Essays on the provision of long term care to older adults in Scotland

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For my wonderful Grandmother.

Elizabeth Sheila Hotson

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Abstract

This thesis presents three empirical analyses on different aspects of the provision of long term care (LTC), in the paid and unpaid settings, to older adults in Scotland. It contributes to the academic literature by deepening our understanding in three interrelated areas.

Firstly, it explores variation in the provision of Free Personal Care (FPC) across Scottish local authorities, in order to establish whether or not FPC provision matches the need of the population. The analysis suggests that there are significant differences in FPC provision, even after accounting for personal care need. This raises equity concerns, suggesting that older Scots might be more or less likely to receive FPC, depending on which local authority they reside.

Secondly, it investigates the interaction between paid care and unpaid care, to understand how unpaid carers influence older people's use of FPC. In particular, it aims to establish whether or not unpaid carers substitute or complement FPC. The paper finds that individuals who have an unpaid carer receive around one hour and a quarter more FPC each week. This raises concerns for the pressure unpaid carers might have on FPC resources and for individuals without unpaid carers, who might not be getting the formal help that they need.

Lastly, it focuses on unpaid carers themselves and explores whether or not providing care has an impact on their Standard of Living (SoL). Specifically, it estimates the monetary amount an unpaid carer would need to be compensated by in order to reach the same SoL as a non-carer. In doing so, it offers evidence for the extent to which the current Carers Allowance is sufficient in compensating them for the material impact of their care giving duties. The results suggest that unpaid carers have a significantly lower SoL compared to non-carers and demonstrate that the Carers Allowance falls considerably short of compensating unpaid carers for the loss in SoL they experience due to caring.

Declaration

I wish to submit the thesis detailed above in according with the University of Stirling research degree regulations. I declare that the thesis embodies the results of my own research and was composed by me. Where appropriate I have acknowledged the nature and extent of work carried out in collaboration with others included in the thesis.

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1 | Introduction

The European Commission's report on ageing in 2018 showed that average life expectancy in the European Union is expected to increase by seven years between 2016 and 2070 (European Commission 2018). Often, older age is associated with poorer health (Walter et al. 2016, Campolina et al. 2014, Beltrán-Sánchez et al. 2016). There is a growing concern among policy makers and governments throughout the world, about the effect such demographic shifts will have on the provision and use of Long Term Care (LTC) services.

LTC services help older adults who have become limited in their ability to perform daily activities, to live at home as independently and safely as possible. LTC provision often involves help with Activities of Daily Living (ADLs) and Instrumental Activities of Daily Living (IADLs). ADLs are fundamental self-care tasks such as washing, dressing and eating. Care for ADLs is often referred to as personal care. IADLs refer to activities that require more thinking and organisational skills such as shopping, housework, taking medication and paying bills. Help with IADLs is often referred to as home care.

LTC services are provided through paid and unpaid channels. Unpaid care is care that is provided by family members, partners or friends to those who require help because they are ill, frail or have a disability (Howard 2002).Paid care services, or formal care services, consist of both residential and community services, and are provided by governments, voluntary organisations and private firms, or a mixture of the three. In Scotland, the legal framework for formal care provision is set by the Scottish Parliament. Formal care is provided by each of the thirty-two local authorities and encompasses a variety of services including residential care, social support, housing support, telecare services, meals services, home care, personal care and self-directed support.

This thesis presents three standalone research papers on several of the fundamental emerging issues surrounding LTC provision to older adults, via both the paid and unpaid channels. Its overall contribution is to deepen our understanding of these issues using a mixture of data sources. Scotland provides an interesting context in which to carry out this exploration, partly due to a number of changes that LTC organisation and policy has undergone in the last two decades.

In particular, in 1999, the Royal Commission on LTC published its report on the funding of LTC for older people in the UK. One of its main recommendations (recommendation 6.4) was that "personal care should be available for those individuals who need it, after an assessment" (Royal Commission on Long Term Care 1999, Chapter 6). Specifically, the report proposed that personal care should be available to those in need, without a cost (Royal Commission on Long Term Care 1999). Personal care, is defined in the Regulation of Care (Scotland) Act 2001 as:

"care which relates to the day to day physical tasks and needs of the person cared for (as for

example, but without prejudice to that generality, to eating and washing) and to mental processes related to those tasks and needs (as for example, but without prejudice to that generality, to remembering to eat and wash)" (Scottish Executive 2001*a*, p.6).

Scotland was, and remains, the only one of the four United Kingdom (UK) nations to take the Royal Commission's recommendation on board and soon after the report was published, the Scottish Executive pledged its commitment to introduce Free Personal and Nursing Care (FPNC). They also established the Care Development Group (CDG) to report on the introduction of FPNC. The recommendations from the CDG's final report (CDG 2001) were fully endorsed by the Scottish Executive and incorporated into the Community Care and Health (Scotland) Act 2002, which provided the legislative backdrop for the implementation of FPNC from 1 July 2002 (Scottish Executive 2002). The FPNC policy can be split into two categories: care in care homes (which covers personal and nursing care) and care at home (which covers personal care only). This thesis is concerned with the latter. This part of the policy states that personal care should be free to anyone assessed as needing it who is aged 65 or over, with no means test for the service. On the other hand, nursing or personal care need for residents living in care homes is assessed and a flat rate payment is made on behalf of the local authority to the care provider.

FPNC became the Scottish Parliaments flagship policy and it is the clearest example of Scotland taking a radically different approach to Westminster on an important policy issue. In England, despite several reviews and debates into the funding and organisation of social care, there have been very few reforms to social care policy and this stalemate has been described as "one of the greatest unresolved policy issues of our time" (Marsh,S 2017). Meanwhile in Scotland, the Scottish Government has committed to extend the policy to cover those under 65 by April 2019 (Scottish Government 2019).

At the same time as the implementation of FPNC in Scotland, the Scottish Government encouraged local authorities to "shift the balance of care" towards providing care in the community. This shift is part of their 2020 Vision and sits within the Health and Social Care Delivery Plan (Scottish Government 2016*a*). Specifically, the movement into the community aims to ensure that older Scots spend less time in care homes or hospital. Instead the emphasis is on aiding frail older people to stay in their own homes or a homely setting, for as long as possible. As a result, there has been more of a shift towards delivering LTC services in a person's own home in order to help individuals maintain their independence and enable them to live in their own homes for as long as possible. This has included a shift away from residential care homes - there were 4% fewer older adults in Scottish care homes in 2017 compared to 2007, despite increases in the numbers of older people requiring care (Information Services Division 2018).

In addition, the Scottish Government has attempted to increase personalisation in LTC by introducing the Social Care (Self-Directed Support (SDS)) (Scotland) Act 2013 (Scottish Parliament 2013). The Act aims to give clients more choice and control over their care packages and sits alongside the Government's wider NHS Quality Strategy which puts patients and their values at the centre of care (Scottish Government 2010). There are four SDS options available to eligible social care clients and local authorities have a legal duty to offer clients these options. The first option is a direct payment. The direct payment option allows individuals to purchase and commission

their own social care services. The second option is to direct the available resource. Under this option the client chooses the services he/she would like to receive with the sum of money they have been assessed as requiring, and the local authority arranges those services for the client. The third option is for local authority arranged services and is the traditional way of arranging services. Lastly, the fourth option allows clients to choose any combination of the first three options. There is significant variation in the implementation rate of SDS across local authorities, some of which is reflected in recording practices but is also due to differences in population need (Health and Social Care Analysis Division 2018).

Moreover, in order to improve the continuity of care provided to people in Scotland and to make more efficient use of limited resources, the Public Bodies (Joint Working) (Scotland) Act 2014 set out the legislative framework for the integration of health and social care services (Scottish Parliament 2016). In 2016, 31 Integration Authorities (one for each of the 32 local authorities in Scotland with the exception of Highland) were established with a view to better coordinate communication and working between NHS boards and local authorities. The Integration Authorities are responsible for the governance, planning and resourcing of adult social care services, adult primary care and community health services and some hospital services (Scottish Parliament 2016). Integration of health and care services is also a key component of the Health and Social Care Delivery Plan and again its aim to shift care out of hospitals and into the community (Scottish Government 2016*a*).

The Scottish Government also acknowledges the significant contribution that unpaid carers make towards LTC provision in Scotland. Unpaid carers not only provide physical help with ADLs and IADLs, they also supervise and monitor the cared for, and anticipate their future care needs (Farina et al. 2017). Without their contribution, the social care system would most likely collapse. It is therefore vital that they are properly supported. To ensure this, the Scottish Government introduced the Carers (Scotland) Act 2016, which provides key legislation designed to support adult and young carers in Scotland (Scottish Government 2017*a*). In particular, the Act aims to support carer's health and well-being, as well as making caring more sustainable. The first measures of the Act came into effect on the 1st April 2018. These included a requirement on local authorities to provide information and advice to carers; to provide adult carer support plans to set out the carer's personal outcomes and identified needs; and to give support to carers, based on their needs, according to local eligibility criteria. The Act contributes towards the Scottish Government's wider vision of a healthier and fairer Scotland.

Finally, Scotland has been devolved several powers from Westminster under the Scotland Act 2016 (Scottish Executive 2016). These powers include social security benefits which affect older people such as disability and carer's benefits. To manage and deliver those benefits to the people of Scotland, the Scottish Government has set up an Executive Agency - Social Security Scotland (SSS). SSS have committed to placing dignity, fairness and respect at the heart of their practice. This commitment is certainly a change from the current approach taken by the Department for Work and Pensions (DWP) and could have implications for the future provision of the benefits. It is therefore increasingly important that we fully understand the aspects of LTC provision in Scotland, which might influence the demand for such benefits, in order to anticipate the impact that both demographic and policy changes will have.

A further feature of the Scottish system which provides a unique opportunity to study LTC provision to older adults, is its collection of administrative data. Since the 1980s, the Scottish Executive has collected information on all clients in Scotland receiving care services. This information is collected by individual local authorities. In 2013, the previous Home Care and SDS surveys were brought together to form the Social Care Survey (SCS). The SCS contains information on care packages delivered to all care clients in Scotland and on any SDS packages. The data collected usually covers the final week in March each year. The clients in the SCS are therefore those whose care needs are being met. That is, it does not include those who might be on a waiting list for care or those who are having their needs met privately either from unpaid carers or from paid private carers.

The SCS is a unique survey: as far as I am aware, no other country collects detailed information from its entire social care population on a regular basis. To access data from the SCS, an application must be made to the Scottish Government detailing the purpose of the research and what data are required to answer the research question.[1]. Ethical approval to access this data was granted by the Scottish Government in January 2017 (project number SG000-000850). Specifically, access was granted to the entire SCS from 2014-2016, for all social care clients in Scotland aged 50 and over. This data were made newly available as part of this project and as such a significant amount of time was spent pre-processing them, before using them in the analysis in Chapters 2 and 3.

In summary, the changing policy landscape in Scotland surrounding LTC provision highlights the Scottish Governments commitment and interest in improving care that is delivered to older people, their health, their access to services, as well as ensuring that unpaid carers are supported in their roles. At a time when Scotland is faced with an increasingly older population who are often living with multiple chronic conditions, it is becoming increasingly important that we understand the provision of LTC services to those individuals.

This thesis presents three standalone research papers on several of the fundamental emerging issues surrounding LTC provision to older adults in Scotland. Chapters 2 and 3 are solely my own work, whilst Chapter 4 is co-authored with my primary supervisor Professor David Bell[2]. In what follows is a brief description of each of the three chapters, including their aims, contributions, methods and results.

Chapter 2: Variations in Domiciliary Free Personal Care Across Scottish Local Authorities

The first paper is focused on the provision of formal care services. In particular, domiciliary FPC services in Scotland. The responsibility for the provision of these services is held by individual local authorities, which can mean that despite central government's pledge to the universal coverage of services, disparities at the local level can still arise. In fact, the starting point for the paper originates from the existence of stark differences in the provision of FPC to the over 65s between local authorities. These differences were previously noted by two independent reviews of FPC that were carried out in 2008 by Audit Scotland and Lord Sutherland (Sutherland 2008, Audit Sotland 2008). The paper aims to examine whether or not these differences can be explained by measured

[1] Further details on accessing the data can be found here.

[2] David's input into this chapter was in the early stages of the research via discussions surrounding the application of the SoL framework to unpaid carers, after which the work in this chapter is entirely my own.

need. In turn, this investigation permits us to determine the existence of geographic inequity in FPC provision and the factors which might drive such inequity.

The paper contributes to the existing research on equity in care provision in several ways. Firstly, the majority of the literature focuses on equity with respect to health care services, whilst this paper focuses on equity within the long term care market. Secondly, it explores geographic inequity, which has also largely been ignored by the existing literature. Moreover, the Scottish context offers a unique opportunity to investigate geographic variation in LTC provision due to its commitment to the universal coverage of such services. Lastly, the paper makes use of an unexampled administrative dataset which allows an investigation of FPC provision to be carried out at lower levels of geography.

The investigation into geographic inequity begins with a descriptive analysis into the potential influences on the provision of FPC within a local authority, followed by the development of basic econometric models to look at those influences in one framework at both the local authority and lower data zone level geographies. We use a mixture of publicly available and administrative data sources over the period 2013-2016.

In summary, the paper concludes that there is evidence of geographic inequity in the provision of FPC in Scotland. In particular, the analysis suggests that the differences between the FPC rate and the rate of disability are not consistent across local authorities, suggesting that a needy individual might be more or less likely to receive care depending on where they live. One explanation for this is that local authorities differ in terms of their practices for managing the demand for FPC. In any case, the results suggest that there is potentially unmet need for FPC. Whilst unmet need is difficult to measure, its existence will inevitably lead to an increased reliance on unpaid carers to step in and fill the gap. At a time when resources for LTC are being squeezed, governments might even try to encourage unpaid carers to step in, to reduce pressure on government-provided care such as FPC. It is therefore crucial to understand the role that unpaid carers play in the provision of LTC and how they might influence older peoples' use of formal care services. Chapter 3 aims to add to this understanding.

Chapter 3: Utilisation of Personal Care Services in Scotland: the Influence of Unpaid Carers

The availability of unpaid care is recognised as a potential influence on the demand for paid care services since one might substitute or complement the other. The current restructuring of policy surrounding unpaid carers in Scotland, in particular the Carers Act (Scottish Government 2017*a*), is aimed at supporting unpaid carers in their role and might encourage unpaid carers to undertake care-giving roles. At the same time, population ageing and the increased likelihood of older individuals living with multiple chronic health conditions is also contributing to an increased demand for unpaid carers.

If unpaid care substitutes paid care, then such policy and demographic shifts could lead to a decreased demand for formal care services provided by the government. On the other hand, if unpaid care complements formal care, then there could be an increased demand for those services and as a result an increased strain on the public purse. Therefore, in order to anticipate the effect of such changes on the overall distribution of LTC provision, it is essential to understand the

relationship between the two care channels.

Chapter 3 seeks to do this by looking at the interaction between paid and unpaid care, and determining whether or not unpaid care and paid care are substitutes or complements – a matter which is fiercely debated in the existing literature.

Specifically, the aim of the paper is to explore how unpaid carers influence FPC use by Scots aged 65 and over. Once again, the Scottish context provides an interesting context in which to investigate this relationship since personal care is provided for free, with no means test, to all individuals aged 65 and over. This policy might alter the incentives faced by unpaid carers and as a result lead to different conclusions about how unpaid care affects FPC use, when compared to other jurisdictions.

The paper contributes to the existing literature by investigating the relationship between unpaid and paid care, using Scotland's unique administrative Social Care Survey (SCS) data for the years 2014- 2016. We compare Ordinary Least Squares (OLS), Generalised Linear Models (GLM) and Two-Part Models (2PM), and conduct a variety of sensitivity analysis to deal with endogeneity concerns.

The findings from the models suggest that unpaid care and personal care services are complements. In particular, the presence of an unpaid carer increases weekly personal care hours by about 1 hour and 14 minutes per week, on average, ceteris paribus. This relationship might be due to unpaid carers advocating on behalf of the cared for, and demanding services from the local authority for them. They might do this because they require more support to enable them to remain in the labour force. It might also be the case that the type of care unpaid carers provide is different to that provided by formal carers.

The implications of this result are concerning for two reasons. Firstly, it might imply that encouraging unpaid care, as might be the case due to the new Carers Act and proposed increase in the Carers Allowance in particular, could lead to increased costs to the government as unpaid carers put pressure on local authorities to increase the care provided to their family members. Secondly, the finding highlights a potential concern surrounding the well-being and outcomes of older adults who do not have an unpaid carer present to help them access the care that they might need. Unmet need has also been identified in formal care recipients who have an unpaid carer helping them (Brimblecombe et al. 2018). The existence of such unmet need once again puts pressure on unpaid carers to support older people and there are most likely to be costs associated with that. Some of those potential costs are explored in Chapter 4.

