC services which aim to support users over an unspecified and generally long period of time (e.g. community, residential and nursing care); short-term care services which are time-limited and mostly aim to maximise independence to reduce the need for LTC;[[1]](#footnote-2) assistive equipment, adaptations and technologies such as smoke alarm for hearing impaired users, shower chair for disabled users, and telecare, respectively; information and early intervention services to inform and signpost potential and existing users; and auxiliary ASC activities such as front-line assessment and review of users. LTC users (simply users from now on) may receive *all* these ASC services. Therefore, our focus on the effect of *all* public ASC expenditure on these users may inform the key policy question of what gain (loss) in CRQoL across existing users is likely to be obtained by investing (disinvesting) money in the public ASC sector. In addition, it may start to help to inform the policy question of whether committing resources from the ASC budget to specific ASC programmes may produce more value for money.Finally, with findings from future studies on other potential effects of public ASC expenditure (e.g. on informal carers, mortality), it may inform the assessment of the opportunity cost in the public ASC sector to aid cost-effectiveness decisions about ASC services.

Our empirical strategy employs a multilevel IV approach to analyse a large representative sample of 52,602 users in 2017/18. Like the multilevel approach suggested by Bhalotra (2007) and Farahani et al. (2010), we measure user CRQoL, our dependent variable, at the user level, while public ASC expenditure per user, our key independent variable, is measured at the more aggregate LA level. We argue that user-level data allow us to account for the heterogeneity in user CRQoL which is not due to public ASC expenditure per user with higher precision, and that the relevant level of expenditure for decision makers is the LA level (which is also the most granular available). Therefore, our findings are still relevant to these decision makers and those in other countries following a similar decision-making process. Moreover, our IV approach avoids potential bad control problems by excluding current ASC outcomes from the set of controls and relaxes the assumptions of no direct effect of LA eligibility policy on CRQoL and of no peer effects among LTC users as in previous studies (Forder et al., 2014b, Forder et al., 2018b). We use the council tax base per user at the LA level as our preferred instrument to estimate the exogenous effect of public ASC expenditure per user on user CRQoL. The council tax is a primary source of revenues for LAs to fund ASC services and we argue that the council tax base at the LA level is related to LTC needs and outcomes only indirectly through LAs’ socio-economic characteristics and, of course, public ASC expenditure. Therefore, conditional on controlling for socio-economic characteristics, the council tax base captures exogenous factors reflecting the urban development across LAs that can be used to instrument public ASC expenditure. Our IV approach is inspired by other studies using exogenous elements of the funding system as instruments to identify the effect of expenditure on outcomes (e.g. Goodspeed, 2000, Hægeland et al., 2012, Andrews et al., 2017, Claxton et al., 2018, Gigliotti and Sorensen, 2018).

This study is structured as follows. Section 2 provides a brief overview of the institutional background and the funding system, and Section 3 introduces the theoretical background. Section 4 describes the data sources and variables, and Section 5 illustrates the empirical strategy. Section 6 shows the results, and Section 7 discusses and concludes.

# Institutional background

In England, 152 LAs are responsible for ASC within their locality. LAs provide public ASC services, directly or through external organisations, free of charge to users with sufficiently high needs, savings and assets below £14,250, and income below a certain minimum level. Users co-pay for public ASC services if they meet the needs eligibility criteria but their savings and assets are between £14,250 and £23,250, or if their income is above a certain minimum level. Regardless of their needs, however, individuals are ineligible for public ASC services if their savings and assets are above £23,250. While a minimum level of care and support is set nationally through the Care Act 2014, eligibility criteria may vary across LAs depending on their local policies. Forder et al. (2014b) suggest that such eligibility criteria may vary systematically by type of LA which may share similar market conditions, culture and administrative organisation including county, London (inner and outer), metropolitan and unitary LAs.

Ineligible individuals for public ASC services might still have their ASC services arranged and managed by their LA but they will bear the full costs of the services received (NHS Digital, 2019).[[2]](#footnote-3) Moreover, they can still purchase LTC services from private providers. Private LTC expenditure is not insignificant, estimated at £10.9 billion in 2016/17 (National Audit Office, 2018), but it is substantially lower than the public ASC expenditure which, in the same year, was above £20 billion (The King's Fund, 2018). All individuals, whether receiving formal ASC or not, may receive informal care from family and friends. Its value in the UK is estimated at £132 billion a year, going far beyond formal ASC expenditure (Buckner and Yeandle, 2015). However, ASC still represents a major source of expenditure for LAs (22% of total expenditure) together with other key local services, such as education services (36%), children’s support (10%) and environmental services (5.5%) (Ministry of Housing‚ Communities and Local Government, 2019).

## Sources of public funding

Our IV strategy is based on conditionally exogenous characteristics of the local funding system and, therefore, this paragraph describes the sources of funding for LA services including ASC. In England, LAs fund their services through revenues from council tax and business rates, grants from the central government, and user contributions (Amin-Smith et al., 2018, Brien, 2018). Of the £94.5 billion spent on LA services in 2017/18, 29% was funded from council tax, 15.5% from retained business rates, 53% from governmental grants, and 2.5% from reserves and other items such as inter-LA transfers (Department for Communities and Local Government, 2017b). Revenues from local taxes are not ring-fenced, while grants from the government may or may not be ring-fenced.

Council tax is levied on the occupation of domestic properties or on their ownership if empty (Sandford, 2018b). LAs fully retain council tax revenues and can also control the amount of revenues in each financial year by setting the budget requirement. The latter is divided by the tax base to calculate the amount of taxation. The council tax base is defined through a national classification which categorises domestic properties into bands: from ‘band A’ for properties with the lowest sale value to ‘band H’ for properties with the highest sale value, where sale values are based on a 1991 national valuation (Sandford, 2018c). The council tax base is therefore calculated as the number of ‘band D’ equivalent domestic properties, i.e. the number of all domestic properties expressed as ‘band D’ properties. In the calculation of the number of ‘band D’ equivalent properties, a ‘band D’ property counts as a whole property and properties in any lower- (higher-) band count as less (more) than one property. For example, a ‘band A’ property counts as 0.67 ‘band D’ property and a ‘band H’ property as two ‘band D’ properties (Department for Communities and Local Government, 2017a). LAs have no control on the levels of tax base because banding is set by the central government and, therefore, it cannot be manipulated by LAs to meet their LTC needs. However, LAs can grant exemptions and discounts depending on property and individuals’ characteristics, respectively. For example, properties which are unoccupied because of the person having gone to live in a care home are exempted from council tax, or individuals living alone or having a severe mental impairment are entitled to a council tax discount. However, only 3% of the total council tax base in 2017 was subject to exemptions and discounts due to LTC needs (Ministry of Housing‚ Communities and Local Government, 2018). Given the partial control on council tax revenues only through the budget requirement rather than the council tax base, LAs were enabled to charge additional council tax amounts, known as precepts, to fund ASC services. Most LAs have been charging an ASC precept since 2015.

Business rates are levied on the occupation of non-domestic properties (e.g. restaurants, barber shops) or on their ownership if empty (Sandford, 2018a). Compared to council tax, LAs have relatively little control over business rates because both tax rates and tax base are set centrally by the government. Tax rates are simple multipliers, while the tax base reflects the hypothetical annual rents of non-domestic properties which are re-evaluated nationally every year. In addition, only 50% of business rates revenues are retained by LAs, and the remaining part is transferred to the central government (Sandford, 2018c). The share of business rates revenues that LAs retain is subject to a tariff and top-up system which redistributes part of these revenues across LAs on the basis of a national needs assessment. LAs can allow also business rates exemptions and discounts. For example, small businesses are exempted from the business rates tax and charities have a discount on their business rates tax of no less than 80%.

Moreover, LAs receive a number of grants from central government (Cromarty, 2019). Ring-fenced grants that aim to support ASC (e.g. improved Better Care Fund, ASC support grant) are distributed across LAs according to the ASC relative needs formula(Department for Communities and Local Government, 2014). This formula includes a constant amount per capita across LAs and a number of top-ups which account for needs through age, socio-economic deprivation, and rurality. The needs formula adjusts also for labour costs through the area cost adjustment (ACA) index.

Finally, LAs can charge fees for services, where some fees are set nationally (Sandford, 2018c). Revenues from fees are retained locally but are treated as a contribution for the specific services paid for and cannot be used for other purposes.

# Theoretical framework

Following Forder et al. (2018a), the utility (*uij*) of a user *i* in LA *j* can be expressed as a generic function (*u)* of several factors:

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First, users with high needs (*ni*) have lower utility. We argue that there exists an eligibility effect across LAs (*gj*) on user utility which is due to the level of financial protection offered, since this reduces uncertainty about future LTC costs (Department of Health, 2015). Eligibility effects may vary across LAs mostly based on the generosity of their policy (*kj*) (Forder et al., 2014b), and local tax revenues (*tj*). In turn, tax revenues are more likely to increase with more favourable local market conditions (*zj*).

Moreover, the user’s utility tends to increase with the amount of the ASC services received, which can be expressed in terms of public ASC expenditure (*eijpublic*), private LTC expenditure (*eijprivate*) and informal care (*cij*). We argue that public ASC expenditure for each user is likely to be higher in the presence of higher user needs and tax revenues, but lower if more individuals are eligible for public ASC services with a given budget. Instead, private LTC expenditure and informal care are likely to increase with user needs and if the amount of alternative ASC services is reduced. For example, if public ASC services cannot fully meet users’ needs, users will purchase additional private services or demand more informal care (Puthenparambil and Kröger, 2016, Urwin et al., 2019). We argue that public ASC expenditure is not affected directly by private LTC expenditure and informal care, while private LTC expenditure and informal care are directly affected by public ASC expenditure. This is because the level of public ASC services for each user is decided by LAs after an assessment of user needs (Department of Health and Social Care, 2021), while users make decisions on the amount of private LTC services and informal care based in part on the amount of publicly funded support. Also, utility depends on other factors unrelated to ASC (*rij*) such as, for example, living in a safe area due to proximity to a police station.

In addition, users are likely to receive some form of informal care and this implies that most users will be influenced by their informal carer’s utility (*Uij*). Becker (1981) suggests that the user’s utility is likely to be higher if the utility of informal carers increases. Similarly to the user’s utility, *Uij* can be expressed as:

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The carer’s utility is a generic function (*U*) of the carer’s caring-related needs (*Nij*), the eligibility policy (*gj*), the public (*Eijpublic*) and private (*Eijprivate*) carer services received, the informal care provided (*cij*), other factors unrelated to ASC (*Rij*), and the utility of the user (*uij*). By replacing into , we obtain:

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where *expenditureijpublic* is the public ASC expenditure including both user (*eijpublic*) and carer (*Eijpublic*) expenditure and therefore affected by both *nij* and *Nij* in addition to *gj* and *tj*.

Equation is a reduced-form equation which we use in our empirical analysis (discussed in Section 5) to estimate the total and direct effect of public ASC expenditure on the user’s utility, measured through user CRQoL. The total effect captures both direct and indirect effect of a change in public ASC expenditure on CRQoL. The direct effect measures how a change in public ASC expenditure impacts CRQoL due to its own action, i.e. while keeping everything else constant including private LTC services and informal care. The indirect effect captures any other effect on CRQoL due to the impact of a change of public ASC expenditure on private LTC services and informal care. For example, an increase in public ASC expenditure is likely to reduce the use of private LTC services (informal care) which, in turn, will reduce CRQoL. The total effect may have a broader policy relevance to the extent decision makers are unable to control the individual use of private LTC and informal care which may vary in response to their funding decisions on public ASC. Therefore, the primary focus of this study is on the total effect. We focus also on the direct effect since this may be policy relevant to the extent decision makers are interested in comparing the marginal productivity of different ways of spending the same ASC budget. In this case, a meaningful comparison of the performance across these different ways of spending can be carried out only for given levels of private LTC and informal care. We can refer to these effects also as the marginal productivity (or marginal effects) of public ASC expenditure per user on user CRQoL.[[3]](#footnote-4)

Using equation we develop intuition about the expected bias in the total and direct effect if our empirical strategy fails to control for factors that impact user CRQoL and, at the same time, impact or are correlated to public ASC expenditure. For example, suppose we observe all variables in except user’s needs, *nij*. Higher public ASC expenditure is expected to occur where needs are high, and users with high needs are expected to have lower CRQoL. If *nij* is unobserved, the effect of a marginal increase in public ASC expenditure on CRQoL captures both the beneficial effect on CRQoL of higher public ASC expenditure as well as the detrimental effect on CRQoL of higher needs. Therefore, the estimated marginal productivity will be biased downwards. Table A1 in the Appendix illustrates that the total (direct) effect estimate is likely to be downwardly biased if any factor related to ASC excluding (including) private LTC and informal care in is unobserved. Finally, we argue that the other factor unrelated to ASC in , *rij* and *Rij*, are unlikely to play any role in our empirical strategy given that the user CRQoL is our outcome measure. As explained in the following Section 4.1, CRQoL is sector-specific and therefore it is unlikely to respond to factors unrelated to ASC.