Chapter 4: The Cost of Unpaid Care: a Standard of Living Approach

Once again, the finding of a complementary relationship between paid and unpaid care could mean that a consequence of an increase in the provision of unpaid care is pressure on the public purse due to a heightened demand for formal care services. Of course, this is only one side of the coin and with an increased provision of unpaid care comes an increased need to understand the consequences of unpaid caring from the caregiver's perspective.

Whilst it is widely acknowledged that unpaid carers experience costs due to care giving – carers are given a Carers Allowance in the form of a cash benefit to help them cover such additional

costs - they are seldom recognised in economic evaluations. Ignoring the costs of unpaid care in this way could lead to an inefficient allocation of resources.

This paper seeks to add to the literature on the consequences of unpaid care by estimating the monetary cost associated with the provision of unpaid care provision. In particular, we use data from Scottish households in the 2013/14 – 2016/17 UK Family Resources Survey (FRS) to estimate the cost of unpaid care in terms of any change in Standard of Living (SoL) an unpaid carer experiences, due to their care giving role. In doing so, we aim to provide evidence for the extent to which the current Carers Allowance appropriately compensates unpaid carers for the service they provide.

We contribute to the literature by focusing on the material impact of unpaid care provision rather than on time spent caring, which is the common approach in the existing literature. Moreover, we offer the first evidence on the ability of the Carers Allowance to compensate carers for the additional material costs they face due to care giving.

The findings from the paper suggest that unpaid caring is associated with a significant reduction in SoL, especially for those who live with the person they are caring for. Specifically, depending on which functional form of income the model supposes, we find that unpaid carers who are living with the person being cared for would need to be compensated by around £229 per week in order to reach the same SoL as their non-caring counterparts. We conclude that the existing Carers Allowance falls considerably short of compensating unpaid carers for the reduction in SoL they experience due to care giving. In particular, it would need to increase to a level that is at least 3 times higher.

The remainder of this document will present the three papers as standalone research outputs, each with their own review of the existing literature, methods, results and discussion. Once again, the three papers are thematically bound together by the overarching concept of LTC provision to older adults in Scotland. In a final step, Chapter 5 offers a summary of the findings and suggests the potential implications of this body of work for future research in the area.

2 | Variations in Domiciliary Free Personal Care Across Scottish Local Authorities

Elizabeth Lemmon

Abstract

Equity, or equal access for equal need, is frequently an objective of social care systems. However, responsibility for social care provision often lies with local government. This can mean that, despite central government commitment to universal coverage, geographic variation in the provision of services may occur. In this paper an investigation into the variation in free personal care (FPC) in Scotland, a service provided to those aged 65 and over who need help with personal care tasks such as washing and dressing etc, is conducted. To do this, a mixture of publicly available and administrative data sources over the period 2013-2016 are used. Both descriptive and econometric methods are employed to investigate the existence of geographic inequity in FPC provision. The results suggest that the variation in FPC provision is not fully explained by variation in measured need, implying that inequity exists between local authorities, suggesting that receipt of FPC might be more or less likely depending on which local authority a person lives.

2.1 INTRODUCTION

The notion of universal coverage is generally understood to imply equal provision for equal need, irrespective of other factors such as geography, income, ethnicity etc. This concept of equity implies that there are no differences in access or use of services where needs are equal (Mangalore & Knapp 2006). Equity is recognised by the World Health Organisation (WHO) as a desirable goal for all health systems (WHO 2000). In 2017, the Commonwealth Fund ranked the NHS in the UK as first in terms of equity of provision, in a comparison with ten developed health systems (Schneider 2017). However, despite best efforts of most European countries, barriers to equal access to care still persist (Doorslaer et al. 2004, Terraneo 2015).

This paper aims to determine whether or not variation in Free Personal Care (FPC) provision across Scotland is matched by similar differences in personal care need in the population. In doing so, it aims to offer evidence on the existence of geographic inequity in FPC provision is, alongside evidence of what factors could be driving this inequity. Understanding the existence and extent of inequity within health and care systems has attracted much attention in the literature. In terms of health care, inequity has been identified with respect to income (d'Uva & Jones 2009, Doorslaer et al. 2004) and various indicators of socio-economic status such as education, ethnicity and employment status (Terraneo 2015, Regidor et al. 2008, d'Uva & Jones 2009).

The existing literature on inequity with respect to healthcare provision can be grouped in two

ways. The first focuses on horizontal equity, as described above, which is defined as the equal treatment of individuals with equal need. These studies generally aim to measure the extent of horizontal inequity, typically by using some version of a Concentration Index whereby the actual distribution of health care utilisation (ranked by some socio-economic indicator) is compared to a needs adjusted distribution of utilisation (d'Uva et al. 2009, Wagstaff & Van Doorslaer 2000, Van Doorslaer et al. 2000, Doorslaer et al. 2004, García-Gómez et al. 2015, Van de Poel et al. 2012).

The second approach focusses on explaining variation in health care utilisation and attempts to identify the factors which drive this. These studies use regression analysis to explicitly model utilisation as a function of both needs and non-needs factors (Trydegård & Thorslund 2001, Propper et al. 2005, Regidor et al. 2008, Cookson et al. 2012, Fernandez & Forder 2015, Otto et al. 2018, Yardim & Uner 2018, Terraneo 2015, Morris et al. 2005, d'Uva & Jones 2009). In such models, the significance of non-needs variables are interpreted as evidence of inequity in provision (d'Uva & Jones 2009). Unlike the first approach, which is limited in its focus on horizontal equity, the second approach also incorporates the principle of vertical equity (Abasolo et al. 2001). That is, individuals with greater need should receive more treatment.

In this paper the focus is shifted from equity in the provision of healthcare to equity in the provision of long term care (LTC). In Scotland, LTC services are organised and delivered by each of the 32 local authorities. The starting point for the focus on LTC stems from the existence of stark disparities in the provision of free personal care (FPC) between local authorities in Scotland. To be specific, based on our definition of care provision, the rate of provision in some local authorities is up to double that of another.

As discussed in Chapter 1, Free Personal and Nursing Care (FPNC) was introduced in Scotland in 2002, on the back of the Royal Commission's main recommendation (recommendation 6.4)(Royal Commission on Long Term Care 1999, Chapter 6). The basis for their recommendation stemmed primarily from a desire for equity in relation to the costs faced by, for example, a cancer patient and a dementia patient, who would face similar costs yet only a cancer patient would receive treatment free of charge. For this reason, the report proposed that personal care should be available to those in need, without a cost (Royal Commission on Long Term Care 1999). The FPNC policy can be split into two categories: care in care homes (which covers personal and nursing care) and care at home (which covers personal care only). This paper is concerned with the latter and will here on be referred to as FPC. This part of the policy states that personal care should be free to any adult over the age of 65 who requires it, subject to a needs assessment.

As with any universal coverage of health or social care, the FPC policy is intended to promote geographic equity in personal care (CDG 2001). Eligibility for FPC is subject to a needs assessment, carried out by the local authority. The Scottish Executive's guidance for local authorities on FPNC set out information on the needs assessment of individuals. Specifically, older persons' needs are assessed according to the Single Shared Assessment of Community Care Needs (Scottish Executive 2001*b*). This process involves a set of minimum standard check-lists to be used by local authorities when assessing the care needs of older people within their area. The assessment of care needs then determines a Resource Use Measure (RUM) to indicate what resources are required to meet the individual's needs. RUM was developed especially to promote equity in care provision

between local authorities as it was noted at the time that often people with the same needs would get differing levels of service depending on where they live (Scottish Executive 2001*b*).

In 2008, Audit Scotland and Lord Sutherland reviewed FPNC in Scotland (Sutherland 2008, Audit Scotland 2008). Both reports highlighted equity concerns surrounding the variability in provision of care between local authorities. The Audit Sotland (2008) report also identified that ambiguities in the FPNC guidance and legislation led to distinct local authority interpretations, and thus differences across Scotland, in how FPNC was implemented. Furthermore, the reports noted that local authorities were using eligibility criteria and waiting lists as a means to manage demand for FPC. This resulted in older people receiving different levels of service depending on where they lived. As a result of recommendations from the reviews, the Scottish Government and the Convention of Scottish Local Authorities (COSLA) developed a set of national standard eligibility criteria and waiting times for FPNC under the National Eligibility Criteria framework (Scottish Government 2009). The aim of such a framework was to achieve greater consistency across local authorities and transparency with respect to access to services for older people.

However, whilst the framework provides guidance on how to prioritise personal care clients according to their need, it remains the responsibility of individual local authorities to assess the needs of each person, via the single shared assessment, and ultimately decide whether or not their needs warrant care provision at home. Therefore, it is still possible that local variation in FPC provision persists. Since the National Eligibility Criteria were established, there has been no formal review of geographic variation in FPC provision across Scotland.

Furthermore, Scotland's LTC system has been subject to significant legislative change in recent years. Differences in the interpretation of these changes may have led to differences in the implementation of care provision across local authorities, as might legacy effects of their own previous care policies. At the same time, the decentralisation of health and care funding means that local authorities can make their own decisions about care provision, and even in a system with legislated universal coverage, significant variation between local authorities is possible.

This paper aims to examine whether the disparities in FPC provision are matched by local levels of need. Aggregated data at different geographical levels are used. In particular, local authority and lower "data zone"[1] levels. This permits us to firstly check whether equity is achieved at a local authority level, and secondly, to identify those factors associated with inequity in provision. We also estimate spatially autoregressive models to investigate whether there are FPC provision spill over effects to neighbouring areas.

The paper contributes to the equity literature in four unique ways. Firstly, it focusses on equity with respect to social care or LTC, which has received little attention in the literature (García-Gómez et al. 2015, Fernandez & Forder 2015). Secondly, it investigates geographical equity, which has also been largely neglected in the literature. Thirdly, the Scottish context for LTC services provides a unique backdrop to study equity, since unlike many social care systems, LTC services in Scotland have a universal coverage element. In addition to this, Scotland is soon to be devolved powers over disability benefits from Westminster, increasing the importance of understanding the demand for such benefits, which are likely correlated with LTC services. Finally, it exploits a unique administrative dataset.

[1] A data zone is a small-area statistical geography in Scotland containing populations of between 500 and 1,000 residents.

The remainder of the paper is structured as follows: Section 2.2 describes the data and key variables. Section 2.3 outlines the descriptive and multivariate analysis. Section 2.4 presents the results. Finally, Section 2.5 discusses the results and concludes.

2.2 KEY VARIABLES & DATA

This section outlines the key variables, alongside their data sources, which will form the model of FPC provision in Scotland, formally outlined in Section 2.3. The data used for the analysis come from a combination of publicly available sources and administrative data held by the Scottish Government, namely the Social Care Survey (SCS)[2]. A description of each variable and its corresponding data source can be found in Table 2.3 in the Appendix.

Key Variables

Free Personal Care Rate (FPCR)

The FPCR within a local authority is the proportion of those aged 65+ receiving FPC. In a traditional market setting, the FPCR would be determined by the interaction of demand and supply influences. However, in the market for FPC in Scotland, since the price of FPC is zero, demand for the service would be infinite and as a result the supply of FPC becomes a binding constraint. Thus, we observe only those clients who actually receive FPC - the so called 'met need' for FPC. As discussed, the FPC legislation requires that care should be provided on the basis of individual need.

Need

We have chosen to use disability benefits data to measure local authority need for personal care. The two main disability benefits available to older people in Scotland are Attendance Allowance (AA) and Personal Independent Payments (PIP). Formerly, PIP was called Disability Living Allowance (DLA). An individual can only receive one of these benefits and both are administered at a UK level by the Department for Work and Pensions (DWP). Receipt of either benefits has no implications for receipt of FPC at home and like FPC, neither benefit is means tested. We argue that since the assessment for disability benefits is uniformly administered across Scotland by DWP, receipt of the benefits should not be affected by geography and it will therefore accurately represent personal care needs across the whole of Scotland. Furthermore, as far as we are aware, there is no existing evidence to suggest that take up rates for disability benefits differ across Scotland.

AA is a disability benefit that is exclusively available to older people (aged 65+) who have a disability severe enough that they require someone to help look after them. This help is specifically help with personal care such as washing, dressing, eating, using the toilet etc. Thus, the AA provides a good indicator of the level of personal care need of the population aged 65+. AA is paid at two different weekly rates which depend on the level of disability a person has, and therefore the level of help they require. The lower rate is paid if the person requires "frequent help or constant supervision during the day, or supervision at night" (GOV.UK 2018*a*). The higher

[2]Ethical approval to access this data was granted by the Scottish Government in January 2017. Project number:SG000-000850.

rate is paid for those who require "help or supervision throughout both day and night" or for the terminally ill (GOV.UK 2018*a*).

PIP is a disability benefit available to those aged 16-64 to help with extra costs that are caused by a long term ill-health or disability. To be eligible for PIP this health condition or disability must cause the individual difficulties with daily living or getting around (or both). Furthermore, an individual must have been experiencing these difficulties for 3 months and expect them to continue to affect them for at least 9 months (GOV.UK 2018*b*). An individual who received PIP before the age of 65 will continue to receive it beyond 65 and will not be eligible for AA. PIP is comprised of two parts: a daily living part and a mobility part. An individual can receive one or both of the PIP components, depending on how severely their disability affects them. As with AA, each part has a lower and higher weekly rate.

In order to claim AA or PIP, an individual must complete a detailed form, which describes their level of disability or illness and its effects. Both benefits cover detailed questions about personal care needs. The DWP use this information to determine eligibility and at what rate. In some circumstances DWP might contact the applicant's GP for confirmation of medical information or arrange for a health professional to visit the applicant to carry out a face-to-face consultation or medical examination.

The data on these benefits is used to calculate the Disability Rate (DR) for each local authority in Scotland, which is the proportion of the population aged 65+ receiving AA or DLA/PIP. Since the assessment for disability benefits should be uniformly administered across Scotland by DWP, such data should not be affected by geography. Furthermore, the spread of disability within a local authority could indicate how needs are distributed and as a result play a role in determining the FPCR. Specifically, if disability is more spread out, then there are likely to be individuals from both ends of the needs distribution within the population. As a result, local authorities with needs that are more spread out might benefit from an economies of scale type effect compared to those with a narrow spread. To capture this, we calculate the standard deviation of the DR from the data zone level DRs.

Other individual characteristics which have been shown to predict need for LTC and which include age and gender (Keene & Li 2005). We therefore also include the number of people aged 80+ and the number of females aged 65+ as a proportion of the population aged 65+, as possible indicators of the FPCR by local authority. In addition, we include life expectancy at age 65 since this could also provide an indication of the need for FPC. These data come from the National Records of Scotland (NRS).

It is argued that the DR, as calculated using the disability benefits described above, will provide a strong measure of the personal care need of the population because the assessment for those benefits is specifically based on the need for personal care. Compared to previous literature, which uses indirect measures of need such as age, gender and life expectancy, this approach provides a direct measure of personal care need.

Funding and Spending

Although local authorities have a legal obligation to provide FPC to those who need it, they are limited in the resources they have to do so. Their funding comes largely from the Scottish

Government, though they also raise revenues through council tax, fees and charges. The Scottish Government allocates revenue funding to each of Scotland's 32 local authorities through the Grant Aided Expenditure (GAE). The total GAE is split into 89 individual local authority sub-services and each sub-service has its own allocation methodology (The Scottish Government 2017-18). The methodology behind GAE aims to take into account the needs of the local authority populations, and allocates funds accordingly. Those allocations are largely proportional to the size of the relevant population in each local authority. Adjustments are made to take into account of differing levels of demand and costs of service provision within these populations. Primary and secondary indicators, i.e. those factors which significantly influence the expenditure for a particular service, are used to make these adjustments [3].

One of the social work sub-services is 'Personal and Nursing Care for Older People'. This is the GAE line which distributes resources for FPC at home and Free Nursing Care payments to self-funders in care homes. The primary indicator used for allocation comes from the Scottish Government Health Directorate Distribution [4]. This distribution uses a composite index made up of five other indicators: Limiting Long Term Illness, Single Owner Occupiers, Council Tax Bands, Pensioners Living Alone, and Standard Mortality Rate. This composite index is then multiplied by the number of people in the age group and further by an historic case load age band weight. The sum of these age groups gives the final GAE allocation for each local authority.

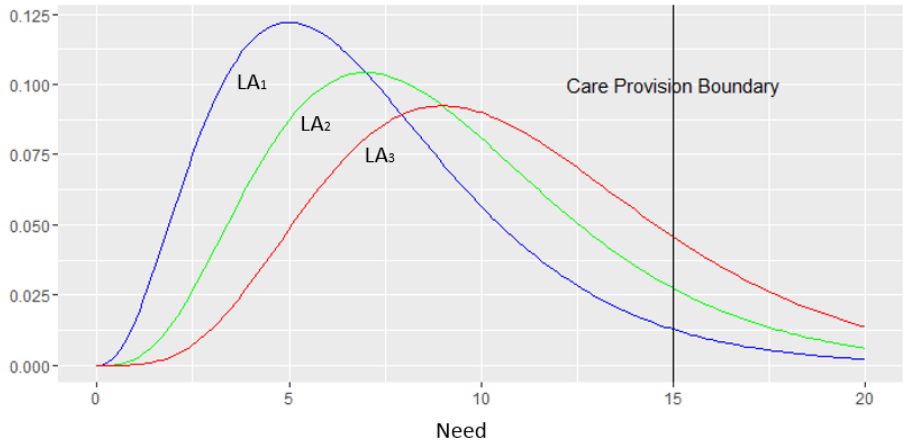
We use GAE data on local authority allocations for the social work sub-service on personal care described above, to calculate each local authority's FPC income per FPC person. This measure indicates the relative size of each local authority's allocation for FPC. Whilst local authorities must meet their statutory duties, one of which is to provide personal care for free to those aged 65+, GAE is simply an allocation methodology. The allocations are not budgets or spending targets and they are not intended to be used by local authorities to allocate resources. Therefore, the decision about spending on specific services like FPC is left entirely up to individual local authorities. As long as they meet their statutory duties, they have latitude to reallocate funding either into or out of FPC support for older people. For this reason, we also use local authority expenditure data and local financial statistics data to calculate expenditure on FPC per FPC client.

The amount a local authority spends on FPC may also provide some indication of the needs distribution of clients within the local authority, since we would expect higher expenditure per person to be associated with higher needs, and thus a lower FPCR. This is demonstrated in Fig. 2.1. Three local authorities are shown in the figure, each with a different distribution of personal care need within their respective populations. For example, the first local authority, LA_1, has needs which are slightly more skewed to the left compared to the two other local authorities. The care provision boundary, or the minimum provision requirement of local authorities, is shown by the vertical line on the right hand side of the figure. In practice, this represents the minimum requirement on local authorities to provide FPC to those assessed as having 'critical' or 'substantial' risk, according to the National Eligibility Framework (Scottish Government 2009). Clearly, LA_3 has a higher proportion of its population who fall above this cut off compared to LA_2 and LA_1. Thus, LA_3, might expend all of its resources in order to meet its statutory duty, whilst LA_1 could actually

[3] For a full description of how indicators are identified please see The Scottish Office (1992)

[4] The methodology was agreed in 2006 by the Scottish Government's Residential Care Funding Distribution Working Group. This group was set up by the Settlement and Distribution Group (SDG). The methodology papers were not published.

Figure 2.1: Local Authority Distributions of Need



increase provision to individuals who fall below the cut off. It is therefore possible that a local authority incurs higher expenditure per FPC person while having a lower FPCR overall.

In summary, the fact that local authorities have the final say over spending on FPC, it might mean that despite a statutory duty to provide care to those in need of personal care, there could still be differences in rates of provision between local authorities, even after accounting for need.

Other Influences

There are also other factors to consider which might influence the FPCR within a local authority and lead to differences in rates of provision.

Awareness

The level of awareness within the local authority population might be a further factor which could influence the FPCR. The Scottish Executive explicitly puts the onus on individuals to apply for help with their care (Scottish Executive 2003). As a result, a lack of information about FPC and how to access it could be a barrier to receiving care (Brimblecombe et al. 2018). Further, if awareness of the FPC policy differs between local authority populations, this could lead to variations in the FPCR. The level of awareness could differ between local authorities due to the quality and accessibility of the information they provide (Dickinson et al. 2007). One factor that might be associated with awareness is education. It is likely that individuals with higher levels of education, are better able to be informed about care services and are therefore more able to access them (Terraneo 2015). To calculate this, we take the Scottish Index of Multiple Deprivation (SIMD)[5] education rank to calculate the local authority shares of the top 20% most education-deprived data zones.

[5]The SIMD is a tool developed by the Scottish Government which measures deprivation and poverty in Scotland. The tool is based on a number of deprivation indicators which are used to create different domains, e.g.income, education and employment. Scotland's data zones are then ranked according to those domains, going from the most deprived to the least deprived. (Scottish Government 2016*c*)

Income

Although receipt of FPC is not means tested, the income of the local authority population may still influence the provision of FPC services. For example, when local authorities are assessing the FPC needs of individuals they might implicitly discriminate based on their impression of the resources available to the person they are assessing. This might result in local authorities with a higher income population having a lower FPCR, since assessors assume that those individuals can afford to get care elsewhere. At the same time, a higher income means that an individual will have more choice about where to receive care, and thus might be more likely to substitute towards other providers of personal care, for example, private providers. This would result in a lower FPCR in higher income local authorities. Further, those with higher incomes might be less willing to claim such benefits because of the stigma that is often associated with benefit dependency. On the other hand, income is likely to be correlated with education, so we might expect that higher income local authorities would have a higher FPCR due to the increased awareness of their population. To measure income we once again utilise data from the SIMD dataset, this time to calculate the proportion of the local authority population that are classed as being income deprived due to their living in a low-income data zone.

Transaction Costs

A further factor which might influence the FPCR is the cost associated with accessing personal care. First, an individual might have to search for information on FPC before applying. This could involve time searching online, speaking to their GP, phoning the local authority etc. Second, the individual has to complete the application process i.e. fill in the relevant form, send it away, wait for an assessment and have the assessment carried out. This process can be time consuming, complex and bureaucratic, and the higher are such transaction costs, the lower will be the FPCR, because we would expect that some individuals are not able or willing to see this process through to the end. Research carried out in England found that transaction costs like these were a key barrier to accessing social care services (Brimblecombe et al. 2018). This effect may be moderated if the affected individual has access to support from paid or unpaid carers or from health or social care professionals.

We propose that rurality could be a factor which affects access. We might imagine areas with a higher level of rurality to have a lower FPCR because the transaction costs associated with accessing care services are likely to be higher for example due to long travel times and slower internet connections.

We therefore use the Scottish Government's Urban Rural Classification to determine the proportion of the local authority geography which is classed as being rural as a potential correlate of the FPCR rate. Specifically, we use the 8-fold classification to calculate the share of local authority data zones which are classified as being either remote and rural or very remote and rural (Scottish Government 2016*b*).

Political Preferences

The political preferences within a local authority might influence the FPCR. In their paper, Fernandez & Forder (2015) hypothesise that areas with more Conservative political preferences, which typically favour smaller government, will provide less services compared to other parties. This is a result of their larger dis-utility from increased taxation and smaller marginal utility for service provision. Indeed, their results show that areas with Conservative party control spend less on LTC provision compared to Labour-controlled areas (Fernandez & Forder 2015). To capture this effect, we decided to use data on the share of Conservative first preference votes within Scottish local authority elections. One caveat is that older people are more likely to vote conservative and possibly then ensure support for provision of services for older people. We decided to let the data determine whether conservative first preference votes are associated with a higher provision of FPC.

Availability of other forms of care

Another factor which might influence the FPCR in a local authority is the availability of other sources of personal care. Given that someone is able to choose where to receive personal care services from, a greater supply of other sources of care increases the personal care choice set available to older people, and this will decrease the likelihood of them choosing local authority FPC. The availability of other personal care sources might differ between local authorities.

The most common alternative source of personal care services comes from unpaid carers, usually family members, friends or neighbours. The relationship between FPC and unpaid care is ambiguous. If unpaid care and formal care are substitutes we might expect a higher rate of unpaid care to be associated with a lower FPCR, since unpaid carers provide personal care services instead of the local authority. On the other hand, it might be that unpaid carers complement formal care provision by advocating on behalf of the person they are caring for and increase the demand for local authority FPC. We use information from the 2011 census to calculate the proportion of unpaid carers within the area. Furthermore, since household composition is highly correlated with unpaid care we also calculate the proportion of married couples within a local authority from the 2011 census data (Comas-Herrera et al. 2007, Pickard et al. 2000).

In addition to unpaid care, the availability of care home places could also impact the FPCR, again because individuals requiring personal care have more choice about where to receive their care. Care homes may be operated by local authorities, private companies and voluntary organisations. We use Scottish Government Care Home Census data on the number of registered care home places available for older people.

The next section outlines the formal model of FPC provision.

2.3 ANALYSIS

Thus far we have discussed a range of factors which might influence the FPCR within a local authority. As a result, we are interested in a relationship of the form:

$$y_{it} = f(n_{it}, m_{it}, a_{it}, g_{it}, p_{it}) \tag{2.1}$$

Where:

i	geography (local authority; data zone)
t	time period in years
y_{it}	the free personal care rate
n_{it}	needs-related characteristics
m_{it}	availability of other forms of care
a_{it}	access to care indicators
g_{it}	expenditure on FPC
p_{it}	political preferences

In Eq. 2.1, we postulate that the FPCR is a function of the factors discussed in Section 2.2. In the first stage of analysis, a descriptive exploration of FPC provision across the 32 local authorities in Scotland is conducted, in order to establish whether variation in service provision exists. We look at the relationships between the FPCR and the factors discussed, to determine which factors might be contributing to this variation. This involves both graphical representations of the data and bivariate Pearson correlations, the results of which are presented in Section 2.4.

In a second stage, we conduct a more thorough econometric analysis to identify the factors that are associated with the FPCR. This analysis also allows us to determine if there is inequity with respect to factors not directly related to need, in particular, geography.

In the first instance, the empirical model to be estimated is as follows:

$$y_{it} = \alpha + \boldsymbol{X_{it}}\boldsymbol{\beta} + u_{it} \tag{2.2}$$

Where i once again indicates geography which is either local authority or data zone, and t indicates the year. The vector $\boldsymbol{X_{it}}$ includes all factors affecting the FPCR as discussed above, and β captures their corresponding effects. u_{it} is a random error term with mean zero and constant variance.

At both the local authority and data zone levels, Eq. 2.2 is estimated in its pooled form and via fixed and random effects. In the latter cases, the error term u_{it} can be decomposed into two parts so that $u_{it} = v_{it} + c_i$. In this case, c_i is a time invariant effect for each local authority or data zone i. Compared to the fixed effects specification, random effects is more efficient because it makes use of both within group and between group variation (Hsiao 2007). However, it requires the additional assumption that there is no correlation between the time invariant group specific effect and the included regressors i.e. $corr(c_i, \boldsymbol{X_{it}}) = 0$. We use a test proposed by Hausman (1978) to check this assumption and choose between fixed or random effects. The time series models are estimated in Stata 15 using the `xtreg` command. In the data zone level specification of Eq. 2.2, due to data restrictions [6], the model is estimated using 2013 and 2014 data only.

One of the concerns with the model as presented in Eq. 2.1 is that the error term might not be independently identically distributed due to the omission of spatial or spillover effects. That is, local policy decisions create externalities outside of the local authority area (Fernandez & Forder

[6] Specifically, the benefits data used to calculate the DR have 2001 data zones, the SCS data used to calculate the FPCR are available for 2013-2016 and use 2011 data zones in 2016, lastly the NRS data on population estimates using 2001 data zones are only available for 2013 and 2014.

2015, Moscone et al. 2007, Moscone & Knapp 2005). In their paper investigating variation in LTC expenditures in England, Fernandez & Forder (2015) provide several potential explanations for the existence of spatial effects. This occurs firstly because local authorities with a high rate of care provision might attract clients from outside their local authority area and as a result local policy makers incorporate the care provision decisions of their neighbouring local authorities when setting their own agenda. Secondly, information spill overs regarding care provision and policies are likely between neighbouring authorities. This might result in similar levels of care provision and policies between neighbouring constituencies since local officials are more able to exchange information with neighbouring officials. Furthermore, they might be expected by their constituents to maintain levels of provision that are similar to surrounding areas. (Fernandez & Forder 2015). Other explanations for spatial effects include contextual factors which might affect provision over a wider geographical area such as long term unemployment and mimicking effects whereby contiguous areas mimic one another based on their good (or bad) performance (Moscone & Knapp 2005).

Thus, in a second step, we follow Fernandez & Forder (2015) and explicitly test for possible policy spill overs by estimating a spatial autocorrelation model. This involves adding both a spatial autoregressive FPC term (y_{-i}) and a spatial autoregressive error term. The empirical model to be estimated becomes:

$$y_{it} = \alpha + \rho W y_{-it} + \boldsymbol{X_{it}\beta} + u_{it} \tag{2.3}$$

In Eq. 2.3, ρ is the autoregressive spatial coefficient of the FPCR and it will indicate the extent to which there are FPC policy spillovers between nearby areas, as defined by the NxN non-negative spatial weighting matrix W. The W matrix in this model assumes that there are potential spillover effects between areas which share a border or a vertex. That is $W_{ij} = 1 \forall i \neq j$ if area i and j share a common border or vertex and 0 otherwise. Now, $u_{it} = e_{it} + \lambda W \epsilon_{it}$, where λ is the coefficient on the spatial error lag ϵ_{it} and e_{it} is an independently identically distributed error term. λ will indicate the extent to which there are spill overs in both shocks to the FPCR and unobserved spatial heterogeneity between nearby areas. The spatial models are estimated separately for each year at both the local authority and data zone levels using Stata's `spregress` command. The spatial time series models are estimated using the `spxtregress` command.

The following section outlines the results from the descriptive and econometric analysis.

2.4 RESULTS

In this section we will present the results from the local authority level descriptive analysis. As a starting point we look at how the FPCR differs between local authorities and check if those differences coincide with differences in the DRs. We also present the results from a bivariate exploration into the relationships between the key variables identified, and the FPCR.

Figure 2.2: 2013-2016 Free Personal Care Rate by Local Authority

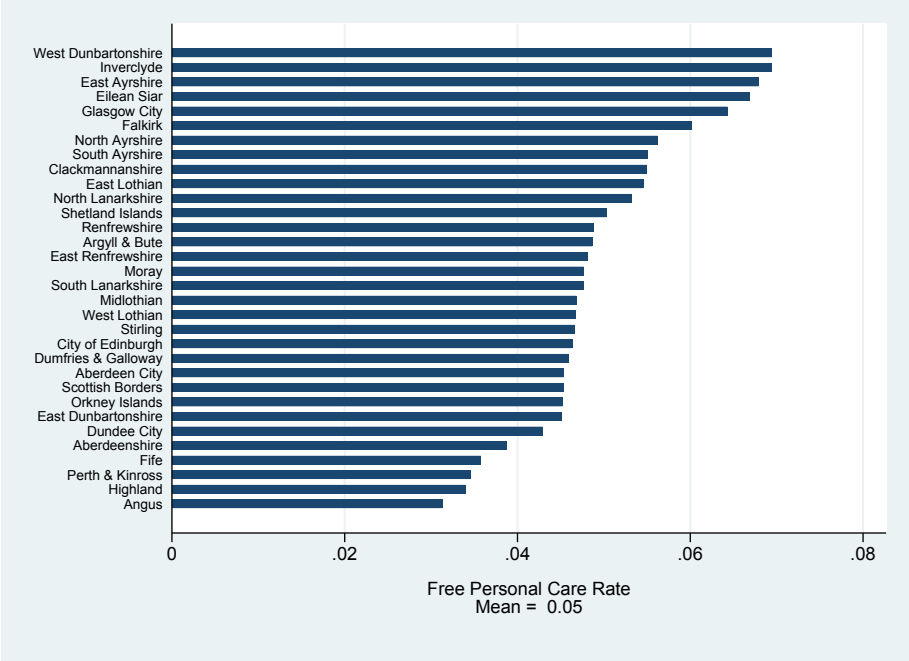
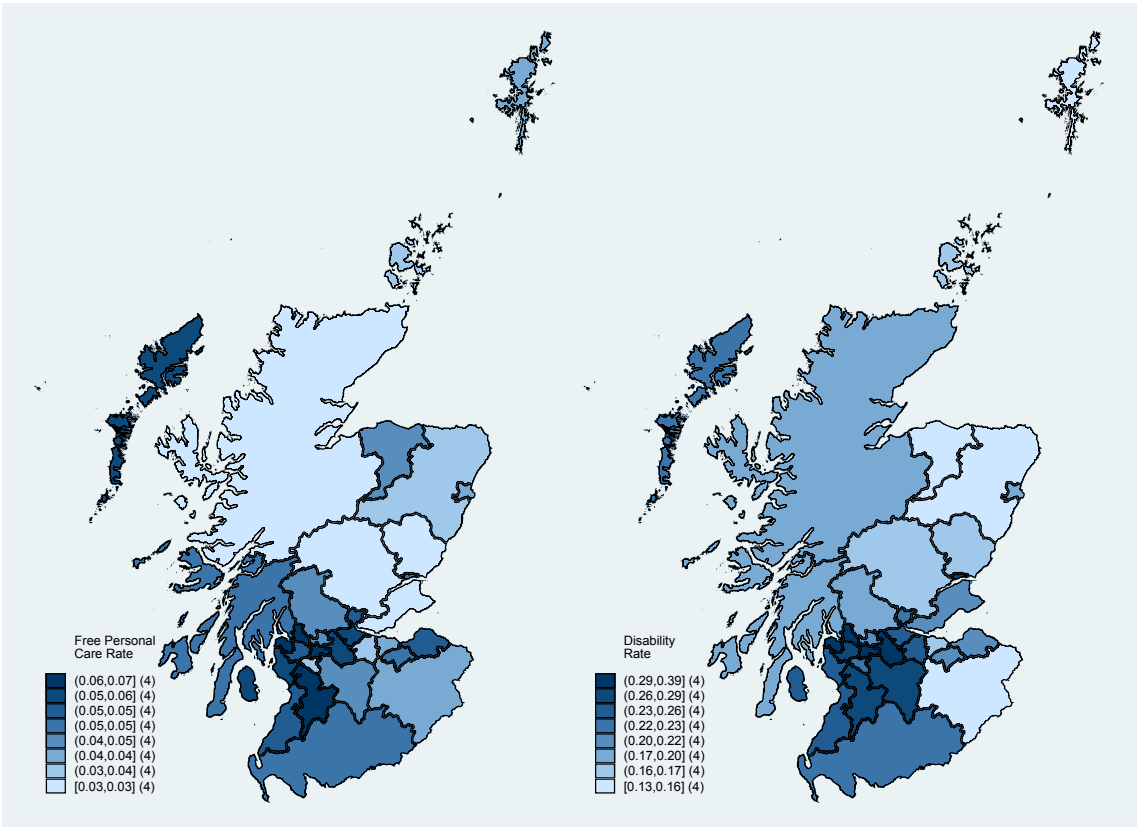


Figure 2.3: 2016 Free Personal Care Rate and Disability Rate



Descriptive Analysis

Fig. 2.2 charts the average FPCR between 2013 and 2016 for each local authority in Scotland. On average, 5% of the over 65s receive FPC, but this ranges from just 3% to 7% in some local

authorities. We might expect that this variation would be due to differing levels of need in the local authority populations. Furthermore, if the DR, as calculated using disability benefits, reflects the personal care need of the local authority population, and since personal care provision is based on need, we might expect the FPCR and DR would be similar.