# Data

Our data are from various sources in the public domain, which are detailed in Table A2 in the Appendix.

## Survey data

Our primary source of data is the Adult Social Care Survey (ASCS). This is an annual cross-sectional survey administered from January to March by post since 2010/11. The target population of the ASCS includes users aged 18 or older receiving LTC services that are funded or managed by the LA following an assessment of needs (NHS Digital, 2018). The target population includes users in need of support because of physical, sensory, memory and cognition, learning disability, mental health or social impairment through community, residential or nursing care. The ASCS selects a stratified random sample that is representative of the target population (NHS Digital, 2017a).

The ASCS questionnaire asks questions about service satisfaction, quality of life including CRQoL through ASCOT, service knowledge and information, health, needs in relation to home and surroundings, and help received on top of LA services.[[4]](#footnote-5) LAs complement this information with their own data on user demographic characteristics, setting and primary support reason, and information on the type of questionnaire sent. The ASCS’ response rate has always been above 30%, which is argued to be adequate for a postal survey (Malley and Fernandez, 2012, van Leeuwen et al., 2014). The ASCS is therefore recommended for the evaluation of local and national policies, and it is currently used for performance monitoring and research purposes (King and Wittenberg, 2015, Rand and Malley, 2017).

Our sample is based on the ASCS sample in 2017/18, which is the most recent sample at the time of writing. From the original sample of 201,969 users, we remove users who did not respond to the survey (136,954), users for which information on sample stratum, primary support reason and demographics was suppressed for privacy reasons (1,856), and users who did not respond to questions used in our main analysis (10,557). The final sample includes 52,602 users.

For each user in the final sample, we calculate the utility-weighted ASCOT score as a measure of CRQoL and this is our dependent variable. The ASCOT is a validated tool (e.g. Malley and Fernandez, 2012, van Leeuwen et al., 2015, Rand et al., 2017) that is recommended by the National Institute for Health and Care Excellence (NICE) in the UK for the evaluation of ASC interventions (NICE, 2018), and it is used routinely by LAs and government (Forder et al., 2014a). It comprises eight domains: control over daily life, personal cleanliness and comfort, food and drink, personal safety, social participation and involvement, occupation, accommodation cleanliness and comfort, and dignity. Each domain contains four possible responses reflecting the level of need: no needs, trivial needs, some needs and high needs. The ASCOT domains were designed to reflect the objectives of ASC services both in terms of user capabilities and functioning (Netten et al., 2012) and are therefore likely to capture the impact of ASC services only. The resulting utility-weighted CRQoL score (Netten et al., 2012) has an upper bound of one, is anchored to zero which indicates dead, and can take negative values with a lower bound of ‑0.171 for states worse than dead.

We also use the ASCS data to construct several dummy variables to capture user characteristics and related needs. These include demographic dummies to indicate gender, age, ethnicity, and language. Needs are captured through dummies indicating primary support reason, help received to complete the ASCS questionnaire, and whether the respondent completed the easy-read version of the ASCS questionnaire. All user-level variables are described in greater detail in Table 1 and briefly commented on in Section A1 in the Appendix.

In addition, we use ASCS data from 2015/16 and 2016/17 to construct the LA-level proportion of users who are unable to carry out various activities of daily living.[[5]](#footnote-6) We use data also from the Survey of Social Carers in England (SACE) in 2016/17 on carer characteristics and related needs. The SACE is a biennial cross-sectional survey distributed from October to November by post since 2012/13. The target population of the SACE includes informal unpaid carers aged 18 or older who either received or not LA support (NHS Digital, 2017b). Since we are unable to link ASCS and SACE data at the individual level, we use SACE data to construct variables on carer characteristics at the LA level. These include carer gender, age, ethnicity, health condition, employment status and financial status. Moreover, we use information on the caring role including whether the carer lives with the care recipient, duration of care, care tasks and time per week spent in the caring role. These LA-level variables are illustrated more precisely in Table 2.

## Public ASC expenditure per user

We use the ASC Finance Return in 2017/18 to obtain data about ASC expenditure for each LA. This is for services which are funded or managed by the LA for users aged over 18 and it includes expenditure on LTC services, short-term care services, assistive equipment, adaptations and technologies, information and early intervention services, and auxiliary ASC activities. Public ASC expenditure includes also expenditure for commissioning and delivery services (e.g. strategic business direction, business planning) because these are sunk costs for the provision of core ASC services. Public ASC expenditure includes expenditure on in-house and contracted-out services, as well as on services provided by voluntary organisations funded through grants. We use the Short and Long Term Support data return to obtain the number of (LTC) users in 2017/18, which represents the target population for the ASCS.

With these data, we calculate public ASC expenditure per user at LA level by dividing current ASC expenditure, i.e. gross ASC expenditure minus ASC capital charges, by the number of users. These are our key independent variables of interest, and they are described in Table 2 and briefly commented on in Section A1 in the Appendix.

## Other local authority characteristics

We control for eligibility levels across LAs through four dummies indicating the type of LA. We further account for the needs of the local population through variables capturing disability levels across LAs. Moreover, we control for socio-economic factors through variables capturing tenure and socio-economic status. Table A3 shows how we account for the need and socio-economic factors included in the relative needs formula (discussed in Section 2).

Finally, concerning the instruments, we calculated the council tax base per user as the number of ‘band D’ equivalent domestic properties divided by the number of users in each LA. We calculate a proxy of the business rates tax base per user as the number of non-domestic properties divided by the number of users in each LA. Finally, the ACA index in 2013/14 is measured at the LA level. Table 2 shows more details about all these LA-level variables, which are briefly described in Section A1 in the Appendix.

# Empirical methods

To identify the total effect of public ASC expenditure per user on user CRQoL using the available data described in Section 4, equation can be estimated empirically by OLS through the following multilevel regression:

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where the dependent variable is the CRQoL of user *i* (=1,…,*I*) living in LA *j* (=1,…,*J*), *μ* is the intercept, *expenditurejpublic* is the average public ASC expenditure per user in LA *j*, *nij* is a vector of user- and LA-level variables capturing user needs, *Nj* is a vector of LA-level variables capturing carer needs, *gj* is a vector of dummies indicating the type of LA to capture eligibility levels, and *αj* and *εij* are the LA- and user-level error term, respectively. We estimate regression using the survey weight and we cluster standard errors to account for sample stratification and within-LA correlations.[[6]](#footnote-7) Regression does not include variables capturing the use of private LTC and informal care because it aims to estimate the total effect as defined in Section 3.

The key coefficient of interest in is  which captures the total effect of public ASC expenditure per user on user CRQoL across LAs. Since *expenditurejpublic* is measured at the LA level,  indicates the effect of a marginal increase of public ASC expenditure per user across LAs on the CRQoL of an average user. For example, a  means that a marginal increase in the public ASC expenditure per user across LAs improves CRQoL of an average user. For fixed eligibility levels across LAs, the marginal increase in the public ASC expenditure per user is interpreted as an increase in service intensity for existing users.  is identified under the assumption that (*a*) CRQoL is a good measure of utility, (*b*) the utility function *uij* in is linear in the parameter and additively separable, and (*c*) we observe perfectly all the confounding factors discussed using equation that may be correlated with both expenditure and utility (e.g. needs, eligibility). Conditions (*a*) and (*b*) are commonly assumed. Condition (*c*) implies that *expenditurejpublic* is likely to be endogenous in practice. More precisely, we argue that  from is likely to be downwardly biased as explained in Section 3.

We address this endogeneity through an IV approach which estimates equation by two-stage least squares (2SLS) and uses the survey weight and clusters standard errors as described above.[[7]](#footnote-8) Our preferred instrument is the council tax base *before exemptions and discounts* per user at the LA level (Section 2.1 explains council tax in greater detail). We argue that the council tax base is likely to be relevant and exogenous (Stock and Watson, 2011; p. 421). It is likely to be relevant, i.e. correlated with public ASC expenditure, because it is a key determinant of council tax revenues which, in turn, are a major source of funding for ASC services across LAs. Conditional on socio-economic characteristics, it is likely to reflect market factors, *zj* in equation and, therefore, it is likely to be exogenous because it is unrelated to user CRQoL and unobserved factors which impact user CRQoL, such as needs.

We argue that LAs are unable to manipulate the council tax base (before exemptions and discounts) because the banding of domestic properties which determines the tax base is set nationally and not locally (as discussed in greater detail in Section 2.1). This implies that LAs cannot link their council tax base to their LTC needs.[[8]](#footnote-9) However, the council tax base can be indirectly related to needs and outcomes across LAs through their socio-economic status. This is because, for example, wealthier LA populations may afford houses with high sale value and, therefore, the total council tax base in these LAs may be higher than average. After netting out the correlation with socio-economic characteristics, however, the council tax base across LAs is likely to be driven by market factors reflecting the urban development within LAs. Urban development can be argued to be mostly a historical artefact and independent from current health and LTC outcomes and needs. For example, a greater tangible cultural heritage (e.g. historical buildings, monuments, parks) in a LA is likely to increase properties’ value and, in turn, the council tax base. To address potential endogeneity concerns of the council tax base we control for a rich set of socio-economic characteristics as well as other variables correlated with socio-economic status including needs and eligibility as described in Section 4. In addition, by analysing the sector-specific CRQoL, the council tax base per user is unlikely to be endogenous because of its correlation with LA expenditure for non-LTC services. On this basis, the exogenous marginal increase in public ASC expenditure per user estimated using the council tax base per user as an instrument will correspond to a real marginal increase in expenditure which may, in turn, impact on user CRQoL.

Under the potential outcome model framework (Rubin, 1974, Rubin, 1978), the 2SLS estimate of  has a local average treatment effect (LATE) interpretation. It estimates a weighted average of the causal effect of public ASC expenditure per user on user CRQoL for those LAs that are compliers. These are LAs which are induced to increase public ASC expenditure per user as a result of having a higher council tax base per user. The identification of LATE requires the council tax base per user to satisfy the monotonicity assumption. This means that LAs with higher council tax base per user never spend on ASC for each user less than LAs with lower council tax base per user. This is plausible because council tax is the major source of funding (Local Government Association, 2017) used by LAs to tackle the increasing demand for ASC services (Bottery, 2020). Figure 1 shows that public ASC expenditure per user is likely to increase monotonically in the council tax base per user. Section A2 in the Appendix provides a further discussion about monotonicity.

Additional instruments are the business rates tax base per user and the ACA index (Section 2.1 provides more details on these variables). These instruments are likely to be relevant and exogenous under similar arguments used for the council tax base. For example, LAs with more businesses are likely to have a larger business rates tax base and, in turn, more business rates revenues to be spent also on local ASC services. Conditional on socio-economic status, a larger business rates tax base is likely to reflect factors, such as touristic attractions, which are unrelated to LTC outcomes and needs. Similarly, a greater ACA index is likely to increase the funding from central ASC grants and, conditional on socio-economic status, the labour cost captured by ACA index is likely to reflect living standards (e.g. appealing neighbourhoods, multicultural environment) which are unlikely to be related to LTC outcomes and needs. Section A3 in the Appendix discusses further details about our identification strategy and instruments.

## Sensitivity analysis

First, we estimate the direct effect by adding to some variables capturing the use of private LTC and informal care, which are summarised in Table A4. This specification also tests the robustness of the estimated total effect to the potential correlation between the use of private LTC and informal care and the instruments, which can occur through socio-economic status. In addition, we test the sensitivity of our results on the total effect to the assumption that other LA non-LTC services may impact user CRQoL by controlling for LA expenditure per capita for non-LTC services. We test sensitivity also to the existence of voluntary-sector organisations providing LTC services using private funding (e.g. through donations), rather than public funding. We do this by controlling for two further LA-level variables including the number of charities providing services to the elderly (and therefore likely to provide LTC services) and expenditure per capita of these charities. Second, we explore potential heterogeneity in the marginal productivity of ASC expenditure per user on user CRQoL by estimating regression for the three ASCS strata: (*a*) users of any age with learning disability, (*b*) users aged between 18 and 64 with any impairment except learning disability, and (*c*) users aged 65 or older with any impairment except learning disability.

In addition, we test the robustness of our findings when all variables are measured at the LA level by estimating the following regression by 2SLS:

,

where *τ* is the intercept, and all variables and the error term, *ηj*, vary only at the LA level. The estimated marginal productivity is now captured by  which is interpreted similarly to  in equation (5). Finally, we test the robustness of our results to different assumptions about the missing data due to item non-response. Our main analysis in equation (4) assumes that missing data due to item non-response are missing completely at random (MCAR). We relax this assumption and assume that data are missing at random (MAR) by imputing the missing data using multiple imputation chained equation (MICE) with predictive mean matching. More details about the imputation model are provided in Table A5 in the Appendix.