However, the maps in Fig. 2.3 suggest that neither of these expectations looks plausible. The maps plot the 2016 FPCR and DR for each of the 32 Scottish local authorities. The distributions of each rate are divided into eight quantiles or octiles, meaning that four local authorities fall into each.

With respect to the latter expectation - that the DR and FPCR should be similar - the map legends show that the DR is consistently higher than the FCPR for all local authorities. If it is the case that the DR accurately reflects the personal care need of the population, this finding might suggest that there is some unmet need for personal care. Having said that, social care resources are scarce and thus it might seem acceptable that the FPCR is lower than the DR (Allin et al. 2010). At the same time, it is not necessarily the case that those who receive disability benefits, also need or want FPC.

Despite this disparity, our first expectation would lead us to predict that the relative differences between local authority FPCRs could be explained by the differences in their respective DRs. If this were the case, the patterns in the two maps would be identical. In other words, we would expect those local authorities in the top DR octile to also be in the top octile of the FPCR distribution and so on. It is immediately clear that more often than not, this does not hold. This variation might indicate that, for one reason or another, there is inequity in FPC provision between local authorities. That is, for a given level of disability, the provision of FPC is different depending on which local authority a person lives.

Fig. 2.3 points to the need for further investigation into the local authority variation in the FPCR. That is, there must be other factors besides the DR, which are affecting the FPCR.

Correlations

Fig. 2.4 shows scatter plots of those variables which had a statistically significant, at the 5% level, bivariate correlation with the FPCR [7]. The first scatter shows the relationship between the FPCR and the DR. As expected the Pearson correlation coefficient is positive. However, surprisingly the correlation is relatively low, suggesting that there must be other factors driving the FPCR.

Figure 2.4.2 shows that the proportion of the population aged 65+ who are female is positively associated with the FPCR. This positive relationship is consistent with research which shows that older women often have poorer health compared to men and thus might have a greater need for personal care (Yong et al. 2011, Josefsson et al. 2016).

Next, Figure 2.4.3 plots the correlation between the FPCR with the proportion of local authority population who are income deprived. In accordance with our initial expectations, local authorities with a high share of income deprivation, tend to have a high FPCR.

Figure 2.4.4 plots the FPCR against average life expectancy at age 65. The scatter shows that there is a negative relationship between the two. This might reflect the fact that a higher

[7] Please see Table 2.4 in the Appendix for the full set of correlations

Figure 2.4: Correlations

life expectancy is often associated with better health in older ages, and thus a lower dependency for FPC. This could be explained by the fact that the gap between life expectancy and healthy life expectancy - that is the number of years a person can expect to live in good health - is much larger in areas with high deprivation, and at the same time, average life expectancy is lower overall (Wood et al. 2006). This would imply that a higher life expectancy is generally associated with better health and thus a reduced need for FPC.

Figures 2.4.5 and 2.4.6 show that FPC expenditure and income, per FPC client, are negatively correlated with the FPCR. This negative relationship is consistent with the idea presented in Fig. 2.1. In particular, that local authorities in which the needs distribution is more negatively skewed i.e. a higher proportion of the population are in the highest needs categories, have to devote more resources to those in the highest need and therefore have a lower FPCR. As expected, figure 2.4.7 also suggests that the spread of disability within the local authority is positively related to the FPCR. This is consistent with the idea that local authorities in which disability is more spread out, benefit from an economies of scale type effect and as a result the FPCR is higher.

The following three plots demonstrate the relationship between the FPCR and other forms of available care. As expected, the living alone rate and FPCR are positively correlated, whilst the married rate is negatively correlated with the FPCR. These variables both indicate the availability of unpaid care, which is often provided by a partner or someone who is living with the person in need. Thus, a higher proportion of single person households, and fewer married couples, means the potential supply of other sources of personal care is lower, and as a result reliance on government

care is higher. Interestingly though, the proportion of the population providing unpaid care is positively associated with the FPCR. This association would support the view that unpaid care and formal care are complements.

Lastly, Figure 2.4.11 plots the FPCR against the share of the Conservative vote in the 2012 local council elections. As expected, the higher the share of the conservative vote, the lower the provision of FPC.

To summarise, the bivariate correlations are mostly consistent with our initial expectations and they have identified several factors which could contribute to the varying FPCRs across Scotland. However, the bivariate analyses has failed to isolate one or more variables that are strongly correlated with the FPCR. Specifically, we have shown that although the DR and FPCR are positively related, the local authority differences in the FPCRs do not seem to be matched by differences in the DR. Overall, the correlations were relatively low i.e. none > 0.63 and point to the need for further exploration into the variation in FPC provision across Scotland. The remainder of this section will outline the results from the multivariate analysis, which attempts to provide more robust evidence on the key drivers contributing to the disparities in the FPCR between local authorities in Scotland.

Econometric Analysis

Table 2.1 displays the output from the local authority estimations of Eq. 2.2 and Eq. 2.3. All models are estimated with robust standard errors. The independent variables included in the models correspond to those found to have significant Pearson correlation coefficients as presented in Fig. 2.4, with a few exceptions. Firstly, although the bivariate correlation between the proportion of the population aged 85+ and the FPCR was not significant, we include it to be consistent with the existing literature. Secondly, to avoid introducing unnecessary multicollinearity into the model we only include the rate of marriages in the population as an indication of the availability of other forms of care. Finally, in the local authority level models we include expenditure on FPC per FPC client instead of the GAE on FPC because as discussed, GAE is not ring fenced and local authorities can choose for themselves what to spend on FPC. Thus, expenditure on FPC at home, per FPC client will provide a more realistic estimate of actual spending on FPC.

The first column of Table 2.1 shows the output from the pooled Ordinary Least Squares (OLS) estimator. As expected, the coefficient on the DR is positive and significant. In particular, the model suggests that if the DR were to increase by 1%, the FPCR would increase by 0.06%. In other words, if the number of people receiving disability benefits was to increase by 1000, the number of people receiving FPC would increase by around 60. Although this seems like a relatively small effect, it does indicate the financial risk to the government of an increasing DR, because of the significant positive effect it has on the FPCR. As expected, the greater the proportion of the oldest old (85+) in the local authority population, the higher is the FPCR. This result is statistically significant at the 1% level.

Moreover, the model predicts that an increase in the proportion of married couples in the local authority will decrease the FPCR. This is consistent with our a priori expectations that the availability of unpaid care could reduce met need for FPC. This result is significant at the 10%

Table 2.1: Local Authority Level Results

	Pooled	FE	RE	Spatial RE
Disability Rate	0.0564**	0.291	0.0791*	0.0957*
	(0.022)	(0.193)	(0.043)	(0.050)
Expenditure on FPC	-0.000622*	-0.00136***	-0.00118***	-0.00119***
	(0.000)	(0.000)	(0.000)	(0.000)
Gender	-0.082	0.306	0.026	0.001
	(0.102)	(0.327)	(0.161)	(0.176)
Age	0.251***	0.0488***	0.0510***	0.052
	(0.062)	(0.017)	(0.014)	(0.058)
Life Expectancy	-0.00317**	-	-0.002	-0.002
	(0.001)	-	(0.002)	(0.003)
Married	-0.0560*	-	-0.056	-0.048
	(0.030)	-	(0.057)	(0.057)
Income Deprivation	0.011	0.404	0.003	0.003
	(0.007)	(0.371)	(0.011)	(0.016)
Standard Deviation DR	-0.054	0.000	-0.151	-0.118
	(0.068)	-	(0.106)	(0.110)
Political Preferences	0.000	-	0.000	0.000
	(0.000)	-	(0.000)	(0.000)
2014	0.000	0.002	0.000	0.000
	(0.002)	(0.002)	(0.001)	(0.001)
2015	-0.003	0.002	-0.001	-0.001
	(0.002)	(0.003)	(0.001)	(0.001)
2016	-0.004	0.003	-0.002	-0.002
	(0.002)	(0.004)	(0.002)	(0.001)
Constant	0.177***	-0.235	0.105	0.111
	(0.061)	(0.232)	(0.114)	(0.113)
ρ	-	-	-	-0.094
	-	-	-	(0.089)
λ	-	-	-	0.023
	-	-	-	(0.232)
Moran Test for Spatial Dependence (prob >chi2)	N/A	N/A	N/A	-
Wald Test of Spatial Terms (prob >chi2)	N/A	N/A	N/A	0.555
R-Squared	0.47	0.34	0.43	0.452
Observations	128	128	128	128

Robust standard errors are shown in parentheses; * p <0.10, ** p <0.05, *** p <0.01.

level. In addition to this, total expenditure on FPC per person receiving FPC has a significantly negative impact on the FPCR. This negative relationship is consistent with the idea presented in Fig. 2.1, that local authorities who have a high FPC spend per person, are likely to have a higher needs population, and due to their limited resources with which to meet those needs, cannot increase FPC provision overall. Life expectancy at age 65 is also associated with a reduction in the FPCR. This is consistent with the correlation in Figure 2.4.5 and might indicate that once we account for age in the model, a higher life expectancy is in fact associated with better health and less need for care.

The remaining covariates in the model are found to have no effect on the FPCR. A joint F-test to check the significance of all covariates excluding the DR suggests that controlling for these observed factors explains a significant amount of variation in the FPCR between local authorities. Specifically, the whole model accounts for 47% of the total variation in the FPCR.

The second and third columns in Table 2.1 present the results from the fixed and random effects specifications respectively. The key advantage of such panel regressions is that they can account for unobserved heterogeneity which is ignored in the pooled specification (Hsiao 2007). The signs of the estimated parameters in both the fixed and random effects specifications are consistent with the pooled results although the life expectancy and marriage variables become

insignificant in the random effects specification. Furthermore, the DR is no longer significant in the fixed effects specification. The model R-squared under fixed effects is 0.34 compared to 0.43 under random effects. The lower R-squared in the fixed effects specification is to be expected since the effect of any time constant variables on the dependent variable is removed.

As mentioned, random effects will produce more efficient estimates compared to fixed effects, and will be consistent as long as the correlation between the local authority specific effects and the regressors is zero. In order to test this and to choose between the two specifications, we use the Hausman test (Hausman 1978). The statistic suggests that random effects is preferred: $\chi^2_{(5)} = 7.30, p - value = 0.20$.

The final column in Table 2.1 displays the results from the random effects model which incorporates the spatial lag of the FPCR and the spatial error correlation as outlined by Eq. 2.3. Once again, the signs of the estimated parameters are consistent with the previous models. The coefficient on the DR variable is significant at the 10% level and suggests that a 1% increase in the DR is associated with a 0.10% increase in the FPCR. In other words, an increase in the number of people receiving disability benefits by 1000, is associated with an increase in the number of people receiving FPC by around 100.

Neither of the spatial elements, ρ or λ, are found to be significant. This suggests that there isn't evidence of interdependencies in the FPC policy between contiguous local authorities for example through information spillovers or mimicking behaviour (Moscone & Knapp 2005, Fernandez & Forder 2015). Moreover, that shocks to the FPCR do not spill over between areas. A Wald test for the joint significance of both spatial terms also concludes that they are insignificant. Further, the direct effect of the DR on the FPCR is very similar to the classical random effects specification. Table 2.5 in the Section 2.6 also shows the local authority level spatial models estimated separately for each year. Although these results are less informative due to their small sample size, they provide Moran tests for the spatial independence of the error terms which also suggest that the errors are not spatially dependent in any year with the exception of 2015 (Moran 1950). Overall, incorporating spatial effects into the model does not improve it and the traditional random effects specification is preferred.

The finding of no spatial effects might not be surprising in the Scottish context given that FPC is a national policy and local authorities don't differ substantially in terms of their political orientation. At the same time, the geography of Scotland might mean that spillover effects are less likely e.g. between the islands and the mainland.

In summary, the local authority level results suggest that even after accounting for a number of factors including personal care need, there is still considerable heterogeneity in FPC provision across Scotland. This finding confirms the results from the descriptive analysis which suggested that differences in FPC provision between local authorities are not fully accounted for by differences in need as we would expect with a policy like FPC, which was specifically designed to eliminate geographical differences in provision.

Table 2.2 presents the results from the data zone level regressions. The data zone level models allow us to check whether or not the inconsistencies we observe at the local authority level, in terms of the variation in FPC provision between local authorities, also persist within local authorities. As with the local authority level model, the first column presents the pooled OLS results and the

Table 2.2: Data Zone Level Results

	Pooled	**FE**	**RE**	**Spatial Edin 2013**	**Spatial Edin 2014**	**Spatial RE Edin**	**Spatial Glas 2013**	**Spatial Glas 2014**	**Spatial RE Glas**
Disability Rate	0.151***	0.0502***	0.119***	0.111***	0.182***	0.114***	0.138***	0.118***	0.0992***
	(0.007)	(0.006)	(0.005)	(0.014)	(0.015)	(0.011)	(0.012)	(0.011)	(0.009)
Gender	0.0448***	-0.008	0.0404***	0.0499**	0.0639***	0.0353**	0.031	0.028	0.0295*
	(0.009)	(0.015)	(0.007)	(0.020)	(0.021)	(0.017)	(0.020)	(0.020)	(0.017)
Age	0.106***	0.0950***	0.106***	0.0627***	0.020	0.0593***	0.127***	0.107***	0.107***
	(0.010)	(0.010)	(0.008)	(0.017)	(0.018)	(0.015)	(0.021)	(0.020)	(0.017)
Married	-0.0175***	-	-0.0227***	0.000	-0.004	-0.005	-0.005	-0.015	-0.012
	(0.005)	-	(0.005)	(0.007)	(0.008)	(0.007)	(0.012)	(0.011)	(0.010)
Income Deprivation	-0.0212***	-0.009	0.001	0.018	-0.0535***	0.008	-0.013	-0.0250*	-0.001
	(0.006)	(0.014)	(0.006)	(0.018)	(0.020)	(0.016)	(0.014)	(0.013)	(0.010)
Standard Deviation DR	0.202	0.223	0.215	-	-	-	-	-	-
	(0.160)	(0.158)	(0.158)	-	-	-	-	-	-
2014	0.001	0.000	0.000	-	-	0.002	-	-	-0.00315***
	(0.001)	(0.001)	(0.001)	-	-	(0.001)	-	-	(0.001)
Constant	-0.0523**	0.008	-0.0418*	-0.018	-0.0224*	-0.007	-0.0207*	-0.011	-0.002
	(0.025)	(0.021)	(0.025)	(0.012)	(0.012)	(0.010)	(0.012)	(0.011)	(0.010)
ρ	-	-	-	0.092	0.069	0.0976*	0.052	0.144**	0.050
	-	-	-	(0.073)	(0.074)	(0.053)	(0.056)	(0.056)	(0.044)
λ	-	-	-	-0.030	0.135	0.129	0.106	-0.156*	0.056
	-	-	-	(0.112)	(0.105)	(0.095)	(0.083)	(0.092)	(0.087)
Moran Test for Spatial Dependence (prob >chi2)	N/A	N/A	N/A	0.46	0.01***	-	0.05**	0.99	-
Wald Test of Spatial Terms (prob >chi2)	N/A	N/A	N/A	0.36	0.03**	0.00***	0.05**	0.04**	0.19
Local Authority Dummies	Yes	Yes	Yes	N/A	N/A	N/A	N/A	N/A	N/A
R-Squared	0.41	0.03	0.41	0.27	0.33	0.29	0.27	0.24	0.25
Observations	12,996	12,996	12,996	548	548	1,096	688	688	1,376

Robust standard errors are shown in parentheses; * p <0.10, ** p <0.05, *** p <0.01

second and third columns show the fixed and random effects estimations respectively. Each estimation includes local authority level dummies, with Glasgow excluded for comparison. As discussed, the data zone level data are only available for the years 2013 and 2014. They also exclude the FPC expenditure, life expectancy and political preferences variables as they are only available at the local authority level. Once again, the models are estimated with robust standard errors and these are clustered at the local authority level for the first three estimations.