# Results

Table 3 shows our key findings. Column 1 includes the results for the OLS regression, which suggest that £1,000 increase in public ASC expenditure per user increases on average user CRQoL by 0.0019. This result is statistically significant at the 1% level. As discussed in Section 3, however, this estimate of the total effect is likely to be downwardly biased because public ASC expenditure per user is likely to be endogenous. Column 2 of Table 3 includes the results from the IV regression when the council tax base per user is used as an instrument. It suggests that £1,000 increase in public ASC expenditure per user increases on average user CRQoL by 0.0030 (statistically significant at the 1% level) with a 95% confidence interval of [0.0014, 0.0046]. The first-stage F statistic (robust to clustering) is equal to 437.9 (far beyond the critical value of 10) suggesting that the council tax base per user is a relevant instrument. Table A6 in the Appendix shows the first stage results and it suggests that when all instruments are used, i.e. council tax base per user, business rates tax base per user and ACA index, the null hypothesis of validity of the over-identified restrictions is not rejected which suggests that instruments are likely to be exogenous. Table 3 includes also the estimated coefficients on control variables which we comment on in Section A4 in the Appendix.

Table 4 shows the results of the sensitivity analysis (estimated coefficients on control variables are not reported). The direct effect is estimated at 0.0031, statistically significant at the 1% level (full results are reported in Table A7), which is almost equal to the estimated total effect (0.0030). This suggests that users receiving additional public ASC services might reduce their use of private LTC and informal care such that their CRQoL gains remain unchanged. It also suggests that bias in the total effect due to omission of private LTC and informal care, which are potentially correlated to socio-economic status, is unlikely. In addition, the results on the total effect are robust to the inclusion of additional controls capturing LA expenditure per capita for non-LTC services (column 1), the number of charities that are likely to provide LTC services and expenditure per capita for these charities (column 2), and all these three additional variables (column 3) (Table A8 in the Appendix provides some descriptive statistics for these variables). In addition, point-estimates of the marginal productivity of ASC expenditure per user on user CRQoL for the three sub-groups (*a*), (*b*) and (*c*), as defined in Section 5.1, are within [0.0014, 0.0046], i.e. the 95% confidence interval of the full sample result. This suggests that primary support reason and age are unlikely to drive the potential heterogeneity in the marginal productivity across users. To the extent these three groups of users have on average different CRQoL, as indicated in Table 4, this result suggests also that CRQoL might not drive the potential heterogeneity in the marginal productivity across individuals. In addition, LA-level regressions estimated by OLS and 2SLS produce results which are qualitatively similar but smaller in magnitude compared to those from our primary specifications. This suggests that estimates from LA-level data may be downwardly biased because of the loss of information in the aggregated outcome and control variables. The multiple imputation analysis under the MAR assumption produces results which are mostly similar to those from our primary specifications described above. This suggests that results are robust to different assumptions on the missing data mechanism.

# Discussion and conclusions

This study has investigated the effects of public expenditure per user invested in the intensity of ASC services controlling for eligibility levels (i.e. for a given number of eligible individuals) on user CRQoL. Our key finding suggests that, across LAs, a £1,000 increase in public ASC expenditure per user increases CRQoL of an average existing user by 0.0030 with a 95% confidence interval of [0.0014, 0.0046]. This effect is relatively small if compared to the CRQoL of an average existing user (0.4%). Assuming that this estimated CRQoL gain of an average existing user across LAs spans over a year, it translates into a high cost per social care-quality-adjusted life year (SC-QALY) of £333,333 per SC-QALY (=£1,000÷0.0030) with a 95% confidence interval of [217,391, 714,286]. Given our model specification, this is a LATE estimate. This may differ from the average treatment effect estimate if there exists heterogeneity in the treatment effect across LAs, i.e. if the treatment effect for LAs that are compliers differ from other LAs. Moreover, our estimate relies on the validity of our IV strategy which requires the assumption of exogeneity, relevance and monotonicity of the instruments as discussed in Section 5. Finally, it is subject to the assumption that the type of LA captures most of the variability in the eligibility policy across LAs as argued by Forder et al. (2014b).

Previous studies suggest lower cost per SC-QALY. Forder et al. (2014b) find a cost per SC-QALY of £50,000, but this estimate refers to public home care services which are only a small proportion of public ASC expenditure (8.2% in 2017/18). Forder et al. (2018b) find a cost per SC-QALY of £15,000 and £19,000 for low-need and high-need users of community care services, respectively, which still represent a relatively small proportion of public ASC expenditure (34% in 2017/18). Moreover, estimates in the latter study are based on the extensive margin: from using no services to new service user. Therefore, results from previous studies are not directly comparable with ours and they suggest some potential reasons why our estimated cost per SC-QALY is substantially higher. For example, by considering all public ASC expenditure, our estimate is likely to reflect a greater heterogeneity in the effectiveness on user CRQoL across ASC services. Moreover, we analyse users accessing services which are more intensive compared to home care, such as residential and nursing care, and these users are more likely to have higher needs and lower CRQoL. Our higher estimated cost per SC-QALY may therefore reflect a higher heterogeneity in the effectiveness of ASC services along the user CRQoL distribution (e.g. ASC is less effective when user CRQoL is low), although our sub-group analysis suggests this heterogeneity might not be substantial. Moreover, if public ASC reduces mortality of users with low CRQoL, this might be a further reason for a high estimated cost per SC-QALY.

To our knowledge, this is one of the first studies to provide a causal estimate of the effect of the all public ASC expenditure on quality of life in England. As discussed, the focus of existing studies is narrower (Forder et al., 2014b, Forder et al., 2018b). Our broader focus on the whole public ASC sector allows us to propose a novel identification strategy which uses conditionally exogenous elements of the public funding system as IVs. Unlike existing studies, we exclude current ASC outcomes measures (e.g. current activities of daily living, home adaptations) from the set of control variables to avoid the potential bad control problem (Angrist and Pischke, 2008, p. 47). Moreover, compared to the existing studies, we use data from a survey of users which includes a much larger representative sample of the LTC population in England. We use survey data in 2017/18 because these are the most recent at the time of writing and they include a richer set of key variables, such as sample stratification category and primary support reason, which are missing in previous years’ survey data available in the public domain. Future waves of the survey can be used to develop a panel data model to test the robustness of our results to different methods. This study also contributes to the literature on the effectiveness of public expenditure which mostly includes studies on health care (Martin et al., 2008, Claxton et al., 2018, Vallejo‐Torres et al., 2018, Siverskog and Henriksson, 2019) and education sector (Hægeland et al., 2012, Hyman, 2017, Gigliotti and Sorensen, 2018).

Our findings can inform policy makers about the effects of changes in public ASC expenditure on the quality of life of users. This is especially relevant in recent years, when the increasing demand of LTC due to, for example, population ageing and the lower availability of informal carers (Joshua, 2017) are expected to make LTC expenditure grow faster than health care expenditure (OECD, 2018). Policy makers around the world have therefore reformed their LTC systems in the attempt to contain costs (Joshua, 2017). For example, in the UK, public ASC expenditure was cut by 11% between 2009/10 and 2015/16 (Simpson, 2017), and the number of elderly individuals receiving public ASC fell by 40% between 2009 and 2015 (Seamer et al., 2019). Our findings suggest that, for fixed eligibility levels, cutting the amount or intensity of public ASC services across LAs can be expected to have had, on average, a relatively small effect on quality of life of users. These findings may also inform other LTC policy makers across OECD countries, who also often operate at sub-national level with typically considerable autonomy over LTC service delivery (Colombo et al., 2011) and whose role is increasingly more important to reduce disparities within countries (Joshua, 2017).

Although this study estimates one important aspect of the effects of changes in public ASC expenditure, there are other effects which require further research as the evolving data in this area allow. For example, changes in public ASC expenditure may also have causal CRQoL effects through its impact on eligibility levels, as well as other outcomes for informal carers. It is also possible that changes in ASC expenditure have a direct effect on mortality for ASC users and an indirect, but causal, effect on other services for other types of users. For example, it may impact the composition of health care expenditure, which, in turn, may impact mortality and quality of life outcomes for health care patients. For these reasons, the cost per SC-QALY implied by the results in this study should not be over-interpreted. Further research is needed for a complete understanding of the likely *overall* effects of changes in public ASC expenditure, which can be used for the assessment of an opportunity costs threshold in the public ASC sector. This will aid judgment about the cost-effectiveness of alternative services and investments given current levels of funding.

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# Tables and figures

Table – Descriptive statistics of individual-level variables.

|  |  |  |  |
| --- | --- | --- | --- |
| Variable at the user level | Mean | Std Err | Std Dev |
| Outcome |  |  |  |
| Care-related quality of life | 0.824 | 0.003 | 0.191 |
| Gender |  |  |  |
| Male user (ref) | 41.9% | 0.005 | 0.493 |
| Female user | 58.1% | 0.005 | 0.493 |
| Age |  |  |  |
| User aged between 18 and 64 years old (ref) | 42.9% | 0.016 | 0.495 |
| User aged 65 or older | 57.1% | 0.016 | 0.495 |
| Ethnicity |  |  |  |
| User of white ethnicity (ref) | 90.1% | 0.006 | 0.299 |
| User of non-white ethnicity | 8.2% | 0.006 | 0.275 |
| User who did not state ethnicity | 1.7% | 0.002 | 0.128 |
| Language |  |  |  |
| User whose questionnaire was in English (ref) | 99.87% | 0.0005 | 0.036 |
| User whose questionnaire was in non-English European languages | 0.02% | 0.0001 | 0.014 |
| User whose questionnaire was in South Asian languages | 0.06% | 0.0005 | 0.025 |
| User whose questionnaire was in Middle Eastern languages | 0.04% | 0.0002 | 0.021 |
| Primary support reason |  |  |  |
| User who received physical support (ref) | 54.4% | 0.014 | 0.498 |
| User who received sensory support | 1.6% | 0.001 | 0.124 |
| User who received support with memory and cognition | 5.2% | 0.003 | 0.221 |
| User who received learning disability support | 28.5% | 0.016 | 0.452 |
| User who received mental health support | 8.2% | 0.004 | 0.274 |
| User who received social support | 2.2% | 0.002 | 0.145 |
| Help with questionnaire |  |  |  |
| User who did not receive help with questionnaire | 18.1% | 0.005 | 0.385 |
| User whose questionnaire was read by someone else | 49.9% | 0.006 | 0.500 |
| User whose questionnaire was translated by someone else | 24.2% | 0.010 | 0.428 |
| User whose questionnaire was only filled in by someone else | 40.7% | 0.004 | 0.491 |
| User whose questionnaire was talked through with someone else | 29.3% | 0.003 | 0.455 |
| User whose questionnaire was answered without asking by someone else | 8.9% | 0.002 | 0.285 |
| Questionnaire version |  |  |  |
| User who received a standard questionnaire (ref) | 71.7% | 0.016 | 0.451 |
| User who received an easy-read questionnaire | 28.3% | 0.016 | 0.451 |
| Observations | 52,602 | | |
| Std Err=standard errors of the mean estimate, Std Dev=standard deviation, ref=reference category | | | |
| Means are estimated using the survey weight, and their standard errors are obtained by taking into account survey stratification and clustering within local authorities. | | | |

Table – Descriptive statistics of local authority-level variables.