In the pooled OLS estimation, once again the DR has a positive and significant impact on the FPCR. Specifically, a 1% increase in the DR is associated with a 0.15% increase in the FPCR. Compared to the local authority level models, gender is also found to have a significantly positive impact on the FPCR. This is likely due to the increase in precision of the estimates from the larger sample size. The results also demonstrate that a higher proportion of the oldest old (those aged 85+) is also associated with a higher FPCR. In addition to this, the results show that a higher rate of income deprivation is associated with a lower FPCR. This result was not apparent in the local authority level estimations and supports the hypothesis that people in lower income areas are less likely to access services (d'Uva et al. 2009).

Finally, the results suggest that compared to Glasgow, the FPCR is higher in all local authorities with the exceptions of Dundee City and Clackmannanshire where it is lower. All local authority dummies are statistically significant apart from Highland, North Lanarkshire, Renfrewshire and Perth and Kinross. The significance of the local authority dummies suggests that holding the level of disability fixed, the local authority in which a person resides influences the likelihood of receiving FPC. This finding confirms the existence of geographic inequity between local authorities. The model R-squared shows that 41% of the total variation in the FPCR is explained by the included regressors.

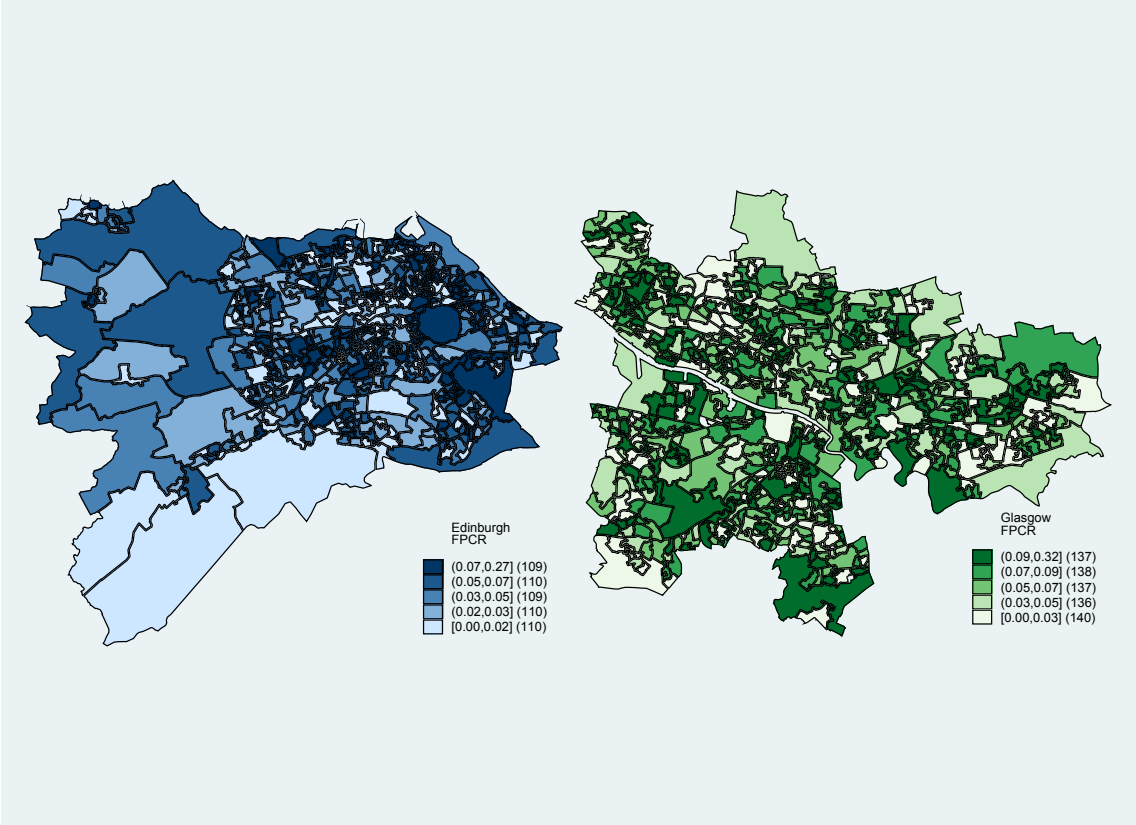
The fixed and random effects specifications are shown in the next two columns of Table 2.2. The signs of the covariates are once again consistent with the pooled regression. However, under both the fixed and random effects, income deprivation is no longer significant, and neither is gender in the fixed effects specification. The local authority dummies in the random effects specification show the same signs and significance as in the pooled OLS estimation, confirming the finding that geography matters.

The R-squared in the fixed effects specification is just 0.03 compared to 0.44 for the random effects. As discussed above, the fixed effects estimator uses only within group variation, whilst random effects uses both within and between. Therefore, it is not unexpected that the fixed effects R-squared would be lower. The Hausman test for choosing between fixed or random effects suggests that the time invariant data zone effects are correlated with the included regressors, and as a result favours fixed effects. However, it is evident that there is very little variation in the included variables over the two years and thus pooled OLS might be preferred.

The final columns of Table 2.2 show the results from the spatial data zone models. Unfortunately Stata cannot generate the spatial contiguity weighting matrix W for the whole of Scotland due to its memory constraints. Thus, the data zone level models are estimated for the two largest local authorities only (Edinburgh and Glasgow City[8]). Whilst the spatial elements in the local authority level models capture FPC policy interdependence between neighbouring areas,

[8]Other local authorities available on request

Figure 2.5: 2014 Edinburgh and Glasgow Data zone Level FPCRs



for example the setting of eligibility criteria, the spatial elements in the data zone level models are more likely to pick up spatial correlations at an individual level. For example, information spillovers between residents in certain areas. The spatial models are estimated for the two chosen local authorities, separately for 2013 and 2014, and together via random effects [9].

Fig. 2.5 provides a data zone level map of the 2014 FPCR in Edinburgh and Glasgow. If the FPCR is spatially dependent between data zones, we would expect to see data zones with high FPCR to be clustered together. From a first glance at the maps, it looks like this could be the case. However, the evidence of spatial dependence is somewhat mixed. In particular, the spatial error and spatial dependent variable coefficients, λ and ρ respectively, are only found to both be individually significant in the 2014 specification for Glasgow. ρ is also found to be significant in the random effects specification for Edinburgh. The Moran test of the spatial error is found to be significant only in 2014 for Edinburgh and 2013 for Glasgow. In Edinburgh, the Wald test of the joint significance of the spatial parameters finds significant spatial effects in the 2014 specification and the random effects specification. In Glasgow, the the Wald test shows that both spatial elements are significant in the 2013 and 2014 estimations but not in the random effects specification. Overall, there seems to be some evidence of spatial spillovers between data zones.

In summary, the data zone level models in Table 2.2 consistently find that increases in the DR are associated with increases in the FPCR. The results also show that there remains considerable unexplained variation in the FPCR, even after accounting for need and other factors.

[9] Note that we avoid the use of fixed effects because at the data zone level, the regressors show very little variation between the two years.

The analysis again suggests that there might be geographic inequity in FPC provision between local authorities. These findings are in keeping with those presented in the descriptive analysis and the local authority level regressions in Table 2.1.

2.5 DISCUSSION AND CONCLUSION

The provision of FPC in Scotland is managed at the local authority level. Even in such a system like Scotland's, with legislated universal coverage of care, decentralisation to lower level government can lead to differences in provision between those localities. In fact, the rate of FPC provision differs substantially between Scottish local authorities.

In this paper we use aggregated data at different geographical levels to examine the extent to which differences in FPC provision in Scotland, are matched by differences in local need. As a result, we aim to offer evidence on the existence of geographic inequity in FPC provision in Scotland, as well as evidence of factors which could be driving this inequity.

The results presented in Section 2.4 show clearly that the share of FPC differs substantially between Scottish local authorities. These differences are visible in Fig. 2.2 and Fig. 2.3. Furthermore, the descriptive analysis suggests that those differences are not matched by similar differences in the share of disability within the population. This suggests the existence of geographic inequity in FPC provision. In particular, for a given level of need, receipt of personal care might be more or less likely, depending on which local authority a person lives. Given that the intention of the legislation was that personal care for those aged 65+ should be available on a uniform and consistent basis, this result is concerning.

The econometric analysis also confirms these geographic disparities between local authorities. Whilst the results suggest that the DR significantly influences the FPCR, there remains significant unexplained differences in FPC provision between local authorities, even after accounting for other influences. Furthermore, the data zone level models show that the inconsistencies which exist between local authorities, are also present within local authorities, and again confirms the significance of geography in determining the FPCR. The spatial models also provide evidence of potential spillovers between contiguous areas at the data zone level but not at the local authority level.

One potential explanation for the unexplained differences between local authorities could be their practices at managing demand for FPC. Managing the demand for FPC was identified as a potential explanation for the variation in FPC provision by Lord Sutherland's 2008 review. Specifically, as discussed in Section 2.1 the review found that local authorities were using eligibility criteria and waiting times as a tool to manage demand. Following this review, the Scottish Government introduced the National Eligibility Criteria (Scottish Government 2009). These were to be adopted by all local authorities when assessing individuals' needs for FPC. The intention is to classify individual need as critical, substantial, moderate and low - with their corresponding urgency of intervention response times and provides guidance on risk factors associated with each category. These categories are used to allocate limited resources to the most needy care clients. As a minimum, local authorities must provide care to those individuals who are categorised as 'critical' or 'substantial' risk, and within a six-week time frame. However, it is the responsibility of

local authorities to determine whether or not those with moderate or low risk require the provision of services. Since local authority resources are generally under pressure, many local authorities set thresholds for FPC provision. For example, many local authorities will only provide FPC to those who have been identified with either critical or substantial needs. At the same time, unlike those with 'critical' or 'substantial' risk, there is no minimum waiting time for those identified with 'moderate' or 'low' risk to receive services. As a result, local authorities might use waiting times for these groups as a means to curtail demand for services, in the hope that some people won't be willing to wait so long to access the services, and will subsequently withdraw their application for support. This has been found to be a barrier to accessing social care services in England (Brimblecombe et al. 2018).

Thus, depending on how local authorities decide to implement the National Eligibility Criteria, differences in provision could emerge. Local authority decisions will depend on the needs of the individuals presenting themselves for FPC services. As a result, the distribution of needs within the local authority will play a role in determining who gets FPC. As outlined in Section 2.2, if needs are skewed to the right, that is, if a large proportion of those applying for FPC have critical needs, a local authority might have to restrict provision to those groups because they cost more to cater for. At the other extreme, if the needs within a local authority are skewed to the left, that is, a large proportion of those applying have low risk needs, and few with critical needs, the local authority might be more able to offer care to all groups. Consistent with this possibility is the result that the spending per FPC client is significantly negatively associated with the FPCR. In other words, this suggests that a higher spend on FPC (which is likely to be associated with higher needs), results in less provision of FPC overall because resources won't stretch so far. Thus, the distribution of those who apply for care could make a substantial difference to the provision of care.

Having said that, it is still the case that the majority of local authorities in Scotland explicitly state that they will only provide care to those with critical or substantial needs [10]. Whether this is to curb demand due to scare resources or because local authorities differ in their spending priorities, it is not possible to tell without further investigation.

In relation to this, the way in which local authorities interpret the National Eligibility Criteria might vary across Scotland and these interpretations are unlikely to be randomly distributed. For example, local authorities which experience tight funding constraints may be more likely to be stringent in their interpretation of the criteria compared to a local authority where funding is less tight. Interpretations might also be correlated with political control in the local authority whereby a more liberally controlled authority may be lenient in their interpretation of criteria compared to a more conservative one. Future research would benefit from carrying out a detailed investigation into individual local authority practices to understand whether and why differences in eligibility for FPC arise during the assessment process and how these influence subsequent provision of care.

Furthermore, the results presented here have also highlighted the importance of the availability of other forms of care. Specifically, the results suggest that the availability of unpaid care might play a role in determining the FPCR. Although the results showed that the number of care home

[10] We collected information on FPC eligibility from 21 local authorities via their websites or via email. Of those, 11 stated that they will only provide care to those in the top two risk categories.

places had no effect on the local authority FPCR, a recent freedom of information request by Robert Kilgour, chairman of Renaissance Care in Scotland, found that there is significant variation in the cost of local authority run care homes. Thus, it might be that local authorities ability to provide FPC to people in their own homes, is also limited by the cost of running their own care homes (Lang Buisson 2018).

At this point it is important to highlight some of the limitations of this paper and suggest areas for future research. Firstly, our results from the spatial models might be sensitive to the specification of the weighting matrix. In this paper we chose to use a basic contiguity matrix where we defined neighbours as sharing a common vertex or border. There are of course other specifications of this matrix which define neighbouring areas in different ways. For example, based on travelling distance between areas.

Secondly, we do not have any information about the distribution of need within local authorities. As discussed above, understanding how needs are distributed would provide a useful insight into how local authorities make decisions on care provision, and subsequently offer an explanation for the differences across Scotland. The SCS does contain information on client need by means of an Indicator of Relative Need (IoRN) score, however, it is very poorly recorded by local authorities and only a small proportion of social care clients have been given a score.

Related to this, we are limited in that we only observe met need for FPC. We do not observe those individuals who require FPC but who do not receive it, either because they are put on a waiting list or they don't meet the eligibility criteria. In addition, we don't know anything about those who do not apply for other reasons. A study carried out in England found that often information barriers, transaction costs and quality of services were reasons for older people not accessing services (Brimblecombe et al. 2018). Moreover, perceived budget cuts within the local authority were also found to be a factor which deterred older people from accessing services (Brimblecombe et al. 2018).

Future research would certainly benefit from measuring and understanding unmet need in order to ensure older people in Scotland get the help they require and to improve health and care outcomes. At the same time, this understanding will be of the utmost importance in Scotland in the coming years as it takes on powers over disability benefits from the UK Government. Social Security Scotland (SSS) has been set up to manage and deliver these benefits and they have made a commitment to putting dignity, fairness and respect at the heart of its practices. This commitment could have implications for the future provision of the benefits compared to the current approach taken by DWP. Especially given the significantly positive relationship identified in this paper between the DR and FPCR, which indicates the financial risk to local authorities associated with increasing the number of people disability benefits are offered to. At the same time, as the Scottish Government takes on these new powers it could provide an opportunity to streamline the assessment processes for disability benefits and FPC, to better identify those individuals who need care services and consequently reduce unmet need and inequity in provision between local authorities. It would be beneficial to revisit the analysis presented here in a few years time to see if the results change after the take over of the new powers, as well as to add additional data points to improve the precision of the estimates.