| Variable at the local authority level | Mean | Std Dev | Min | Max |
| --- | --- | --- | --- | --- |
| Expenditure and activity |  |  |  |  |
| Public adult social care expenditure (£000s) | 140,414 | 103,508 | 15,739 | 585,225 |
| Number of adult long-term care users | 5,627 | 4,085 | 415 | 22,585 |
| Public adult social care expenditure (£000s) per user | 26 | 5 | 15 | 43 |
| Type of local authority | | | | |
| Inner London borough (ref) | 8.1% | 0.273 | 0 | 1 |
| Outer London borough | 13.4% | 0.342 | 0 | 1 |
| County | 17.4% | 0.381 | 0 | 1 |
| Metropolitan district | 24.2% | 0.430 | 0 | 1 |
| Unitary authority | 36.9% | 0.484 | 0 | 1 |
| Activities of daily living in the past two years | | | | |
| Users who cannot manage personal hygiene by themselves 2016/17 | 44.3% | 5.9% | 26.2% | 58.8% |
| Users who cannot manage continence by themselves 2016/17 | 23.1% | 4.6% | 10.9% | 35.3% |
| Users who cannot dress by themselves 2016/17 | 33.4% | 5.5% | 18.0% | 46.4% |
| Users who cannot feed by themselves 2016/17 | 8.3% | 2.3% | 2.6% | 21.2% |
| Users who cannot ambulate by themselves 2016/17 | 26.6% | 4.6% | 14.6% | 38.2% |
| Users who cannot manage personal hygiene by themselves 2015/16 | 43.3% | 7.0% | 3.9% | 59.8% |
| Users who cannot manage continence by themselves 2015/16 | 22.1% | 4.6% | 3.9% | 35.8% |
| Users who cannot dress by themselves 2015/16 | 32.2% | 6.1% | 3.9% | 50.5% |
| Users who cannot feed by themselves 2015/16 | 7.8% | 2.2% | 3.9% | 14.7% |
| Users who cannot ambulate by themselves 2015/16 | 25.8% | 5.0% | 3.9% | 39.6% |
| Disability |  |  |  |  |
| People who are sight impaired 2016/17 | 0.5% | 0.2% | 0.1% | 1.3% |
| People who are hearing impaired 2010 | 0.4% | 0.3% | 0.0% | 1.6% |
| People who are sight and hearing impaired 2016/17 | 0.04% | 0.04% | 0.00% | 0.2% |
| People aged 65 or older with dementia | 6.4% | 0.5% | 5.1% | 9.2% |
| People whose disability does not limit daily activities (ref) | 82.3% | 3.3% | 74.4% | 88.8% |
| People whose disability limits daily activities a little | 9.2% | 1.4% | 6.0% | 12.3% |
| People whose disability limits daily activities a lot | 8.4% | 2.0% | 4.7% | 14.2% |
| Disability deprivation 2015: quartile 1 (ref: least deprived) | 23.5% | 0.425 | 0 | 1 |
| Disability deprivation 2015: quartile 2 | 25.5% | 0.437 | 0 | 1 |
| Disability deprivation 2015: quartile 3 | 25.5% | 0.437 | 0 | 1 |
| Disability deprivation 2015: quartile 4 (most deprived) | 25.5% | 0.437 | 0 | 1 |
| People aged 18-64 claiming Disability Living Allowance | 2.6% | 3.1% | 0.4% | 17.6% |
| People aged 65 or older claiming Attendance Allowance | 2.4% | 3.1% | 0.4% | 20.2% |
| Tenure |  |  |  |  |
| Households with more than a person (ref) | 69.4% | 3.6% | 53.5% | 77.4% |
| Single-person households aged 0-64 | 18.6% | 4.1% | 11.9% | 36.0% |
| Single-person households aged 65 or older | 12.0% | 2.1% | 6.0% | 16.7% |
| People in household with up to 0.5 persons per bedroom (ref) | 13.7% | 3.1% | 5.4% | 23.0% |
| People in household with 0.5 to 1.0 persons per bedroom | 48.2% | 5.6% | 24.5% | 55.1% |
| People in household with 1.0 to 1.5 persons per bedroom | 21.7% | 2.0% | 16.9% | 27.0% |
| People in household with over 1.5 persons per bedroom | 16.4% | 7.5% | 6.8% | 47.0% |
| People who are house owners | 62.1% | 11.4% | 26.1% | 80.9% |
| Socio-economic status |  |  |  |  |
| Population density per 10,000 people | 0.2722 | 0.3259 | 0.0063 | 1.5814 |
| People who are students or in a non-routine occupation (ref) | 82.7% | 4.6% | 72.6% | 92.6% |
| People who are in routine occupation | 11.2% | 3.3% | 4.0% | 19.7% |
| People who never worked and are long-term unemployed | 6.1% | 2.6% | 2.6% | 14.3% |
| Education deprivation 2015: quartile 1 (ref: least deprived) | 23.5% | 0.425 | 0 | 1 |
| Education deprivation 2015: quartile 2 | 25.5% | 0.437 | 0 | 1 |
| Education deprivation 2015: quartile 3 | 25.5% | 0.437 | 0 | 1 |
| Education deprivation 2015: quartile 4 (most deprived) | 25.5% | 0.437 | 0 | 1 |
| Income deprivation 2015: quartile 1 (ref: least deprived) | 23.5% | 0.425 | 0 | 1 |
| Income deprivation 2015: quartile 2 | 25.5% | 0.437 | 0 | 1 |
| Income deprivation 2015: quartile 3 | 25.5% | 0.437 | 0 | 1 |
| Income deprivation 2015: quartile 4 (most deprived) | 25.5% | 0.437 | 0 | 1 |
| People with income support | 1.7% | 1.8% | 0.2% | 10.8% |
| People with pension credit | 6.6% | 7.6% | 1.3% | 43.3% |
| Informal unpaid carer characteristics |  |  |  |  |
| Gender |  |  |  |  |
| Male carers (ref) | 31.2% | 3.3% | 20.6% | 39.8% |
| Female carers | 68.8% | 3.3% | 60.2% | 79.4% |
| Age |  |  |  |  |
| Carers aged 18-64 (ref) | 56.0% | 9.1% | 33.5% | 81.2% |
| Carers aged 65 or older | 44.0% | 9.1% | 18.8% | 66.5% |
| Ethnicity |  |  |  |  |
| Carers of white ethnicity (ref) | 80.7% | 19.2% | 23.5% | 100.0% |
| Carers of non-white ethnicity | 12.8% | 17.8% | 0.0% | 71.5% |
| Carers who did not state ethnicity | 6.4% | 9.7% | 0.0% | 67.3% |
| Health condition |  |  |  |  |
| Carers with Physical impairment | 20.5% | 4.0% | 13.9% | 50.0% |
| Carers with sight or hearing loss | 16.5% | 3.5% | 0.0% | 24.3% |
| Carers with long-standing illness | 28.6% | 4.6% | 0.0% | 41.0% |
| Employment status |  |  |  |  |
| Carers who is retired | 50.4% | 7.8% | 23.1% | 65.5% |
| Carers who is employed | 18.9% | 4.2% | 7.9% | 29.4% |
| Carers who is self-employed | 4.8% | 2.1% | 0.9% | 16.7% |
| Carers who is unemployed | 21.3% | 4.5% | 12.4% | 36.4% |
| Carers who is not in paid work because of caring role | 22.3% | 7.2% | 10.2% | 52.0% |
| Carers who is in paid work but do not feel supported by their employer | 3.9% | 1.6% | 0.0% | 12.5% |
| Carers who is self-employed but unable to balance work and caring role | 1.5% | 0.9% | 0.0% | 4.9% |
| Financial status |  |  |  |  |
| Carers with no financial difficulties because of caring role (ref) | 53.4% | 7.0% | 34.1% | 68.9% |
| Carers with financial difficulties because of caring role | 46.6% | 7.0% | 31.0% | 65.9% |
| Living with the care recipient |  |  |  |  |
| Carers who live with care recipient (ref) | 75.1% | 8.1% | 41.4% | 90.1% |
| Carers who do not live with care recipient | 24.9% | 8.1% | 9.9% | 58.6% |
| Duration of care | 0.5% | 0.6% | 0.0% | 4.6% |
| Carers in caring role for less than 6 months (ref) | 0.5% | 0.6% | 0.0% | 4.6% |
| Carers in caring role between 6 months and 1 year | 2.3% | 1.1% | 0.0% | 5.0% |
| Carers in caring role for more than 1 year | 97.2% | 1.4% | 93.7% | 100.0% |
| Care task | 0.5% | 0.6% | 0.0% | 4.6% |
| Carers who provide personal care | 68.8% | 6.3% | 23.9% | 82.1% |
| Carers who provide physical help | 57.7% | 6.0% | 16.5% | 71.0% |
| Carers who provide other practical help | 92.5% | 2.9% | 82.2% | 98.4% |
| Carers who provide help with medicines | 76.7% | 5.7% | 52.2% | 90.3% |
| Carers who provide emotional support | 84.0% | 3.4% | 69.8% | 93.5% |
| Instruments |  |  |  |  |
| Council tax base per user | 26.6 | 7.9 | 13.5 | 56.5 |
| Business rates tax base per user | 1.3 | 0.6 | 0.4 | 4.0 |
| Area cost adjustment index in 2013/14 | 1.041 | 0.058 | 1.000 | 1.198 |
| Observations | 149 | | | |
| Std Dev=standard deviation, ref=reference category | | | | |

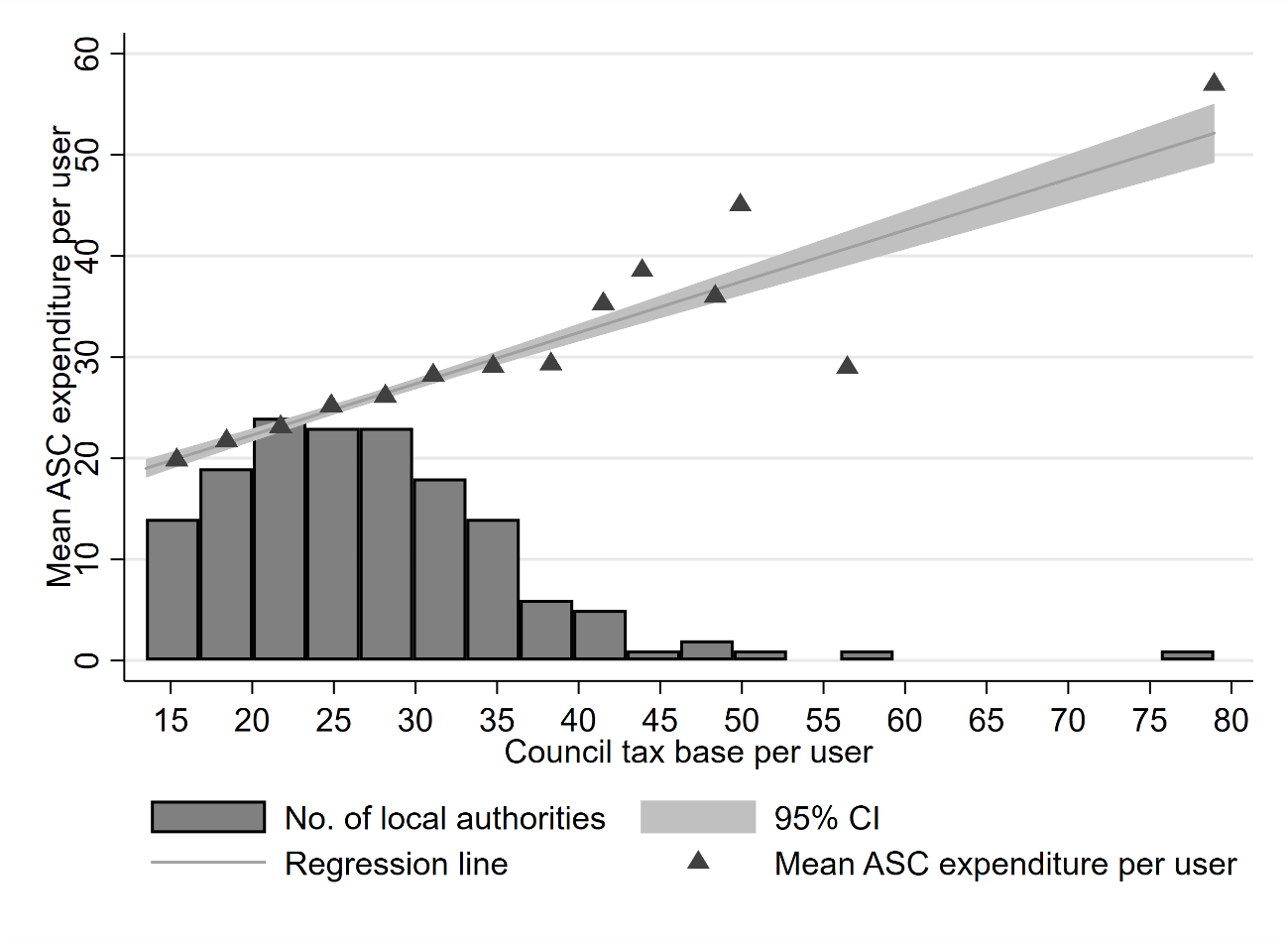
Table – OLS and IV results.

| Variable | |  | (1) | (2) |
| --- | --- | --- | --- | --- |
|  | Total effect | |
|  | OLS | IV |
|  | Public adult social care expenditure per user | LA | 0.0019\*\*\* | 0.0030\*\*\* |
|  | (0.0006) | (0.0008) |
| user needs (nij) | Female user | Ind | -0.008\*\*\* | -0.008\*\*\* |
| User aged 65 or older | Ind | 0.037\*\*\* | 0.037\*\*\* |
| User of non-white ethnicity | Ind | -0.032\*\*\* | -0.032\*\*\* |
| User who did not state ethnicity | Ind | -0.023\*\* | -0.023\*\* |
| User whose questionnaire was in non-English European languages | Ind | -0.093 | -0.09 |
| User whose questionnaire was in South Asian languages | Ind | -0.068\*\* | -0.067\*\* |
| User whose questionnaire was in Middle Eastern languages | Ind | -0.114\*\* | -0.115\*\* |
| User who received sensory support | Ind | 0.014 | 0.014 |
| User who received support with memory and cognition | Ind | 0.027\*\*\* | 0.027\*\*\* |
| User who received learning disability support | Ind | 0.127\*\*\* | 0.126\*\*\* |
| User who received mental health support | Ind | 0.014\*\* | 0.014\*\* |
| User who received social support | Ind | -0.003 | -0.003 |
| User who did not receive help with questionnaire | Ind | 0.016\*\*\* | 0.016\*\*\* |
| User whose questionnaire was read by someone else | Ind | 0.031\*\*\* | 0.031\*\*\* |
| User whose questionnaire was translated by someone else | Ind | 0.008\*\*\* | 0.008\*\*\* |
| User whose questionnaire was only filled in by someone else | Ind | -0.015\*\*\* | -0.015\*\*\* |
| User whose questionnaire was talked through with someone else | Ind | -0.020\*\*\* | -0.020\*\*\* |
| User whose questionnaire was answered without asking by someone else | Ind | -0.064\*\*\* | -0.064\*\*\* |
| User who received an easy-read questionnaire | Ind | 0.016 | 0.016 |
| Users who cannot manage personal hygiene by themselves 2016/17 | LA | -0.033 | -0.018 |
| Users who cannot manage continence by themselves 2016/17 | LA | -0.101 | -0.108 |
| Users who cannot dress by themselves 2016/17 | LA | 0.164 | 0.16 |
| Users who cannot feed by themselves 2016/17 | LA | -0.211\* | -0.209\* |
| Users who cannot ambulate by themselves 2016/17 | LA | 0.076 | 0.071 |
| Users who cannot manage personal hygiene by themselves 2015/16 | LA | -0.057 | -0.042 |
| Users who cannot manage continence by themselves 2015/16 | LA | 0.370\*\* | 0.418\*\*\* |
| Users who cannot dress by themselves 2015/16 | LA | -0.076 | -0.092 |
| Users who cannot feed by themselves 2015/16 | LA | -0.305\*\* | -0.371\*\* |
| Users who cannot ambulate by themselves 2015/16 | LA | -0.17 | -0.23 |
| People who are sight impaired 2016/17 | LA | -1.816 | -1.419 |
| People who are hearing impaired 2010 | LA | -0.38 | -0.42 |
| People who are sight and hearing impaired 2016/17 | LA | 6.404 | 6.477 |
| People aged 65 or older with dementia | LA | 0.226 | 0.197 |
| People whose disability limits daily activities a little | LA | -1.801\* | -1.632 |
| People whose disability limits daily activities a lot | LA | -0.958\*\* | -1.019\*\* |
| Disability deprivation 2015: quartile 2 | LA | -0.003 | -0.003 |
| Disability deprivation 2015: quartile 3 | LA | -0.01 | -0.008 |
| Disability deprivation 2015: quartile 4 (most deprived) | LA | -0.013 | -0.014 |
| People aged 18-64 claiming Disability Living Allowance | LA | -0.584\*\*\* | -0.653\*\*\* |
| People aged 65 or older claiming Attendance Allowance | LA | 0.07 | 0.011 |
| Single-person households aged 0-64 | LA | -0.159 | -0.15 |
| Single-person households aged 65 or older | LA | 0.159 | 0.026 |
| People in household with 0.5 to 1.0 persons per bedroom | LA | -0.327 | -0.395 |
| People in household with 1.0 to 1.5 persons per bedroom | LA | 0.029 | 0.083 |
| People in household with over 1.5 persons per bedroom | LA | -0.38 | -0.483 |
| People who are house owners | LA | -0.035 | -0.023 |
| Population density per 10,000 people | LA | -0.002 | -0.005 |
| People who are in routine occupation | LA | -0.148 | -0.188 |
| People who never worked and are long-term unemployed | LA | 0.416 | 0.493\* |
| Education deprivation 2015: quartile 2 | LA | -0.005 | -0.003 |
| Education deprivation 2015: quartile 3 | LA | -0.008 | -0.006 |
| Education deprivation 2015: quartile 4 (most deprived) | LA | -0.014 | -0.011 |
| Income deprivation 2015: quartile 2 | LA | -0.001 | -0.003 |
| Income deprivation 2015: quartile 3 | LA | 0.004 | 0.002 |
| Income deprivation 2015: quartile 4 (most deprived) | LA | -0.003 | -0.007 |
| People with income support | LA | -0.507 | -0.435 |
| People with pension credit | LA | 0.328\* | 0.370\*\* |
| Carer needs (Nj) | Female carers | LA | -0.065 | -0.045 |
| Carers aged 65 or older | LA | -0.023 | -0.027 |
| Carers of non-white ethnicity | LA | 0.053 | 0.073\* |
| Carers who did not state ethnicity | LA | 0.041\* | 0.038\* |
| Carers with Physical impairment | LA | 0.048 | 0.051 |
| Carers with sight or hearing loss | LA | 0.045 | 0.079 |
| Carers with long-standing illness | LA | 0.047 | 0.073 |
| Carers who is retired | LA | -0.021 | -0.076 |
| Carers who is employed | LA | -0.021 | -0.068 |
| Carers who is self-employed | LA | 0.154 | 0.138 |
| Carers who is unemployed | LA | -0.124 | -0.199 |
| Carers who is not in paid work because of caring role | LA | 0.06 | 0.061 |
| Carers who is in paid work but do not feel supported by their employer | LA | -0.064 | -0.018 |
| Carers who is self-employed but unable to balance work and caring role | LA | -0.222 | -0.227 |
| Carers with financial difficulties because of caring role | LA | -0.075 | -0.092\* |
| Carers who do not live with care recipient | LA | 0.002 | -0.016 |
| Carers in caring role between 6 months and 1 year | LA | -0.053 | -0.265 |
| Carers in caring role for more than 1 year | LA | -0.082 | -0.224 |
| Carers who provide personal care | LA | 0.056 | 0.056 |
| Carers who provide physical help | LA | 0.019 | 0.017 |
| Carers who provide other practical help | LA | -0.006 | 0.004 |
| Carers who provide help with medicines | LA | 0.031 | 0.05 |
| Carers who provide emotional support | LA | -0.078 | -0.084 |
| Eligibility (gj) | Outer London borough | LA | -0.008 | -0.009 |
| County | LA | 0.011 | 0.005 |
| Metropolitan district | LA | 0.011 | 0.009 |
| Unitary authority | LA | 0.018 | 0.014 |
|  | Constant |  | 2.074\*\*\* | 2.305\*\*\* |
| Observations | |  | 52,602 | 52,602 |
| First stage Kleibergen-Paap rk Wald F statistic | |  | - | 437.9 |
| OLS=ordinary least square, IV=instrumental variable, LA=local-authority level variable, Ind=individual-level variable | | | | |
| The dependent variable is the user care-related quality of life measured at the individual level. The Instrumental variable in column (2) is the council tax base per user. All regressions are weighted using the survey weight. Standard errors are clustered within LAs and strata, and they are reported in parenthesis. | | | | |
| \*\*\* = p-value<0.01, \*\* = p-value<0.05, \* = p-value<0.1 | | | | |

Table – Results of the sensitivity analysis.

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Variable | (1) | (2) |  | (3) | (4) | (5) |  | (6) | (7) | (8) |  | (9) | (10) |  | (11) | (12) |
| Direct effect | |  | Additional control variables | | |  | Sub-group analysis | | |  | LA-level analysis | |  | Multiple imputation | |
| OLS | IV |  | Non-LTC | Charity | All |  | (*a*) | (*b*) | (*c*) |  | OLS | IV |  | OLS | IV |
| Public adult social care expenditure per user | 0.0019\*\*\* | 0.0031\*\*\* |  | 0.0029\*\*\* | 0.0031\*\*\* | 0.0030\*\*\* |  | 0.0014\*\*\* | 0.0041\*\*\* | 0.0030\*\* |  | 0.0011\*\* | 0.0023\*\*\* |  | 0.0017\*\*\* | 0.0026\*\*\* |
| (0.0006) | (0.0009) |  | (0.0009) | (0.0009) | (0.0009) |  | (0.0004) | (0.0011) | (0.0012) |  | (0.0005) | (0.0005) |  | (0.0005) | (0.0008) |
| First stage Kleibergen-Paap rk Wald F statistic | - | 399.8 |  | 450.5 | 413.6 | 395.2 |  | 138.3 | 115.5 | 196.9 |  | - | 30.6 |  | - | - |
| Over-identification test (Hansen J statistic) p-value | - | 0.583 |  | 0.691 | 0.508 | 0.626 |  | 0.069\* | 0.722 | 0.581 |  | - | 0.169 |  | - | - |
| Observations | 49,907 | 49,907 |  | 52,602 | 52,602 | 52,602 |  | 14,733 | 9,882 | 27,987 |  | 149 | 149 |  | 63,159 | 63,159 |
| Non-LTC=regression (4) including LA expenditure per capita for non-LTC services as additional control, Charity=regression (4) including number of charities providing services to the elderly and expenditure per capita for these charities as additional controls, All=regression (4) including all additional controls, (a)=sub-group a (users of any age with learning disability), (b)=sub-group b (users aged between 18 and 64 in need of support for any reason except learning disability), (c)=sub-group c (users aged 65 or older in need of support for any reason except learning disability), OLS=ordinary least square, IV=instrumental variable. | | | | | | | | | | | | | | | | |
| The dependent variable is the user care-related quality of life. Estimated coefficients on control variables are not reported. The instrument used in column (2), (3), (4), (5), (6), (7), (8), (10) and (12) is the council tax base per user. All regressions are weighted using the survey weight. Standard errors are clustered within LAs and strata, and they are reported in parenthesis. The Hansen J statistic is estimated when all instruments are used including council tax base per user, business rate tax base per user and ACA index. | | | | | | | | | | | | | | | | |
| In column (1) and (2), the number of observations decreases from 52,602 (in the main analysis) to 49,907 because the user-level variables described in Table A4, which are added to the model, have additional missing values. | | | | | | | | | | | | | | | | |
| Mean care-related quality of life in sub-group (a) is 0.909, in sub-group (b) is 0.753 and in sub-group (c) is 0.796. | | | | | | | | | | | | | | | | |
| \*\*\* = p-value<0.01, \*\* = p-value<0.05, \* = p-value<0.10 | | | | | | | | | | | | | | | | |

Figure – Relationship between mean ASC expenditure per user and council tax base per user.



# Appendix

### Descriptive statistics

Table 1 shows descriptive statistics for variables measured at the user level. User CRQoL is on average 0.824 and its standard deviation is 0.191 (23% of the average), which indicates a substantial variability across users. Most users are female (58.1%), aged 65 or older (57.1%), and white (90.1%). Almost all users choose to receive their questionnaire in English (99.87%). Most users received physical support (54.4%) and learning disability support (28.5%), and smaller proportions of users received mental health (8.2%), memory and cognition (5.2%), social (2.2%) and sensory support (1.6%). Only a relatively small proportion of users did not receive help with the questionnaire (18.1%), and most users received a standard questionnaire (71.7%) rather than an easy-read questionnaire.

Table 2 shows descriptive statistics for variables measured at the LA level. On average, LAs spend £140.4 million on ASC to support 5,627 users. On average, this translates into a public ASC expenditure per user of £26,000, which substantially varies across LAs with a standard deviation of £5,000 per user, i.e. 18% of the average. Substantial variability in ASC expenditure per user and user CRQoL, as mentioned above, warrants the analysis of these two key variables in the cross-sectional case.

Out of 149 LAs in our sample, 55 are unitary LAs, 36 are metropolitan districts, 26 are counties, and 20 and 12 are outer and inner London boroughs, respectively. Data on activities of daily living in the past two years (2016/17 and 2015/16) suggest that, on average, a higher proportion of users cannot manage personal hygiene by themselves (44.3% and 43.3%) and a relatively minor proportion cannot feed by themselves (8.3% and 7.8%). Information on socio-economic characteristics suggests that, on average, 30.6% of households only include a person and 62.1% are house owners. Descriptive statistics on (informal unpaid) carer characteristics show that, on average, 68.8% of carers are female and 44% are aged 65 and above. Only a minority of carers do not live with the care recipient (24.9%), and most of the carers have been in their caring role for more than a year (97.2%). Most carers carry out intensive tasks such as personal care (68.8%), physical help (57.7%) or other practical help (92.5%). Finally, as regards our instruments, LAs have on average 26.6 equivalent ‘band D’ domestic properties per user and 1.3 non-domestic properties per user. The ACA index is on average 1.041, and it varies from 1.000 to 1.198.

### LATE and monotonicity

This Section discusses further reasons for monotonicity to hold true. The existence of ASC precepts is unlikely to invalidate monotonicity because most LAs charge an ASC precept given the common issue of lack of funding. Because of increasing financial pressures, 79% of LAs charge additional amounts on the council tax bill in 2017/18 called ASC precepts. These additional charges are capped to a 3% increase each year, up to a maximum overall increase of 5% (although an increase above 5% can in principle be implemented if approved through a local referendum).