2.6 APPENDIX

Table 2.3: Variables and Data Sources

Variable	Geography	Description	Data Source	Year(s)
Free Personal Care Rate (FPCR)	Local Authority	Proportion of the over 65s in the local authority who are receiving FPC	Social Care Survey (Scottish Government)	2013-2016
	Data zone	Proportion of the over 65s in the data zone who are receiving FPC		2013-2014
Disability Rate (DR)	Local Authority	Proportion of the over 65s in the local authority who are receiving Attendance Allowance or Personal Independent Payments/ Disability Living Allowance	Department for Work and Pensions	2013-2016
	Data zone	Proportion of the over 65s in the data zone who are receiving Attendance Allowance or Personal Independent Payments/ Disability Living Allowance		2013-2014
Standard Deviation DR	Local Authority	Local authority standard deviation of the DR over 2013-2014 from data zone level DR	Department for Work and Pensions	2013-2014
	Data zone	Local authority standard deviation of the DR from data zone level DR		2013-2014
Age	Local Authority	Proportion of the over 65s in the local authority who are over 85	National Records of Scotland	2013-2016
	Data zone	Proportion of the over 65s in the data zone who are over 85		2013-2014
Gender	Local Authority	Proportion of the over 65s in the local authority who are female	National Records of Scotland	2013-2016
	Data zone	Proportion of the over 65s in the data zone who are female		2013-2014
Life Expectancy	Local Authority	Life expectancy in years at age 65	National Records of Scotland	2009-2013 (mean)
Education	Local Authority	Proportion of data zones in the Local Authority which are in the top 20% most education deprived data zones	Scottish Index of Multiple Deprivation	2012
Income Deprivation	Local Authority	Average proportion of data zones within the Local Authority which are income deprived	Scottish Index of Multiple Deprivation	2012
	Data zone	Proportion of people within the data zone who are income deprived		2012
Rurality	Local Authority	Proportion of data zones in the Local Authority which are classified as very remote (UR8FOLD = 8) and rural or remote and rural (UR8FOLD = 7).	Scottish Government 8 fold Urban Rural Classification	2011
	Data zone	1 = Large Urban Areas, 2 = Other Urban Areas, 3 = Accessible small Towns, 4 = Remote Small Towns, 5 = Very Remote Small Towns, 6 = Accessible Rural, 7 = Remote Rural, 8 = Very Remote Rural		
Income for FPC	Local Authority	Grant Aided Expenditure for Personal and Nursing Care for Older People per FPC client	Scottish Government	2013-2016
Expenditure on FPC	Local Authority	Expenditure on FPC at home per FPC person (excluding overheads)	Scottish Government	2013-2016
Political Preferences	Local Authority	2012 local elections conservative share of the first preference vote	Scottish Government	2012
Availability of other forms of care	Local Authority	Number of registered care home places per person aged 65+; Proportion of the over 65s who are married	Scottish Government Care Home Census; Census	2013-2016; 2011
	Data zone	Proportion of the over 65s who are married	Census	2011

Table 2.4: Bivariate Correlations

	FPCR	DR	Gender	Age	Education	Income	Rurality	Life Expectancy	Expenditure pp FPC	Income pp FPC	Standard Deviation DR	Unpaid Care	Alone	Married	Care Home Places pp 65+	Political Preferences
FPCR	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
DR	0.5972*	1.000	-	-	-	-		-	-	-	-	-	-	-	-	-
Gender	0.3738*	0.6763*	1.000	-	-	-	-	-	-	-	-	-	-	-	-	-
Age	0.026	-0.2296*	-0.136	1.000	-	-	-	-	-	-	-	-	-	-	-	-
Education	0.160	0.4778*	0.5653*	-0.172	1.000	-	-	-	-	-	-	-	-	-	-	-
Income	0.1926*	0.3297*	0.4032*	-0.052	0.8828*	1.000	-	-	-	-	-	-	-	-	-	-
Rurality	0.004	-0.3948*	-0.6201*	0.3788*	-0.4018*	-0.2486*	1.000	-	-	-	-	-	-	-	-	-
Life Expectancy	-0.5437*	-0.8068*	-0.4888*	0.3508*	-0.2500*	-0.101	0.3784*	1.000	-	-	-	-			-	-
Expenditure pp FPC	-0.1927*	-0.2777*	-0.2829*	0.080	-0.142	-0.2157*	0.5071*	0.143	1.000	-	-	-	-		-	
Income pp FPC	-0.6286*	-0.5084*	0.027	0.142	0.001	-0.082	-0.2331*	0.5733*	0.070	1.000	-	-	-	-	-	-
Standard Deviation DR	0.2807*	0.6923*	0.7635*	-0.3516*	0.4674*	0.2680*	-0.7439*	-0.5772*	-0.3041*	-0.0286	1	-	-	-	-	-
Unpaid Care	0.4226*	0.5387*	0.169	0.129	0.2684*	0.3192*	-0.031	-0.1896*	-0.2753*	-0.3330*	0.2366*	1.000	-	-	-	-
Alone	0.4545*	0.6564*	0.6917*	-0.085	0.3183*	0.167	-0.2034*	-0.6381*	-0.001	-0.2742*	0.5024*	0.005	1.000	-	-	-
Married	-0.5359*	-0.7133*	-0.6330*	0.038	-0.2517*	-0.092	0.068	0.6983*	-0.067	0.4044*	-0.4347*	-0.049	-0.9419*	1.000	-	-
Care Home Places pp 65+	0.043	0.3494*	0.5164*	-0.084	0.2443*	0.010	-0.3718*	-0.4100*	0.003	0.1949*	0.4292*	-0.089	0.4461*	-0.4413*	1.000	-
Political Preferences	-0.2988*	-0.3060*	0.037	0.093	0.2212*	0.167	-0.3762*	0.3928*	-0.081	0.7412*	0.077	-0.074	-0.2750*	0.4307*	0.053	1.000

*Asterisk denotes significance at the 5% significance level.

Table 2.5: Local Authority Level Spatial Results: Individual Years

	2016	**2015**	**2014**	**2013**
Disability Rate	0.032	0.035	0.063	0.073
	(0.061)	(0.048)	(0.056)	(0.066)
Expenditure on FPC	0.000	-0.001	-0.001	-0.001
	(0.001)	(0.001)	(0.001)	(0.001)
Gender	0.095	-0.258	-0.133	-0.108
	(0.211)	(0.176)	(0.204)	(0.239)
Age	0.694	0.217**	0.447	0.238
	(0.577)	(0.107)	(0.545)	(0.727)
Life Expectancy	-0.00775**	-0.002	-0.002	-0.003
	(0.004)	(0.003)	(0.003)	(0.004)
Married	-0.005	-0.0983*	-0.065	-0.081
	(0.063)	(0.050)	(0.063)	(0.069)
Income Deprivation	0.001	0.009	0.011	0.015
	(0.017)	(0.014)	(0.016)	(0.019)
Standard Deviation DR	-0.030	0.017	-0.055	-0.101
	(0.127)	(0.098)	(0.120)	(0.139)
Political Preferences	0.000	0.000	0.000	0.000
	(0.000)	(0.000)	(0.000)	(0.000)
Constant	0.124	0.265**	0.189	0.202
	(0.134)	(0.108)	(0.135)	(0.159)
ρ	0.010	0.004	-0.063	-0.127
	(0.101)	(0.103)	(0.091)	(0.113)
λ	0.491	0.789***	0.520	0.668
	(0.457)	(0.293)	(0.518)	(0.442)
Moran Test for Spatial Dependence (prob >chi2)	0.48	0.04**	0.44	0.23
Wald Test of Spatial Terms (prob >chi2)	0.56	0.03**	0.49	0.18
R-Squared	0.55	0.53	0.46	0.43
Observations	32	32	32	32

Robust standard errors are shown in parentheses; * p <0.10, ** p <0.05, *** p <0.01.

3 | Utilisation of Personal Care Services in Scotland: the Influence of Unpaid Carers

Elizabeth Lemmon

Abstract

Unpaid carers may have an influence on the formal care utilisation of the cared for. Whether this influence is positive or negative will have important implications for the costs of formal care provision. The existing evidence on the impact of unpaid care on formal care utilisation is extremely mixed. Scotland provides an interesting context in which to study this relationship. Unlike many other jurisdictions, personal care in Scotland is provided free to all individuals aged 65+ who are assessed as needing it. This may affect the incentives faced by unpaid carers, leading to different conclusions about the relationship between unpaid and paid care, compared to previous literature. Moreover, the Scottish Government is unique in its collection of administrative data on all social care clients. This paper investigates how the presence of an unpaid carer influences personal care use by those aged 65+ in Scotland, using Scotland's Social Care Survey (SCS) for the years 2014-2016. Specifically, it compares results from Ordinary Least Squares (OLS), Generalised Linear Models (GLM), and Two-Part Models (2PMs) and conducts a variety of sensitivity analysis to deal with endogeneity concerns. The results suggest that unpaid care complements personal care services. In particular, the presence of an unpaid carer is associated with an increase in weekly personal care hours by 1 hour and 14 minutes per week, on average, other things being equal. This result is robust to a variety of sensitivity checks. Complementarity between unpaid and paid care may imply that incentivising unpaid care could increase personal care costs, and at the same time it points to the potential for unmet need of those who do not have an unpaid carer.

3.1 INTRODUCTION

Population ageing - the increasing proportion of older people in a population - is a global phenomenon. The United Nations (2017) report on World Population Ageing found that almost every country in the world will see an increase in the share of their populations aged 60+ between 2017 and 2050. Ageing is primarily driven by reduced fertility rates and increases in life expectancy. As the population ages, pressure on health and social care services is expected to increase. This will be further increased if there is an expansion of morbidity, i.e. an increase in the number of people living with chronic conditions related to age. If ageing is associated with an expansion of morbidity, as much of the literature suggests (Walter et al. 2016, Campolina et al. 2014, Beltrán-Sánchez et al. 2016), it is likely it will be associated with an even larger increase in demand for

formal care services than that warranted by population ageing alone. Having said this, evidence also exists to suggest a compression of morbidity (Stallard 2016). Pressure on long term care (LTC) provision is already high in the UK. Age UK (2011) published a report highlighting the issue of under-funding within the UK care system and the knock-on effects this has on the quantity and quality of care that is provided. Since funding for social care has not adequately kept up with an increasing number of older people requiring support, a shrinking social care resource is being spread over an increasing number of individuals in need. This inevitably leads to unmet need.

Unpaid care might offset pressure on formal care services. Unpaid carers are those who provide care to family members, partners or neighbours because they are frail, ill or have a disability (Carers UK 2014). They often step in to provide help to older people when they experience difficulties with Activities of Daily Living (ADLs) and Instrumental Activities of Daily Living (IADLs). ADLs are fundamental self-care tasks such as washing, dressing and eating. Care for ADLs is often referred to as personal care. IADLs refer to activities that require more thinking and organisational skills such as shopping, housework, taking medication and paying bills. Help with IADLs is often referred to as home care.

In the absence of unpaid care, it seems likely that the demand for state provision would increase. The supply of unpaid care is also under threat as a result of other demographic changes occurring in Scotland.

One mechanism to reduce this demand is for policy intervention to incentivise unpaid care. For example, through offering financial support, like the UK Carers Allowance, to unpaid carers (DWP 2017). Furthermore, the Scottish Carers Act 2016, to be implemented in April 2018, has been "designed to support carers' health and well-being, and help make caring more sustainable" (Scottish Government 2017*a*). Although the Act is not aimed explicitly at incentivising unpaid care, the benefits set out in the Act could have a motivating effect. However, policies which incentivise unpaid care will only be effective in terms of reducing pressure on formal LTC services, if unpaid care substitutes for formal care.

There are currently two competing hypotheses in the literature: the *substitution hypothesis* and the *complementary hypothesis*. The former posits that unpaid care indeed substitutes for formal care. In other words, as unpaid care increases, the utilisation of formal care by the cared for decreases. For example, an unpaid carer might perform tasks such as help with getting dressed, that would otherwise be carried out by a formal carer. The policy implications of this hypothesis might be to encourage unpaid care giving, in an attempt to reduce reliance on formal LTC services provided by the government. In contrast, the complementary hypothesis suggests that unpaid and formal care are positively related. As unpaid care rises, so does the use of formal care services by the cared for. This might be because unpaid carers demand formal care services on behalf of the cared for. For example, an unpaid carer might provide help with IADLs, but realise that the person they are caring for also needs help with ADLs. They may therefore endeavour to increase the level of support for the cared for by engaging with the formal care sector. At the same time, they might advocate formal care use in order to reduce their own care responsibility (Bass & Noelker 1987). Furthermore, unpaid carers might seek help from the formal care sector to enable them to remain in employment (Pickard et al. 2015, Brimblecombe et al. 2018). If unpaid care complements formal care in this way, incentivising unpaid care could lead to increased pressure on formal care

services.

Clearly, the two opposing hypotheses could have significant impacts on the utilisation and consequent costs of formal LTC services. Thus, in order to design social care policy to respond optimally to the changing structure of the population, it is crucial that the relationship between unpaid and formal care is better understood. The existing evidence in the literature is somewhat mixed in terms of which hypothesis holds true. Since Greene (1983) published evidence on the substitutability between unpaid and formal care, a significant body of research has supported the substitution hypothesis (Boaz & Muller 1994, Pezzin et al. 1996, Kehusmaa et al. 2013, Van Houtven & Norton 2008, 2004, Charles & Sevak 2005, Lo Sasso & Johnson 2002, Coughlin et al. 1992). More recently, Kehusmaa et al. (2013) investigated the effect that unpaid care has on public expenditure for older people in Finland. Their findings showed that older people without an unpaid carer had the highest costs of formal care services, whilst those who lived with the person caring for them had the lowest costs. Van Houtven & Norton (2008) and Van Houtven & Norton (2004) both found evidence of substitution when analysing administrative and survey data for older individuals in the US.

On the other hand, there is evidence in support of the complementary hypothesis (Chappell & Blandford 1991, Geerts & Van den Bosch 2012, Litwin & Attias-Donfut 2009, Bass & Noelker 1987, Pickard et al. 2015). In particular, Geerts & Van den Bosch (2012) in their analysis of the effect that needs-based entitlements for LTC has on the dynamics of formal and unpaid care utilisation, found that in all countries studied, formal and unpaid care were more often complements. Furthermore, analysis of European data by Litwin & Attias-Donfut (2009) concluded that unpaid care was often supplemented with formal care.

Some studies have found a mixture of substitution and complementarity effects, depending on the needs of the cared for and the type of formal care service used (Bolin et al. 2008, Bonsang 2009, Lo Sasso & Johnson 2002). For example, Bolin et al. (2008) found that whilst unpaid care tended to substitute for formal social care services such as personal and home care, the relationship was in fact complementary for health care services like doctor visits and hospital stays. In addition, Bonsang (2009) finds that the substitution hypothesis holds for services like home care, whilst the complementary hypothesis holds for personal and nursing care. Other authors have suggested that the nature of the relationship between unpaid and formal care depends on the relationship between the unpaid carer and the person being cared for. For example, substitution is more likely for spouses and family carers, whilst complementarity is more likely for friends or neighbour carers (Geerlings et al. 2005). Furthermore, some research has found evidence that unpaid care has no effect at all on formal care service utilisation (Weaver & Weaver 2014, Zhu et al. 2008, Langa, Chernew, Kabeto & Katz 2001).

The conflicting evidence in the existing literature highlights the complexity of the relationship between unpaid and formal care. This is further complicated by the ongoing debate of the endogeneity of unpaid care in the analysis. Specifically, there is a concern that there could be a reverse causality occurring between unpaid and formal care. This could be because an unpaid carer could change their decision to provide unpaid care based on how much formal care is being utilised. Furthermore, there might be other unobserved characteristics, for example health characteristics, which could influence both the demand for formal and unpaid care. Both of these sources of

endogeneity would lead to Ordinary Least Squares (OLS) estimates being biased. Some studies have ignored the issue of endogeneity (Kehusmaa et al. 2013, Geerlings et al. 2005, Coughlin et al. 1992) whilst others have used Instrumental Variables (IV) techniques to try and account for it (Bonsang 2009, Bolin et al. 2008, Van Houtven & Norton 2008, 2004, Charles & Sevak 2005). Overall, there are mixed conclusions on the extent to which endogeneity is an issue. Several authors have found limited evidence of it (Weaver & Weaver 2014, McMaughan Moudouni et al. 2012, Bolin et al. 2008) and some have found that endogeneity is present and that failing to remedy it alters results considerably (Van Houtven & Norton 2004, 2008).

In addition to this, other literature has examined how the use of formal care services affects unpaid care (Christianson 1988, Penning 2002, Johansson et al. 2003, Shelley & Rose 2004, Li 2005, Franca et al. 2008, McNamee 2006, Bell et al. 2007, Arntz & Thomsen 2011, Pickard 2012, McMaughan Moudouni et al. 2012, Karlsberg Schaffer 2015). Much of this research has found that there is no relationship between formal care and unpaid care (Penning 2002, Shelley & Rose 2004, Li 2005, McNamee 2006, Bell et al. 2007, McMaughan Moudouni et al. 2012) suggesting that reverse causation might not be an issue.

The Scottish context provides a unique opportunity to analyse the effect that unpaid carers have on older peoples' use of LTC services. Like the rest of the world, Scotland has experienced significant ageing in its population in recent decades, a trend that will continue until at least 2040 (National Records of Scotland 2016*c*). The Scottish Government estimates there were 744,000 unpaid carers aged 18+ in Scotland in 2017 (Scottish Government 2017*b*). That is around 17% of the adult population (National Records of Scotland 2016*a*). On 1st July 2002, the Community Care and Health (Scotland) Act 2002 was implemented and Free Personal and Nursing Care (FPNC) was introduced to those aged 65 or over, who were assessed as needing it (Scottish Executive 2002).

The existence of FPNC in Scotland makes it unalike other jurisdictions analysed in the existing literature, where the financial burden of LTC services are often borne by the individual and their families. The existence of such a policy may mean quite different financial incentives for care givers, leading to contrasting conclusions surrounding complementarity and substitution. Furthermore, Scotland collects rich administrative data on all social care service recipients, including FPNC clients who are receiving personal care services at home, in an annual Social Care Survey (SCS), which provides an opportunity to analyse the whole personal care population. This paper will provide new evidence on the existence of substitution or complementarity between unpaid and formal care. Specifically, it adds to the existing literature by utilising the unique Scottish SCS and demonstrating for the first time how unpaid carers influence personal care use by Scots aged 65 and over.

The remainder of the paper will be structured as follows: Section 3.2 describes the data and characteristics of the SCS sample. Section 3.3 introduces the theoretical framework and discusses the empirical specifications of the models to be estimated. Following this, Section 3.4 outlines the results and provides a discussion. Finally, Section 3.5 concludes.