Service capacity is also unlikely to be an invalidating factor for monotonicity because LAs are flexible in the way they can coordinate LTC services. LAs can indeed provide LTC services in-house or through external organisations including private providers and charities. More precisely, the private LTC market in England includes several providers (Hudson, 2016) and, therefore, capacity issues are likely to be only marginal compared to issues about lack of funding.

Concerning eligibility, the Care Act 2014 states that LAs must guarantee a minimum level of support. LAs can decide to spend more than the minimum level of support and, therefore, some variability in eligibility levels across LAs may exist. This variability has been argued to be mostly driven by LAs’ innate culture (Forder et al., 2014b). Therefore, after accounting for culture through the type of LA, eligibility levels are expected to be similar across LAs and, therefore, unlikely to invalidate monotonicity.

Finally, differences in preferences about LTC across LAs are plausible. This are however unlikely to invalidate monotonicity because LTC is viewed as a sensitive topic in England, where the LTC demand of more and more people remains unmet (Hemmings, 2019). In fact, preferences are likely to be one more factor in favour of monotonicity to the extent they may push towards more LTC services rather than less in the presence of more available funding.

Figure 1 shows that monotonicity is likely to hold true in practice. However, the relationship between mean public ASC expenditure per user and council tax base per user becomes noisy for values of the council tax base per user greater than 45. This is because, in this part of the council tax base per user distribution, there are only five LAs. As a robustness check, we remove these five LAs and re-estimate our preferred specification. We find that results are robust (and are available upon request).

### Further discussion about the identification strategy

We divide public LTC expenditure by the number of users to address the research question about the marginal productivity of public ASC expenditure per user on user CRQoL. This can be computed accurately by considering the individuals receiving the service, i.e. the users. Moreover, this choice is consistent with the analysis of CRQoL across users, which is our dependent variable.

We divide the council tax base by the number of users to replicate LAs’ funding approach as closely as possible by conditioning on the number of users in the first stage of the 2SLS estimator. LAs are expected to allocate their available resources by prioritising those services that must be guaranteed by law, including ASC for which a minimum level of services must be provided. How much funding LAs need for ASC must be informed by expectations on number and type of users. The number of users is likely to be driven by two factors including local eligibility policy and needs. Once these factors have been accounted for, as we do, the number of users is exogenous to LAs given the legal requirements. Similar considerations hold true for business rate tax base per user.

Unlike council tax base and business rate tax base per user, the funding allocation process involving the ACA index is based on rules defined by the central government rather than LAs. This process ignores the number of users across LAs and, therefore, conditioning on the number of users is unnecessary to replicate this funding allocation process.

To test the sensitivity of our results to these structural assumptions we compare the results from our primary specification (where the council tax base per user is the only instrument) with those from a specification where the ACA index is the only instrument. The estimated marginal effect of public ASC expenditure per user is similar in these two specifications, i.e. 0.0030 and 0.0037, respectively.

### Results on control variables

Table 3 includes also the estimated coefficients on control variables which, for brevity, we comment only if statistically significant at the 1% or 5% level. In column 2, we find that female users are associated with 0.008 lower CRQoL compared to male users. Similarly, we find lower CRQoL for users of non-white ethnicity (-0.032) and those who did not state their ethnicity (-0.023) compared to white users, and for users who received a questionnaire translated in a South Asian language (-0.067) or a Middle Easter language (-0.115) compared to those who received an English questionnaire. Users aged 65 or older are associated on average 0.037 higher CRQoL compared to younger users, similarly to users who received memory and cognition (0.027), learning disability (0.126), and mental health support (0.014) compared to users who received physical support. Users who did not receive help with the questionnaire, those whose questionnaire was read or translated by someone else are associated with 0.016, 0.031 and 0.008 higher CRQoL, respectively. CRQoL tends to be lower for those whose questionnaire was only filled in (-0.015), talked through (-0.020) or answered without asking (-0.064) by someone else.

LAs with one percentage point higher proportion of users who could not manage continence by themselves two years ago have on average users with 0.418 higher user CRQoL. Instead, LAs with one percentage point higher proportion of users who could not feed by themselves two years ago have on average users with 0.371 lower user CRQoL, respectively. In addition, LAs with one percentage point higher proportion of people whose disability limits daily activities a lot and people aged between 18 and 64 claiming disability living allowance have on average users with 1.019 and 0.653 lower user CRQoL, respectively. Finally, LAs with one percentage point higher proportion of people with pension credit are associated with 0.370 higher user CRQoL.

Table A – Further details on the theoretical framework.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Factor related to ASC | | Impact on or correlation to public ASC expenditure | Impact on CRQoL | Expected bias if unobserved | | Interpretation |
| Biased estimate | Direction of the bias |
| *nij* | User's needs | + | - | Total and direct effect | ↓ | Higher public ASC expenditure is expected to occur where needs are high, and users with high needs are expected to have lower CRQoL. Higher needs for the user's informal care are expected to translate also in lower CRQoL. If unobserved, the effect of a marginal increase in public ASC expenditure on CRQoL will capture both the beneficial effect on CRQoL of higher public ASC expenditure as well as the detrimental effect on CRQoL of higher user's (carer's) needs. |
| *Nij* | Carer's needs |
|  | | | | | |
| *gj* | Eligibility levels | - | + | Total and direct effect | ↓ | The higher the eligibility levels, the more users receive ASC and, therefore, for a given budget, the lower the public ASC expenditure or intensity of care for each user. In addition, higher eligibility levels reduce users’ uncertainty on future LTC costs and, therefore, are expected to have a positive impact on users’ CRQoL. If unobserved, the effect of a marginal increase in public ASC expenditure on CRQoL will capture the beneficial effect on CRQoL of greater intensity of care and the detrimental effect on CRQoL of lower eligibility levels. |
|  |  |  |  |  |
| *eijprivate* | User's private LTC expenditure | - | + | Direct effect | ↓ | The greater public ASC expenditure for each user the less likely users are to purchase private LTC services or ask informal care. In addition, private LTC and informal care are expected to have a beneficial impact on CRQoL. If unobserved, the effect of a marginal increase in public ASC expenditure on CRQoL captures the beneficial effect of higher public ASC expenditure as well as the detrimental effect on CRQoL of lower private LTC expenditure and informal care. |
| *Eijprivate* | Informal carer's private LTC expenditure |
| *cij* | Informal care |
|  | | | | | |
| ASC=adult social care, CRQoL=care-related quality of life, -=decrease, +=increase, ↓=downward bias, LTC=long-term care | | | | | | |
| In discussing the bias for each factor, if unobserved, we assume all other factors are observed. | | | | | | |

Table A – Sources of data.

| Variable | Original unit | Unit of analysis | Financial year | Source of data | Link | Date of last access |
| --- | --- | --- | --- | --- | --- | --- |
| Care-related quality of life, gender, age, ethnicity, language, type of social care support, help with questionnaire, questionnaire version, private and informal care received | Individual | Individual | 2017/18 | NHS Digital: Personal Social Services Adult Social Care Survey | <https://digital.nhs.uk/data-and-information/publications/statistical/personal-social-services-adult-social-care-survey/2017-18> | 26/02/2021 |
| Activities of daily living in the past two years | Individual | Local authority | 2016/17, 2015/16 |
| Informal unpaid carer characteristics | Individual | Local authority | 2016/17 | NHS Digital: Personal Social Services Survey of Adult Carers in England | <https://digital.nhs.uk/data-and-information/publications/statistical/personal-social-services-survey-of-adult-carers/personal-social-services-survey-of-adult-carers-in-england-2016-17> | 26/02/2021 |
| Public adult social care expenditure, adult social care activity volumes | Local authority | Local authority | 2017/18 | NHS Digital: Adult Social Care Activity and Finance Report | <https://digital.nhs.uk/data-and-information/publications/statistical/adult-social-care-activity-and-finance-report/2017-18> | 26/02/2021 |
| Expenditure for non-long-term care services | Local authority | Local authority | 2017/18 | Government website | <https://www.gov.uk/government/statistics/local-authority-revenue-expenditure-and-financing-england-2017-to-2018-individual-local-authority-data-outturn> | 26/02/2021 |
| Number of charities providing services to the elderly, total expenditure of charities providing services to the elderly | Charity | Local authority | 2017/18 | Charity commission for England and Wales website | <https://register-of-charities.charitycommission.gov.uk/register/full-register-download> | 26/02/2021 |
| Public adult social care expenditure, adult social care activity volumes | Local authority | Local authority | 2017/18 | NHS Digital: Adult Social Care Activity and Finance Report | <https://digital.nhs.uk/data-and-information/publications/statistical/adult-social-care-activity-and-finance-report/2017-18> | 26/02/2021 |
| Vision impairment | Local authority | Local authority | 2016/17 | NHS Digital: Registered Blind and Partially Sighted People | <https://digital.nhs.uk/data-and-information/publications/statistical/registered-blind-and-partially-sighted-people/registered-blind-and-partially-sighted-people-england-2016-17> | 26/02/2021 |
| Hearing impairment | Local authority | Local authority | 2010 | NHS Digital: People registered as deaf or hard of hearing | <https://digital.nhs.uk/data-and-information/publications/statistical/people-registered-as-deaf-or-hard-of-hearing/people-registered-as-deaf-or-hard-of-hearing-england-year-ending-31-march-2010> | 26/02/2021 |
| Dementia | Local authority | Local authority | 2017/18 | NHS Digital: Recorded Dementia Diagnoses March 2018 | <https://digital.nhs.uk/data-and-information/publications/statistical/recorded-dementia-diagnoses/march-2018> | 26/02/2021 |
| Population characteristics across local authorities | LSOA | Local authority | 2011 | 2011 Census | <https://census.ukdataservice.ac.uk/get-data/aggregate-data> | 26/02/2021 |
| Income deprivation, disability deprivation, education deprivation | LSOA | Local authority | 2015 | Ministry of Housing, Communities & Local Government website | <http://opendatacommunities.org/resource?uri=http%3A%2F%2Fopendatacommunities.org%2Fdata%2Fsocietal-wellbeing%2Fimd%2Findices> | 26/02/2021 |
| Council tax base | Local authority | Local authority | 2017/18 | Government website | <https://www.gov.uk/government/statistics/council-tax-levels-set-by-local-authorities-in-england-2017-to-2018> | 26/02/2021 |
| Business rate tax base | Local authority | Local authority | 2017/18 | Government website | <https://www.gov.uk/government/statistics/non-domestic-rating-stock-of-properties-and-update-of-2017-revaluation-statistics> | 26/02/2021 |
| Area cost adjustment index | Local authority | Local authority | 2013/14 | National archive | <https://webarchive.nationalarchives.gov.uk/20140505105851/http:/www.local.communities.gov.uk/finance/1314/CalcFFs.pdf> | 26/02/2021 |

Table A – Factors included in the relative needs formula and relating variables.

|  |  |  |  |
| --- | --- | --- | --- |
| Factor | Type of variable in the analysis | Variable used in the analysis | Variable level |
| *Relative needs formula for people aged between 18 and 64* | | | |
| Amount per capita fixed across local authorities |  | Intercept |  |
| Deprivation top-up |  |  |  |
| Prop people in receipt of financial disability support | Covariate | People aged 18-64 claiming Disability Living Allowance | LA |
| Prop people who have never worked or are long-term unemployed | Covariate | People who never worked and are long-term unemployed | LA |
| Prop people in routine occupations | Covariate | People who are in routine occupation | LA |
| Prop people with no family | Covariate | Single-person households aged 0-64 | LA |
| Area cost adjustment index | Instrument | Area cost adjustment index | LA |
| *Relative needs formula for people aged 65 or older* | | | |
| Amount per capita fixed across local authorities |  | Intercept |  |
| Age top-up |  |  |  |
| Prop people aged 90 year or older | Covariate | User aged 65 or older | Ind |
| Deprivation top-up |  |  |  |
| Prop people in receipt of income support or pension credit | Covariate | People with income support; People with pension credit | LA |
| Prop people in receipt of attendance allowance | Covariate | People aged 65 or older claiming Attendance Allowance | LA |
| Prop people living in a rented accommodation | Covariate | People who are house owners | LA |
| Prop people living alone in a household | Covariate | Single-person households aged 65 or older | LA |
| Low income top-up |  |  |  |
| Expenditure for residential care | Covariate | Adult social care expenditure per user | LA |
| Prop people in receipt of income support or pension credit | Covariate | People with income support; People with pension credit | LA |
| Sparsity index | Covariate | Population density per 10,000 people | LA |
| Area cost adjustment index | Instrument | Area cost adjustment index | LA |
| Prop=proportion, LA=variable measured at the local authority level, Ind=variable measured at the individual level | | | |

Table A – Descriptive statistics of variables capturing private LTC and informal care.

|  |  |  |  |
| --- | --- | --- | --- |
| Variable | Obs | Mean | Std Err/Dev |
| At the user level | | | |
| Other care received |  |  |  |
| User who received informal care | 49,907 | 80.6% | 0.004 |
| User who received private long-term care services | 49,907 | 36.7% | 0.006 |
| User who received informal care and private long-term care services | 49,907 | 32.4% | 0.006 |
| At the local authority level | | | |
| Informal care (time per week spent in the caring role) | 149 | 0.5% | 0.6% |
| Carers who care for no more than 19 hours per week (ref) | 149 | 14.9% | 6.0% |
| Carers who care for 20 hours or more although may vary | 149 | 6.8% | 2.0% |
| Carers who care for 20 to 49 hours per week | 149 | 15.5% | 3.1% |
| Carers who care for no less than 50 hours per week | 149 | 50.9% | 8.0% |
| Carers who care for other unspecified amounts of time | 149 | 11.8% | 4.9% |
| Obs=number of observations, Std Err/Dev=standard error for user-level variables or standard deviation for local authority-level variables, ref=reference category | | | |
| The variables measured at the user level are dummy variables. For these variables, the mean is estimated using the survey weight, and their standard errors are obtained by taking into account survey stratification and clustering within local authorities. The variables measured at the local authority level capture proportions across local authorities. | | | |

Table A – Imputation model.

|  |  |  |  |
| --- | --- | --- | --- |
| Imputed variable | Type of variable | Missing data | Main analysis |
| Question 3a - ASCOT: control over daily life | Categorical | 2.60% | Yes |
| Question 4a - ASCOT: personal cleanliness and comfort | Categorical | 2.36% | Yes |
| Question 5a - ASCOT: food and drink | Categorical | 3.21% | Yes |
| Question 6a - ASCOT: accommodation cleanliness and comfort | Categorical | 2.63% | Yes |
| Question 7a - ASCOT: personal safety | Categorical | 2.63% | Yes |
| Question 8a - ASCOT: social participation and involvement | Categorical | 3.05% | Yes |
| Question 9a - ASCOT: occupation | Categorical | 3.90% | Yes |
| Question 11 - ASCOT: dignity | Categorical | 4.97% | Yes |
| Gender | Dummy | 0.01% | Yes |
| Ethnicity | Categorical | 1.34% | Yes |
| Language | Categorical | 0.16% | Yes |
| User who did not receive help with questionnaire | Dummy | 5.06% | Yes |
| User whose questionnaire was read by someone else | Dummy | 5.06% | Yes |
| User whose questionnaire was translated by someone else | Dummy | 5.06% | Yes |
| User whose questionnaire was only filled in by someone else | Dummy | 5.06% | Yes |
| User whose questionnaire was talked through with someone else | Dummy | 5.06% | Yes |
| User whose questionnaire was answered without asking by someone else | Dummy | 5.06% | Yes |
| User who received informal care | Dummy | 4.96% | Yes |
| User who received private long-term care services | Dummy | 6.96% | Yes |
| Question 1 - Overall satisfaction | Categorical | 2.31% | No |
| Question 2 - Quality of life | Categorical | 2.55% | No |
| Question 2b - Care and support services improve quality of life | Dummy | 4.12% | No |
| Question 10 - Feeling about having help | Categorical | 4.72% | No |
| Question 12 - Level of difficulty in finding information | Categorical | 5.53% | No |
| Question 13 - Health in general | Categorical | 2.56% | No |
| Question 14.1 - EQ-5D-3L: pain or discomfort | Categorical | 3.47% | No |
| Question 14.2 - EQ-5D-3L: anxiety or depression | Categorical | 4.30% | No |
| Question 15.a - Get around indoors by yourself | Categorical | 3.26% | No |
| Question 15.b - Get in and out of a bed by yourself | Categorical | 3.05% | No |
| Question 15.c - Feed by yourself | Categorical | 3.15% | No |
| Question 15.d - Deal with finances and paperwork by yourself | Categorical | 3.74% | No |
| Question 16.a - Wash all over by yourself | Categorical | 3.22% | No |
| Question 16.b - Get dressed and undressed by yourself | Categorical | 3.36% | No |
| Question 16.c - Use the toilet by yourself | Categorical | 3.42% | No |
| Question 16.d - wash your face and hands by yourself | Categorical | 3.07% | No |
| Question 17 - Home design to meet needs | Categorical | 3.49% | No |
| Question 18 - Getting around outside of your home | Categorical | 4.89% | No |
| Observations | 63,159 | | |
| The proportion of missing data refers to item non-responses. The "Main analysis" column indicates whether the variable was included in the main analysis: "No" means that the variable was only used in the imputation model. The imputation model includes the following covariates with non-missing values: user aged 65 or older, user who received sensory support, user who received support with memory and cognition, user who received learning disability support, user who received mental health support, user who received social support, user who received an easy-read questionnaire, user who received residential care (not included in the main analysis), and user who received nursing care (not included in the main analysis), and local authority dummies (not included in the main analysis). All variables with missing data are added as covariates to the imputation model once their missing values are imputed. All variables are imputed using predictive mean matching with 10 nearest neighbours to draw from. Ten datasets were imputed for the analysis. | | | |

Table A – First-stage results of the primary IV approach.

| Variable | | (1) | (2) |
| --- | --- | --- | --- |
| Public Adult Social Care expenditure per capita | |
| Instruments | Council tax base per user | 0.693\*\*\* | 0.666\*\*\* |
| (0.035) | (0.041) |
| Business rate tax base per user |  | -0.114 |
|  | (0.249) |
| Area cost adjustment index for older adult 2013/14 |  | 23.847\*\*\* |
|  | (8.983) |
| user needs (nij) | Female user | 0.004 | 0.005 |
| User aged 65 or older | 0.075 | 0.070 |
| User of non-white ethnicity | 0.028 | 0.022 |
| User who did not state ethnicity | -0.069 | -0.082 |
| User whose questionnaire was in non-English European languages | -0.513 | -0.528 |
| User whose questionnaire was in South Asian languages | 0.581 | 0.336 |
| User whose questionnaire was in Middle Eastern languages | 0.341\* | 0.326\* |
| User who received sensory support | 0.120 | 0.124 |
| User who received support with memory and cognition | 0.075 | 0.056 |
| User who received learning disability support | 0.521\* | 0.501 |
| User who received mental health support | -0.097 | -0.100 |
| User who received social support | 0.200\*\* | 0.200\*\* |
| User who did not receive help with questionnaire | -0.022 | -0.026 |
| User whose questionnaire was read by someone else | -0.045\* | -0.043\* |
| User whose questionnaire was translated by someone else | -0.034 | -0.035 |
| User whose questionnaire was only filled in by someone else | -0.021 | -0.018 |
| User whose questionnaire was talked through with someone else | 0.014 | 0.016 |
| User whose questionnaire was answered without asking by someone else | -0.065\* | -0.061\* |
| User who received an easy-read questionnaire | -0.373 | -0.360 |
| Users who cannot manage personal hygiene by themselves 2016/17 | 11.711\*\* | 12.494\*\* |
| Users who cannot manage continence by themselves 2016/17 | 0.024 | -2.523 |
| Users who cannot dress by themselves 2016/17 | -19.733\*\*\* | -20.346\*\*\* |
| Users who cannot feed by themselves 2016/17 | -3.758 | -3.634 |
| Users who cannot ambulate by themselves 2016/17 | -0.461 | 2.722 |
| Users who cannot manage personal hygiene by themselves 2015/16 | -6.911 | -7.040 |
| Users who cannot manage continence by themselves 2015/16 | 6.099 | 9.003 |
| Users who cannot dress by themselves 2015/16 | -7.793 | -9.013 |
| Users who cannot feed by themselves 2015/16 | 18.983\*\* | 17.292\*\* |
| Users who cannot ambulate by themselves 2015/16 | 12.365 | 11.406 |
| People who are sight impaired 2016/17 | -407.1\*\*\* | -406.728\*\*\* |
| People who are hearing impaired 2010 | -69.038 | -42.109 |
| People who are sight and hearing impaired 2016/17 | 983.726\*\*\* | 1,034.489\*\*\* |
| People aged 65 or older with dementia | 69.209\*\* | 59.858\* |
| People whose disability limits daily activities a little | 69.462 | 121.998\* |
| People whose disability limits daily activities a lot | -25.586 | -5.168 |
| Disability deprivation 2015: quartile 2 | -0.335 | -0.371 |
| Disability deprivation 2015: quartile 3 | 0.186 | 0.165 |
| Disability deprivation 2015: quartile 4 (most deprived) | -0.151 | -0.258 |
| People aged 18-64 claiming Disability Living Allowance | 36.039\*\*\* | 31.263\*\*\* |
| People aged 65 or older claiming Attendance Allowance | 37.347\*\* | 34.737\* |
| Single-person households aged 0-64 | -33.836\*\*\* | -27.471\*\*\* |
| Single-person households aged 65 or older | -41.821\*\* | -36.994\* |
| People in household with 0.5 to 1.0 persons per bedroom | 24.712 | 38.193\*\* |
| People in household with 1.0 to 1.5 persons per bedroom | -3.676 | 2.689 |
| People in household with over 1.5 persons per bedroom | 41.962\*\*\* | 48.242\*\*\* |
| People who are house owners | -18.844\*\*\* | -18.058\*\*\* |
| Population density per 10,000 people | 0.964 | 1.039 |
| People who are in routine occupation | -2.346 | 3.726 |
| People who never worked and are long-term unemployed | -33.610\* | -22.740 |
| Education deprivation 2015: quartile 2 | -0.462 | -0.256 |
| Education deprivation 2015: quartile 3 | -1.075\*\* | -0.803 |
| Education deprivation 2015: quartile 4 (most deprived) | -0.421 | -0.459 |
| Income deprivation 2015: quartile 2 | 1.564\*\*\* | 1.448\*\*\* |
| Income deprivation 2015: quartile 3 | 2.507\*\*\* | 2.190\*\*\* |
| Income deprivation 2015: quartile 4 (most deprived) | 3.621\*\*\* | 3.474\*\*\* |
| People with income support | -68.859\*\*\* | -83.410\*\*\* |
| People with pension credit | -9.8120 | -4.3410 |
| Carer needs (Nj) | Female carers | -11.421\*\*\* | -13.103\*\*\* |
| Carers aged 65 or older | -4.784\* | -2.891 |
| Carers of non-white ethnicity | -9.056\*\*\* | -8.512\*\*\* |
| Carers who did not state ethnicity | -0.337 | 0.786 |
| Carers with Physical impairment | 1.842 | 2.003 |
| Carers with sight or hearing loss | -5.191 | -8.781 |
| Carers with long-standing illness | -23.938\*\*\* | -22.117\*\*\* |
| Carers who is retired | 47.986\*\*\* | 46.861\*\*\* |
| Carers who is employed | 45.254\*\*\* | 44.404\*\*\* |
| Carers who is self-employed | 9.159 | 5.071 |
| Carers who is unemployed | 60.750\*\*\* | 61.907\*\*\* |
| Carers who is not in paid work because of caring role | -3.863 | -5.373\* |
| Carers who is in paid work but do not feel supported by their employer | -26.470\*\*\* | -30.177\*\*\* |
| Carers who is self-employed but unable to balance work and caring role | 20.611 | 26.427 |
| Carers with financial difficulties because of caring role | -0.405 | 0.266 |
| Carers who do not live with care recipient | 8.324\*\* | 7.200\*\* |
| Carers in caring role between 6 months and 1 year | 39.485 | 22.286 |
| Carers in caring role for more than 1 year | 10.414 | -8.484 |
| Carers who provide personal care | 0.589 | -0.892 |
| Carers who provide physical help | 6.348\*\* | 7.490\*\* |
| Carers who provide other practical help | -26.933\*\*\* | -28.086\*\*\* |
| Carers who provide help with medicines | -13.669\*\*\* | -15.243\*\*\* |
| Carers who provide emotional support | 13.277\*\* | 14.784\*\*\* |
| Eligibility (gj) | Outer London borough | 2.651\*\*\* | 5.429\*\*\* |
| County | 4.005\*\*\* | 7.744\*\*\* |
| Metropolitan district | 4.529\*\*\* | 8.276\*\*\* |
| Unitary authority | 5.566\*\*\* | 9.155\*\*\* |
| Private care (Pij) and informal care (cij) | User who received informal care | 0.011 | 0.011 |
| User who received private long-term care services | -0.012 | -0.010 |
| User who received informal care and private long-term care services | 0.001 | -0.002 |
| Carers who care for 20 hours or more although may vary | 3.166 | 4.618 |
| Carers who care for 20 to 49 hours per week | 19.979\*\*\* | 22.517\*\*\* |
| Carers who care for no less than 50 hours per week | 11.571\*\* | 14.881\*\*\* |
| Carers who care for other unspecified amounts of time | 17.144\*\*\* | 20.315\*\*\* |
|  | Constant | -12.134 | -53.737 |
| Observations | | 49,907 | 49,907 |
| First stage Kleibergen-Paap rk Wald F statistic | | 399.8 | 159.6 |
| Over-identification test (Hansen J statistic) p-value | | - | 0.583 |
| All regressions are weighted using the survey weight. Standard errors are clustered within LAs and strata, and they are reported in parenthesis. | | | |
| \*\*\* = p-value<0.01, \*\* = p-value<0.05, \* = p-value<0.1 | | | |