3.2 DATA

The data used in this paper come from the 2014, 2015 and 2016 Scottish SCS[1]. This is a comprehensive survey set up by the Scottish Government and administered annually by each of the 32 local authorities in Scotland. All individuals who receive at least one of seven possible social care services are included in the survey. Those services are: home care, personal care, telecare, meals services, self directed support (SDS), social work and housing support [2]. The SCS contains information on which care packages individuals' are receiving, as well as additional information on their basic demographics, needs and unpaid care status.

As discussed in Section 3.1, FPNC was introduced in Scotland in 2002. The FPNC policy can be split into two categories: care in care homes (which covers personal and nursing care) and care at home (which covers personal care only). The type of care analysed in this chapter is personal care at home. This part of the policy makes personal care at home free to all individuals aged 65 and over in Scotland, subject to a needs assessment. Personal care at home can be provided directly by the local authority or the local authority can purchase personal care from the private and voluntary sectors. It is intended to help individuals maintain their independence and enable them to continue to live in their own homes. It comprises help with personal hygiene, continence management, food and diet, immobility problems, counselling and support, simple treatments and personal assistance[3]. The SCS collects information on the weekly number of hours of personal care an individual received during the final week in March each year.

Sample Selection Criteria

This paper focuses on social care clients' aged 65 and over. In total, across the three years studied, there were approximately 335,000 social care clients in Scotland aged 65 and over, who were receiving social care services due to problems associated with age [4].

The sample is restricted further to include those clients who had unpaid carer information available. The recording of unpaid carer information is optional for local authorities and as such a large proportion (around 80%) of these clients have an 'unknown' unpaid care status. Unfortunately it is difficult to confirm whether or not the recording of this information is missing at random and as such the extent to which it could introduce selection bias into the final sample. As a sensitivity check, a comparison of the main descriptive statistics between the sample before removing those without unpaid care information and after was carried out. This comparison didn't reveal any large differences between the samples, with the exception of the personal care variable in which only 34% of the pre-unpaid care selection sample were receiving FPC, compared to 44% in the final sample. This suggests that the final sample is likely to be a higher needs sub-sample of social care clients. Furthermore, as a further sensitivity check, the main models are estimated for

[1] Ethical approval to access this data was granted by the Scottish Government in January 2017. Project number:SG000-000850.

[2] For a detailed description of the information included in the SCS please see Scottish Government (2016*d*)

[3] The formal definition for personal care can be found in schedule 1 of the Community Care and Health Act 2002 (Scottish Executive 2001*a*).

[4] The SCS categorises clients into one of eight client groups. Those are: dementia, physical disability, frail older people, mental health problems, learning disability, learning and physical disability, other and not known. The first three categories are used as criteria to select individuals most likely to be receiving social care services due to problems associated with older age. These three groups account for about 78% of all social care clients aged 65+.

those local authorities who recorded the unpaid carer information for the majority of individuals [5].

Removing the clients with missing unpaid carer information results in a final sample of almost 68,000 [6] social care clients across the three years.

Descriptive Statistics

Table 3.1 provides a set of basic descriptive statistics for the whole sample, the personal care clients and the unpaid care clients [7].

The gender distribution is similar in the whole sample and personal care sample, where in both groups, around 70% are women. This is also similar to the whole population of social care clients aged 65+ and most likely reflects the higher life expectancy of women. However, a slightly lower proportion, 66%, of individuals with an unpaid carer are women. The age distribution of clients is also similar across the three groups, with about 15% aged 65-74, 40% aged 75-84 and 85-94, and the remaining 5% aged 95 or over.

We observe that around 42% of the sample are from the 2016 census, compared to 36% from 2015 and just 22% from 2014. This is due to increases over time in the number of social care clients receiving care in each of the selected client groups. The SCS previously variable indicates where the client received social care in more than one of the three years. This was the case for approximately 44% of the whole sample, compared to 51% of personal care clients, and over 54% for clients with an unpaid carer.

In terms of unpaid care status, approximately 34% of the whole sample have an unpaid carer compared to 39% of the personal care sample. Furthermore, around 45% of the whole sample receive personal care services, compared to 51% of the unpaid care sample. This might suggest that individuals with an unpaid carer are more likely to receive personal care services.

Overall, around 11% of the sample have been assigned a dementia status[8]. This is similar for personal care clients. This is somewhat lower than the 2017 population estimate of almost 20%, for those aged 65+ (Alzheimer Scotland 2017, National Records of Scotland 2016*a*). In contrast, nearly 19% of clients with an unpaid carer have been assigned the dementia client group. This might indicate that individuals with dementia are far more likely to have an unpaid carer looking after them.

The number of other services variable is the total number of social care services an individual is receiving, excluding home care and personal care. On average, clients receive one other service. Although, those with an unpaid carer receive closer to an average of two other services.

Table 3.1 also provides information on the distribution of weekly hours of personal care and the number of staff providing personal care to the individual. The mean number of hours of care for the whole sample is just over four hours per week. For the personal care sample it is around nine hours per week and for the unpaid care sample it is around five hours per week. As expected, the distribution of hours of personal care is clearly positively skewed and thus the median number

[5] Please see Table 3.8 in the Appendix

[6] Note that this figure does not reflect the total number of individuals because some clients will appear in more than one year.

[7] Please see Table 3.5 in the Appendix for a full description of all variables

[8] The dementia status of an individual is based on a care workers assessment of the individual and thus cannot be considered a medical diagnosis of dementia.

Table 3.1: Descriptive Statistics

	Whole Sample		**PC Clients**		**UC Clients**	
	N = 67,695		n = 30,359		n = 23,066	
Variable	No of Obs	% of N	No of Obs	% of N	No of Obs	% of N
Gender						
Female	46,650	68.91	21,284	70.11	15,229	66.02
Male	21,045	31.09	9,075	29.89	7,837	33.98
Age						
65-74	10,281	15.19	4,337	14.29	3,468	15.04
75-84	26,386	38.98	811,949	39.36	8,835	38.30
85-94	27,421	40.51	12,405	40.86	9,339	40.49
95+	3,607	5.33	1,668	5.49	1,421	6.17
Year						
2014	15,099	22.3	8,140	26.81	2,952	12.8
2015	24,455	36.13	10,738	35.37	9,379	40.66
2016	28,141	41.57	11,481	37.82	10,735	46.54
SCS Previously						
Yes	29,763	43.97	15,609	51.41	12,527	54.31
No	37,932	56.03	14,750	48.59	10,539	45.69
Dementia						
Yes	7,425	10.97	3,454	11.38	4,368	18.94
No	60,270	89.03	26,905	88.62	18,698	81.06
Unpaid Carer						
Yes	23,066	34.07	11,811	38.9	23,066	100
No	44,629	65.93	18,548	61.1	-	-
Personal Care						
Yes	30,359	44.85	30,359	100	11,811	51.21
No	37,336	55.15	-	-	11,255	48.79
No. other Services						
Mean	1.39	-	1.31	-	1.72	-
Weekly PC Hours						
Min	0	-	0.5	-	0	-
Mean	4.07	-	9.09	-	5.07	-
Median	0	-	7	-	1	-
Max	168	-	168	-	168	-
Multistaff					-	-
Yes	-	-	3,104	10.22	-	-
No	-	-	27,255	89.78		

of hours of care might provide a more accurate description of the average hours of personal care. This is seven hours per week for the personal care sample, one hour for the unpaid care sub-group, and zero for the whole sample.

Finally, the multistaff variable indicates whether or not a personal care client requires two or more members of care staff helping them. This is the case when a client has significant mobility problems such that they need more than one person to help them move around the house. Therefore, this variable will provide an indication of need. Around 10% of personal care clients have been assigned the multistaff indicator.

The following section will outline the model of interest, explore the difficulties encountered when working with skewed explanatory variables and propose three approaches to estimate the model which account for skewness.

3.3 METHODS

The relationship of interest is between the presence of an unpaid carer and an individuals' utilisation of personal care services. Specifically, personal care services PC_i are described as a function

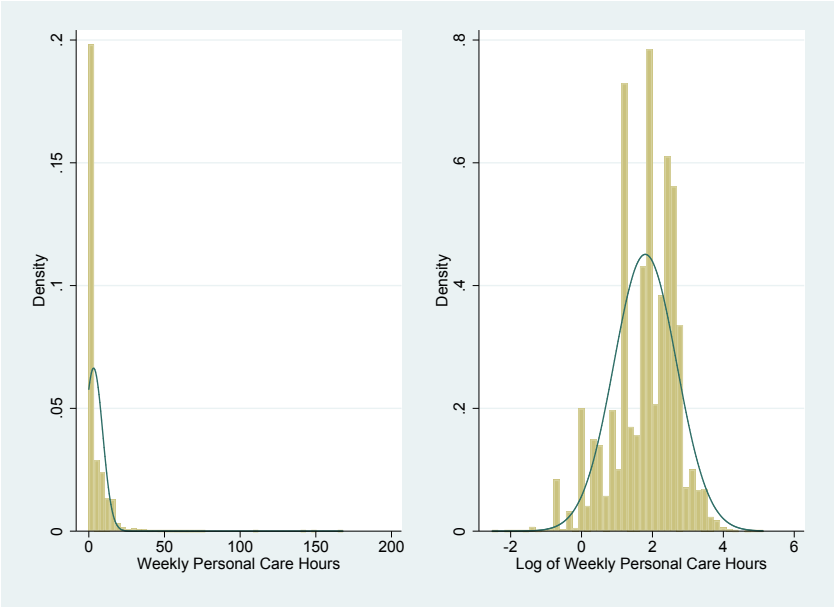


Figure 3.1: Distribution of Weekly Personal Care Hours

of unpaid care UC_i and other observed and unobserved characteristics:

$$PC_i = f(UC_i, X_i, \epsilon_i) \tag{3.1}$$

Where i indexes individuals for $i = 1...n$, X_i represents other socio-demographic and health characteristics of the individual, and ϵ_i is the unobserved error term.

In the empirical estimations of the relationship as described by Eq. 3.1, the dependent variable is PC_i and is a continuous variable measuring the number of hours of personal care services individual i received during the census week. The explanatory variable of interest, UC_i is a binary indicator which is equal to 1 if the individual was known to have an unpaid carer and 0 if the individual was known not to have an unpaid carer.

As can be seen in the left hand panel of Fig. 3.1, weekly personal care hours are highly positively skewed. In particular, for those who have positive personal care hours, a large proportion have very few hours of care and a small proportion have a very large number of hours of care. Specifically, the skewness of the distribution is 3.4. Heavily skewed distributions of health outcomes, such as hours of personal care, is a common problem in the analysis of health care data and especially with expenditure data, which is highly correlated with hours of care. Heavily skewed dependent variables in standard regression models such as Ordinary Least Squares (OLS) can lead to non-normal residuals which will yield inconsistent estimates of marginal and treatment effects. Economists have developed several ways to deal with this problem, three of which are explored in this paper.

The remainder of this section will outline the empirical models to be estimated and the calculations of the incremental effect of the UC variable in each model.

OLS

One approach to dealing with skewed distributions of dependent variables in regression analysis is to transform the dependent variable by taking its natural logarithm to ensure that the disturbance approximates normality. This approach is common in the health economics literature, particularly in the modelling of utilisation and spending on health resources. (Buntin & Zaslavsky 2004, Mihaylova et al. 2011). The panel in the right of Fig. 3.1 shows the distribution of the logged personal care hours for those with non-zero hours of personal care. Clearly, the distribution is more normal for the logged hours of personal care.
The model is estimated via OLS as:

$$E[lnPC_i|UC_i, X_i] = (\beta_{uc}UC_i + \boldsymbol{X_i'\beta} + \epsilon_i) \tag{3.2}$$

Where $lnPC_i$ is the natural log of positive personal care hours, β_{uc} is the parameter to be estimated on unpaid care (UC_i), $\mathbf{X_i}'$ is the vector of explanatory variables which includes a constant, $\boldsymbol{\beta}$ is the vector of parameters to be estimated, and lastly ϵ_i is the random error term.

Interpreting the marginal effects in log-linear models requires transforming the coefficients such that unit changes in explanatory variables can be interpreted as percent changes in the log of personal care hours. In order to calculate the incremental effect of unpaid care on the raw scale of personal care hours rather than the log of hours, one has to re-transform the dependent variable. This is more complex if the exponentiated error term is not homoskedastic and can lead to inconsistent estimates of the incremental effect (Manning 1998).

Generalized Linear Model

A second approach to dealing with skewness is to use a Generalized Linear Model (GLM). This approach has increasingly been applied in health economics research (Deb et al. 2017). The GLM framework allows the mean of the dependent variable to be a function of the linear index of covariates, and at the same time allows the variance of the dependent variable to be a function of its predicted value through the choice of a suitable distribution family (for general overview see (Deb et al. 2017)).

The model becomes:

$$E[PC_i|UC_i, X_i] = g^{-1}(\beta_{uc}UC_i + \boldsymbol{X_i'\beta} + \epsilon_i) \tag{3.3}$$

Where g^-1 represents the inverse of the log-link function and the outcome variable is generated by the gamma distribution. The decision to use the log-link function and gamma distribution family is based on Akaike and Bayesian Information Criteria, AIC and BIC respectively, and statistical tests including the Box-Cox and Modified Park tests [9]. The log-link and gamma family is a common choice for GLM models of health care expenditures and costs (Deb et al. 2017, pg.86)

GLM's are especially useful because they model heteroskedasticity directly and avoid the re-transformation of the outcome variable back to the raw scale as with log-linear models. This means

[9] Output from tests available on request.

that marginal and incremental effects can more easily be calculated. Specifically in the GLM, the marginal effect of a continuous variable X is:

$$\frac{\partial E[PC_i|UC_i, X_i]}{\partial X} = \beta_x e^{X_i'\beta} \tag{3.4}$$

Since the unpaid care variable is a binary indicator, the marginal effect is simply the incremental effect on weekly hours of personal care:

$$\frac{\Delta E[PC_i|X_i]}{\Delta UC} = e^{(X_i'\beta|UC=1)} - e^{(X_i'\beta|UC=0)} \tag{3.5}$$

Of course, the OLS and GLM models are both conditional on an individual having positive personal care hours. This condition results in a loss of information since those clients who do not receive any personal care in the first place are ignored. That is, we know that many clients in fact have zero hours of personal care. The third estimation attempts to account for this.

Two-Part Model

We observe that 55% of the total sample were not receiving personal care and subsequently had zero personal care hours. Using statistical models that ignore this mass at zero might mean that the effects of the explanatory variables on the outcome cannot be generalised to the whole population. Specifically, OLS and GLM only describe the effect of an unpaid carer on personal care hours for those who receive personal care, however this effect might differ from the effect of an unpaid carer on whether or not a person receives personal care in the first instance. Thus, it is important to explicitly model the mass at zero, and subsequently calculate marginal and incremental effects which account for this.

One model which does this is the two-part model (2PM). It involves firstly estimating the probability of having a non-zero outcome via probit or logit, and subsequently estimating the mean of the outcome, conditional on having a non-zero outcome via OLS or GLM. 2PMs have widely been used and discussed in the health economics literature (Mihaylova et al. 2011, Duan et al. 1984, Mullahy 1998, Buntin & Zaslavsky 2004) and have often been shown to outperform other models when a large proportion of zeroes exist in the data (Mihaylova et al. 2011). Moreover, the 2PM is frequently employed within the literature on the relationship between unpaid and formal care (Bonsang 2009, Charles & Sevak 2005, Bolin et al. 2008, Van Houtven & Norton 2004). Intuitively, there are different decisions occurring in the two parts of the 2PM, which implies that covariates may have different effects on the dependent variable each step (Deb & Trivedi 2002). Firstly an individual decides whether or not to demand any personal care services, and secondly the local authority decides how much care to supply. The 2PM is therefore appealing in this setting because it takes both decisions into account.

Other approaches to deal with a high proportion of zeroes include Heckman's 2-step selection model. Compared to the 2PM, where the zeroes are observed or 'genuine', the Heckman model treats the zeroes as unobserved individuals. Thus, it is argued that the 2PM is the most appropriate model for the analysis in this paper because those with zero hours of personal care are observed in the sample. Nevertheless, it is worth noting that there are unobserved individuals i.e. those in the

general population who do not receive social care services at all, and as a result are missing from the dataset. Thus, it is important to bear in mind that the probit model in the first part of the 2PM is estimated for a population who are perhaps already at an increased risk of requiring personal care.

Formally, the 2PM can be written as:

$$Pr[PC_i > 0|UC_i, \boldsymbol{X_i}] = \boldsymbol{\Phi}(\alpha_{uc} UC_i + \boldsymbol{X_i'\alpha} + \xi_i) \tag{3.6}$$

$$E[PC_i|PC_i > 0, UC_i] = g^{-1}(\beta_{uc} UC_i + \boldsymbol{X_i'\beta} + \epsilon_i) \tag{3.7}$$

The threshold in Eq. 3.6 is modelled as a binary probit model where Φ represents the cumulative density function of the standard normal distribution. This is known as the 1st part of the 2PM. The dependent variable PC_i and key explanatory variable of interest UC_i are as described above. Here, $\mathbf{X}'$ is a vector of explanatory variables including an intercept. The parameters to be estimated are in the vector $\boldsymbol{\alpha}$ and ξ_i is the error term.