Table A – Full results of the regression estimating the direct effect.

| Variable | |  | (1) | (2) |
| --- | --- | --- | --- | --- |
| Direct effect | | |
|  | OLS | IV |
|  | Public adult social care expenditure per user | LA | 0.0019\*\*\* | 0.0031\*\*\* |
|  | (0.0006) | (0.0009) |
| user needs (nij) | Female user | Ind | -0.009\*\*\* | -0.009\*\*\* |
| User aged 65 or older | Ind | 0.039\*\*\* | 0.039\*\*\* |
| User of non-white ethnicity | Ind | -0.031\*\*\* | -0.031\*\*\* |
| User who did not state ethnicity | Ind | -0.023\*\* | -0.023\*\* |
| User whose questionnaire was in non-English European languages | Ind | -0.112 | -0.110 |
| User whose questionnaire was in South Asian languages | Ind | -0.071\*\*\* | -0.070\*\*\* |
| User whose questionnaire was in Middle Eastern languages | Ind | -0.095 | -0.096 |
| User who received sensory support | Ind | 0.014 | 0.014 |
| User who received support with memory and cognition | Ind | 0.024\*\*\* | 0.024\*\*\* |
| User who received learning disability support | Ind | 0.123\*\*\* | 0.122\*\*\* |
| User who received mental health support | Ind | 0.011\* | 0.011\* |
| User who received social support | Ind | -0.005 | -0.006 |
| User who did not receive help with questionnaire | Ind | 0.017\*\*\* | 0.017\*\*\* |
| User whose questionnaire was read by someone else | Ind | 0.030\*\*\* | 0.030\*\*\* |
| User whose questionnaire was translated by someone else | Ind | 0.007\*\* | 0.007\*\* |
| User whose questionnaire was only filled in by someone else | Ind | -0.014\*\*\* | -0.014\*\*\* |
| User whose questionnaire was talked through with someone else | Ind | -0.019\*\*\* | -0.019\*\*\* |
| User whose questionnaire was answered without asking by someone else | Ind | -0.064\*\*\* | -0.064\*\*\* |
| User who received an easy-read questionnaire | Ind | 0.019 | 0.020\* |
| Users who cannot manage personal hygiene by themselves 2016/17 | LA | -0.003 | 0.023 |
| Users who cannot manage continence by themselves 2016/17 | LA | -0.123 | -0.136 |
| Users who cannot dress by themselves 2016/17 | LA | 0.140 | 0.128 |
| Users who cannot feed by themselves 2016/17 | LA | -0.211\* | -0.226\*\* |
| Users who cannot ambulate by themselves 2016/17 | LA | 0.098 | 0.106 |
| Users who cannot manage personal hygiene by themselves 2015/16 | LA | -0.076 | -0.056 |
| Users who cannot manage continence by themselves 2015/16 | LA | 0.387\*\* | 0.428\*\*\* |
| Users who cannot dress by themselves 2015/16 | LA | -0.056 | -0.068 |
| Users who cannot feed by themselves 2015/16 | LA | -0.339\*\* | -0.409\*\* |
| Users who cannot ambulate by themselves 2015/16 | LA | -0.182 | -0.248 |
| People who are sight impaired 2016/17 | LA | -1.812 | -1.365 |
| People who are hearing impaired 2010 | LA | -0.481 | -0.602 |
| People who are sight and hearing impaired 2016/17 | LA | 6.051 | 5.702 |
| People aged 65 or older with dementia | LA | 0.068 | 0.006 |
| People whose disability limits daily activities a little | LA | -1.852\* | -1.654 |
| People whose disability limits daily activities a lot | LA | -0.991\*\* | -1.069\*\* |
| Disability deprivation 2015: quartile 2 | LA | -0.004 | -0.004 |
| Disability deprivation 2015: quartile 3 | LA | -0.011 | -0.009 |
| Disability deprivation 2015: quartile 4 (most deprived) | LA | -0.016 | -0.017 |
| People aged 18-64 claiming Disability Living Allowance | LA | -0.581\*\* | -0.661\*\*\* |
| People aged 65 or older claiming Attendance Allowance | LA | 0.044 | 0.011 |
| Single-person households aged 0-64 | LA | -0.100 | -0.079 |
| Single-person households aged 65 or older | LA | 0.219 | 0.086 |
| People in household with 0.5 to 1.0 persons per bedroom | LA | -0.351 | -0.439 |
| People in household with 1.0 to 1.5 persons per bedroom | LA | 0.082 | 0.146 |
| People in household with over 1.5 persons per bedroom | LA | -0.419 | -0.549\* |
| People who are house owners | LA | -0.033 | -0.026 |
| Population density per 10,000 people | LA | 0.001 | -0.003 |
| People who are in routine occupation | LA | -0.136 | -0.190 |
| People who never worked and are long-term unemployed | LA | 0.466\* | 0.557\*\* |
| Education deprivation 2015: quartile 2 | LA | -0.006 | -0.004 |
| Education deprivation 2015: quartile 3 | LA | -0.010 | -0.007 |
| Education deprivation 2015: quartile 4 (most deprived) | LA | -0.016 | -0.012 |
| Income deprivation 2015: quartile 2 | LA | -0.002 | -0.004 |
| Income deprivation 2015: quartile 3 | LA | 0.001 | -0.001 |
| Income deprivation 2015: quartile 4 (most deprived) | LA | -0.006 | -0.011 |
| People with income support | LA | -0.418 | -0.256 |
| People with pension credit | LA | 0.324\* | 0.341\* |
| Carer needs (Nj) | Female carers | LA | -0.058 | -0.029 |
| Carers aged 65 or older | LA | -0.025 | -0.033 |
| Carers of non-white ethnicity | LA | 0.061 | 0.083\* |
| Carers who did not state ethnicity | LA | 0.038 | 0.034 |
| Carers with Physical impairment | LA | 0.050 | 0.045 |
| Carers with sight or hearing loss | LA | 0.032 | 0.061 |
| Carers with long-standing illness | LA | 0.064 | 0.092 |
| Carers who is retired | LA | -0.039 | -0.105 |
| Carers who is employed | LA | -0.054 | -0.115 |
| Carers who is self-employed | LA | 0.135 | 0.102 |
| Carers who is unemployed | LA | -0.129 | -0.217 |
| Carers who is not in paid work because of caring role | LA | 0.054 | 0.059 |
| Carers who is in paid work but do not feel supported by their employer | LA | -0.020 | 0.026 |
| Carers who is self-employed but unable to balance work and caring role | LA | -0.150 | -0.137 |
| Carers with financial difficulties because of caring role | LA | -0.085\* | -0.099\*\* |
| Carers who do not live with care recipient | LA | 0.008 | 0.003 |
| Carers in caring role between 6 months and 1 year | LA | -0.105 | -0.281 |
| Carers in caring role for more than 1 year | LA | -0.087 | -0.194 |
| Carers who provide personal care | LA | 0.038 | 0.035 |
| Carers who provide physical help | LA | 0.025 | 0.028 |
| Carers who provide other practical help | LA | 0.013 | 0.015 |
| Carers who provide help with medicines | LA | 0.042 | 0.069 |
| Carers who provide emotional support | LA | -0.074 | -0.080 |
| Eligibility (gj) | Outer London borough | LA | -0.003 | -0.004 |
| County | LA | 0.016 | 0.011 |
| Metropolitan district | LA | 0.017 | 0.015 |
| Unitary authority | LA | 0.024 | 0.021 |
| Private care (Pij) and informal care (cij) | User who received informal care | Ind | 0.003 | 0.003 |
| User who received private long-term care services | Ind | -0.051\*\*\* | -0.051\*\*\* |
| User who received informal care and private long-term care services | Ind | 0.027\*\*\* | 0.027\*\*\* |
| Carers who care for 20 hours or more although may vary | LA | -0.014 | -0.022 |
| Carers who care for 20 to 49 hours per week | LA | -0.057 | -0.109 |
| Carers who care for no less than 50 hours per week | LA | -0.025 | -0.057 |
| Carers who care for other unspecified amounts of time | LA | -0.045 | -0.081 |
|  | Constant |  | 2.122\*\*\* | 2.366\*\*\* |
| Observations | |  | 49,907 | 49,907 |
| First stage Kleibergen-Paap rk Wald F statistic | |  | - | 399.8 |
| OLS=ordinary least square, IV=instrumental variable, LA=local-authority level variable, Ind=individual-level variable | | | | |
| The dependent variable is the user care-related quality of life measured at the individual level. The Instrumental variable in column (2) is the council tax base per user. All regressions are weighted using the survey weight. Standard errors are clustered within LAs and strata, and they are reported in parenthesis. | | | | |
| \*\*\* = p-value<0.01, \*\* = p-value<0.05, \* = p-value<0.10 | | | | |

Table A – Descriptive statistics of the additional LA-level control variables.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Variable at the local authority level | Mean | Prop | Std Dev | Min | Max |
| Local authority expenditure per capita for non-long-term care services | 1,449 |  | 392 | 780 | 2,815 |
| Expenditure per capita for education services | 675 | 46.6% | 216 | 275 | 1,594 |
| Expenditure per capita for children social care services | 186 | 12.9% | 51 | 32 | 335 |
| Expenditure per capita for central administrative services | 175 | 12.1% | 105 | 11 | 748 |
| Expenditure per capita for environmental and regulatory services | 101 | 6.9% | 42 | 26 | 334 |
| Expenditure per capita for highways and transport services | 86 | 6.0% | 36 | 29 | 223 |
| Expenditure per capita for public health services | 71 | 4.9% | 27 | 33 | 155 |
| Expenditure per capita for cultural and related services | 55 | 3.8% | 31 | 7 | 151 |
| Expenditure per capita for housing services | 55 | 3.8% | 66 | 0 | 342 |
| Expenditure per capita for planning and development services | 36 | 2.5% | 20 | 2 | 96 |
| Expenditure per capita for other services | 5 | 0.3% | 15 | -7 | 127 |
| Number of charities providing services for the elderly | 284 |  | 260 | 28 | 1,176 |
| Expenditure per capita of all charities providing services for the elderly | 449 |  | 770 | 34 | 5,271 |
| Observations |  | 149 | | | |
| Prop=proportion of the total, Std Dev=standard deviation, ref=reference category | | | | | |

1. Short-term services in England are generally labelled as rehabilitation or reablement services (e.g. after a stay in hospital). An example is vision rehabilitation, which is provided to people with vision impairment over a few weeks with the aim of training their everyday skills (e.g. cooking) to encourage their independence (Rabiee et al., 2016). [↑](#footnote-ref-2)
2. On average, these users only represent a small proportion (6%) across LAs. [↑](#footnote-ref-3)
3. Note that the concept of marginal productivity used in this study differs from the traditional economic concept of productivity, which refers to technical or allocative efficiency considering how well inputs are transformed into outputs rather than outcomes (Koopmans, 1951, Jacobs et al., 2006). [↑](#footnote-ref-4)
4. The questionnaire can be found at this link: <https://digital.nhs.uk/data-and-information/data-collections-and-data-sets/data-collections/social-care-user-surveys/social-care-user-survey-guidance-2017-18> [↑](#footnote-ref-5)
5. We use past rather than current activities of daily living to avoid the bad control problem (Angrist and Pischke, 2008, p. 47). [↑](#footnote-ref-6)
6. The survey weight is calculated as the product of a design, a unit non-response and a post-stratification weight. The design weight takes account of sample stratification (NHS Digital, 2018), and it is calculated by stratum and LA as the eligible population divided by the number of respondents (NHS Digital, 2017a). The unit non-response weight is predicted using a logit regression where the dependent variable is a dummy variable equal to one if the user responded to the survey and the independent variables include age, support setting, primary support reason, survey stratum, a dummy indicating whether the user received the easy-read version of the questionnaire, and LA dummies. Finally, the post-stratification weight is calculated using the total population by age, support setting and primary support reason. [↑](#footnote-ref-7)
7. Rice et al. (2002) suggest that the 2SLS estimator is consistent in multilevel models where covariates may be correlated with the group-level error term (*αj*) [↑](#footnote-ref-8)
8. In turn, this can be argued to be a reason for the introduction of the ASC precept as discussed in Section 2.1. [↑](#footnote-ref-9)