Eq. 3.7 is a GLM model for individuals with strictly positive hours of personal care and is known as the 2nd part of the 2PM. It is identical to Eq. 3.3. Once again, g^{-1} is the inverse of the log-link function and the outcome variable, PC_i, is generated by the gamma distribution. The parameters to be estimated are in the vector $\boldsymbol{\beta}$ and ϵ_i is the error term. Estimation of the 2PM is carried out in Stata using the `twopm` command (Belotti 2015).

Post estimation, the full marginal effects can be calculated:

$$\frac{\partial E[PC_i|UC_i, X_i]}{\partial UC} = e^{X_i'\beta}\phi(\boldsymbol{X_i'\alpha})\alpha_{uc} + \beta_{uc} e^{X_i'\beta}\Phi(\boldsymbol{X_i'\alpha}) \tag{3.8}$$

Where $\boldsymbol{X_i'\alpha_i}$ are the linear predictions from Eq. 3.6 and α_{uc} is the estimated parameter on the unpaid care indicator. As before $\boldsymbol{X_i'\beta_i}$ and β_{uc} are the respective predictions from Eq. 3.7. Finally, ϕ represents the standard normal density function.

Eq. 3.8 shows the marginal effect for a continuous variable. The incremental effect of the presence of an unpaid carer on personal care hours can be calculated simply as:

$$\frac{\Delta E[PC_i|X_i]}{\Delta UC} = \Phi(\boldsymbol{X_i'\alpha}|UC = 1)e^{(\boldsymbol{X_i'\beta}|UC=1)} - \Phi(\boldsymbol{X_i'\alpha}|UC = 0)e^{(\boldsymbol{X_i'\beta}|UC=0)} \tag{3.9}$$

Endogeneity

As mentioned in Section 3.1, there are potential sources of endogeneity that could exist in the model. Firstly, endogeneity might be present due to omitted variable bias where an omitted variable is correlated with both unpaid care and the dependent variable. One potential omitted factor is the need of the social care client. The models account for client need via several variables. If these do not fully reflect client need, there could be a correlation between unpaid care and the error term, leading to the estimate of the incremental effect of unpaid care being biased. Unfortunately, the SCS is limited in its collection of needs indicators. Whilst it does have an entry for an Indicator of Relative Need (IoRN) score. This is a non-mandatory item in the survey

and as a result it is very poorly recorded by local authorities. To give an indication of the direction and extent of any bias due to the omission of need, we also present the results from the 2PM in which we incrementally add each control for need, to show how the marginal effect of unpaid care changes as a result. These results are shown in Table 3.5.

Secondly, endogeneity might be present due to the potential reverse relationship that could exist between unpaid and formal care services. For example, the number of hours of personal care a person receives might influence the decision of their unpaid carer to provide care. As outlined in Section 3.1, a number of studies have found that not accounting for this reverse causality can significantly alter model results (Van Houtven & Norton 2004, 2008). In order to test and account for this reverse causation, Instrumental Variables (IV) methods can be used. Of the literature which implements IV techniques, the most commonly used instruments are varying characteristics of the care givers. Unfortunately, since the SCS data are collected for administrative purposes, they don't contain any information on the carer themselves. Having said that, we conduct an IV analysis as a sensitivity check, by constructing instruments from Census information. As a further check against reverse causality, the models are re-estimated for those clients who appeared in 2016 only. The reason being that this is the first time those clients started receiving social care, meaning that their unpaid care status is unlikely to have been influenced by the number of hours of personal care they received. These estimates can be compared to the initial model results to see if there is any evidence of reverse causality confounding the estimates.

The next section presents and discusses the model results from the three estimation approaches and sensitivity analyses.

3.4 RESULTS AND DISCUSSION

Table 3.2 displays the model results. The OLS and GLM estimations (this includes the 2nd part of the 2PM), are estimated on the sample of individuals who received personal care, whilst the 1st part of the 2PM, as shown in the table, is estimated for the whole sample.

Overall, the signs of coefficients in the OLS and GLM estimations are in line with a priori expectations. In particular, older age is shown to have a positive relationship with weekly hours of personal care and in general. This is consistent with the idea that ageing is associated with increased frailty and need for care. Having said that, in the GLM specification, compared to being aged 65-74, being aged 75-84 is associated with significantly lower hours of personal care. With respect to gender, there are significant differences in weekly hours of personal care between men and women. In particular, women have significantly higher personal care hours compared to men.

Moreover, the greater the number of other services a client is receiving, i.e. over and above home care, the higher are their weekly personal care hours. The number of other services variable will act as a proxy for level of need and thus the positive relationship is what one would expect. In addition to this, individuals with two members of staff caring for them also have significantly higher weekly personal care hours. At the same time, having received any form of social care service in more than one year is also associated with significantly higher weekly personal care hours. All effects of the aforementioned needs indicators are significant at the 1% significance level in both models. The dementia variable is found to be insignificant in both models.

Table 3.2: Model Results

Variable	OLS	GLM	2PM (P1)
Aged 75-84	-0.00818	-0.0273*	0.0511***
	(0.016)	(0.016)	(0.016)
Aged 85-94	0.0506***	0.0252	0.0155
	(0.016)	(0.017)	(0.016)
Aged 95+	0.150***	0.125***	0.0326
	(0.026)	(0.023)	(0.027)
Female	0.0250**	0.0262**	0.0313***
	(0.011)	(-0.0102)	(-0.0112)
Has unpaid carer	0.114***	0.106***	0.269***
	(0.013)	(0.013)	(0.015)
No. Oth Services	0.125***	0.100***	-0.185***
	(0.008)	(0.007)	(0.008)
Dementia	0.0222	0.0161	0.00458
	(0.017)	(0.015)	(0.018)
Multistaff	0.994***	0.939***	-
	(0.017)	(0.015)	-
SCS previously	0.0633***	0.0437***	0.169***
	(0.013)	(0.012)	(0.014)
2015	-0.156***	-0.120***	-0.663***
	(0.020)	(0.018)	(0.021)
2016	-0.113***	-0.0742***	-0.353***
	(-0.0207)	(-0.0189)	(-0.0214)
Constant	1.521***	1.886***	0.511***
	(0.120)	(0.123)	(0.128)
Observations	25,423	25,423	67,682
Marginal Effect	0.80***	0.90***	1.23***

*Robust standard errors are shown in parentheses; * p <0.10, ** p <0.05, *** p <0.01*
Local authority dummies are included but are not presented in output.

As for the unpaid carer variable, the coefficients are positive and highly significant in both estimations, suggesting that weekly personal care hours are higher on average for clients with an unpaid carer compared to those without, other things being equal. This finding provides support for the complementary hypothesis.

With respect to the year indicators, both OLS and GLM suggest that weekly care hours are significantly lower in 2015 and 2016 compared to 2014.

The third column in Table 3.2 shows the results from the 1st part of the 2PM. Thus, the dependent variable is the probability of receiving personal care, or in other words, the probability of having positive weekly personal care hours. As with the OLS and GLM estimations, age has a positive impact on the probability of receiving personal care. However, this effect is smaller and becomes insignificant into the oldest age groups. Furthermore, the 2PM also predicts that females and those who received some form of care in more than one year are significantly more likely to receive personal care. Once again, the dementia indicator is insignificant and clients are less likely to receive personal care in 2015 and 2016 compared to 2014.

Interestingly, the probit model predicts that the higher the number of other services a client receives, the less likely they are to receive personal care. This reflects the fact that the other services are possibly preventing older people from requiring personal care. For example, meals and telecare services. Lastly, the model predicts that clients with an unpaid carer are significantly more likely to receive personal care services. This is in accordance once again with the complementary hypothesis.

In terms of the incremental effect of an unpaid carer on weekly hours of personal care, the results are consistent across the three models. With OLS, the coefficient on the carer dummy

indicates that those with an unpaid carer have higher weekly personal care hours by about 11.4%. As discussed in Section 3.3, calculating marginal and incremental effects in models with a log-transformed dependent variable requires re-transformation back to the raw scale. This re-transformation depends on the estimated errors from the model which can be incorrect if these errors are heteroskedastic. A Breusch-Pagan test for constant variance of the residuals in the OLS estimation finds that heteroskedasticity is present in the model. As a result, calculating the incremental effect of unpaid care is not appropriate. Instead, we can use the coefficient of 0.114 and apply it to the median personal care hours to get an estimate of the effect in terms of the average number of hours of weekly personal care. This gives a figure of about 50 minutes per week. That is, those with an unpaid carer receive about 50 minutes more per week of personal care.

With GLM, the incremental effect of an unpaid carer can be calculated using Eq. 3.5. This results in a positive incremental effect of 0.90 hours per week. This result is significant at the 1% significance level. In other words, those with an unpaid carer receive, on average, about 54 minutes more personal care per week, all other things being equal.

Moreover, the incremental effect of unpaid care in the 2PM, calculated using Eq. 3.9, which takes into account the probability of receiving personal care, is 1.23 hours per week. That is, personal care clients with an unpaid carer receive around 1 hour and 14 minutes more per week compared to personal care clients without an unpaid carer, ceteris paribus. Once again, this result is statistically significant at the 1% level.

The small difference in the predicted incremental effect of unpaid care on hours of weekly personal care between the three estimations is promising, showing that the findings are robust across different methods of estimation. This has been shown to be the case in previous research which compares methods for modelling skewed health care data (Buntin & Zaslavsky 2004). In terms of deciding which estimation is the most appropriate, specification tests, including Pregibon's link and Ramsey's RESET tests, find that the model as estimated with OLS is possibly misspecified, whilst GLM is correctly specified. As outlined in Section 3.3, the 2PM is generally preferred in this setting because it takes into account the full incremental effect of unpaid care, incorporating the two parts of the decision process in determining personal care utilisation. This is also the approach taken by the vast majority of the literature (Bonsang 2009, Van Houtven & Norton 2004, 2008, Weaver & Weaver 2014).

On the whole, the results outlined in this section show that unpaid care tends to complement personal care services. That is, in general, the presence of an unpaid carer is associated with an increase in the number of weekly personal care hours. This finding supports the complementary hypothesis and might suggest that unpaid carers are demanding personal care services on behalf of the person they are caring for. These results are also in line with some of the existing literature which finds that a complementary relationship exists between unpaid and formal care (Geerts & Van den Bosch 2012, Litwin & Attias-Donfut 2009). However, they are in contrast to much of the existing literature which finds evidence of a negative relationship between unpaid care and formal care (Van Houtven & Norton 2004, 2008, Charles & Sevak 2005, Bolin et al. 2008, Lo Sasso & Johnson 2002).

The finding of a complementary relationship between unpaid and paid care in Scotland might

Table 3.3: 2PM Results: Accounting for client need

Variable	2PM-1		2PM-2		2PM-3		2PM-4	
	(P1)	(P2)	(P1)	(P2)	(P1)	(P2)	(P1)	(P2)
Aged 75-84	0.0546***	-0.113***	0.0546***	-0.0257	0.0513***	-0.0268*	0.0511***	-0.0273*
	(0.016)	(0.018)	(0.016)	(0.016)	(0.016)	(0.016)	(0.016)	(0.016)
Aged 85-94	0.0221	-0.0909***	0.0221	0.0273*	0.0156	0.0254	0.0155	0.0252
	(0.016)	(0.018)	(0.016)	(0.017)	(0.016)	(0.017)	(0.016)	(0.017)
Aged 95+	0.0433	-0.0215	0.0433	0.127***	0.0325	0.124***	0.0326	0.125***
	(0.027)	(0.025)	(0.027)	(0.023)	(0.027)	(0.023)	(0.027)	(0.023)
Female	0.0359***	-0.00745	0.0359***	0.0284***	0.0313***	0.0263***	0.0313***	0.0262**
	(0.011)	(0.012)	-0.0112	-0.0102	-0.0112	-0.0102	-0.0112	-0.0102
Has unpaid carer	0.298***	0.196***	0.298***	0.114***	0.269***	0.107***	0.269***	0.106***
	(0.014)	(0.014)	(0.014)	(0.012)	(0.014)	(0.013)	(0.015)	(0.013)
No. Oth Services	-0.172***	0.105***	-0.172***	0.102***	-0.184***	0.100***	-0.185***	0.100***
	(0.008)	(0.007)	(0.008)	(0.007)	(0.008)	(0.007)	(0.008)	(0.007)
Demenita	-	-	-	-	-	-	0.00458	0.0161
	-	-	-	-	-	-	(0.018)	(0.015)
Multistaff	-	-	-	0.939***	-	0.938***	-	0.939***
	-	-	-	(0.014)	-	(0.014)	-	(0.015)
SCS previously	-	-	-	-	0.169***	0.0438***	0.169***	0.0437***
	-	-	-	-	(0.014)	(0.012)	(0.014)	(0.012)
2015	-0.626***	-0.104***	-0.626***	-0.105***	-0.663***	-0.120***	-0.663***	-0.120***
	(0.021)	(0.021)	(0.021)	(0.018)	(0.021)	(0.018)	(0.021)	(0.018)
2016	-0.323***	-0.0633***	-0.323***	-0.0610***	-0.353***	-0.0735***	-0.353***	-0.0742***
	(0.021)	(0.022)	(0.021)	(0.019)	(0.021)	(0.019)	(0.021)	(0.019)
Constant	0.421***	2.073***	0.421***	1.869***	0.513***	1.894***	0.511***	1.886***
	(0.127)	(0.120)	(0.127)	(0.123)	(0.127)	(0.123)	(0.128)	(0.123)
Observations	67,682	25,423	67,682	25,423	67,682	25,423	67,682	25,423
Marginal Effect	1.55***		1.35***		1.24***		1.23***	

Robust standard errors are shown in parentheses
** p <0.10, ** p <0.05, *** p <0.01*
Local authority dummies are included but are not presented in output.

be explained by the fact that personal care services are free for the over 65s. Thus, unpaid carers might not be making the same financial calculations as would be the case in jurisdictions where personal care bears a financial cost. That is, if the cost of personal care were to fall on the unpaid carer, there is more likely to be a substitution. Furthermore, complementarity might not be surprising, given the sample of individuals analysed in this paper are likely to be of a higher dependency level. Intuitively, a complementary relationship might be expected for those with a higher level of dependency since it might be that unpaid carers, who are most likely to be partners or children, are less able to help with personal care tasks such as bathing and toileting. Moreover, for parents who are getting care from their children, they might be less willing to let their child help them with such tasks. This finding is consistent with Bonsang (2009) who finds evidence of complementarity for nursing care.

Sensitivity Checks

As mentioned in Section 3.3, a variety of sensitivity analysis are carried out to check for the extent of endogeneity. One source of endogeneity is omitted variable bias due to not accounting fully for individual need. Table 3.3 presents the parameter estimates from both parts of the 2PM when each control for client need is added. Overall, the results suggest that including additional controls for need reduces the marginal effect of unpaid care on weekly hours of personal care. This suggests that any bias resulting from not accounting for need will tend to lead to overestimates of the marginal effect of unpaid care. However, we find that as additional controls for need are added,

the change in the marginal effect gets smaller and smaller. This is promising and indicates that altering the model specification to include additional controls for need will make little difference to the estimated marginal effect of unpaid care.

The second source of endogeneity comes from the potential reverse causality between personal and unpaid care which would result in the unpaid care variable being endogenous and parameter estimates biased. As discussed, IV can be used to account for reverse causality. IV involves sourcing exogenous variation in the unpaid care variable UC, that does not directly influence the dependent variable PC. Such exogenous variation takes the form of an instrument. Of the literature which implements IV techniques, the most commonly used instruments are varying characteristics of the care givers. Much of the literature focusses explicitly on children caring for parents, hence among the most frequently used instruments are, proportion of daughters, distance to nearest child and age of eldest child (Bonsang 2009, Bolin et al. 2008, Van Houtven & Norton 2008, 2004, Charles & Sevak 2005). Our focus however, is not restricted to children caring for parents and individuals in the SCS could be receiving care from a child, partner or someone else.

As discussed, since the SCS data are collected for administrative purposes, there is limited opportunity for finding suitable instruments. However, we propose using publicly available data zone[10] level information from the 2011 Census to construct two IVs. Those are, the number of one person households and the number of married individuals, both as proportions of the data zone populations. In Scotland, around 78% of carers are living with someone in a couple (Scottish Government 2015). Thus, both of the proposed data zone level rates are thought to be good predictors of an individuals' likelihood of having an unpaid carer, i.e. living in an area with a high marriage rate or low one-person household rate should be highly positively correlated with a persons unpaid care status, but have no influence on a specific individuals' personal care utilisation. We use both IVs to instrument the carer variable. Due to the recording of data zones in the SCS, which changes between the three years, this approach is only possible for those clients who were in either all three years, 2016 only, 2016 and 2015, or 2016 and 2014. We also include an additional income variable in the IV regressions because income might be correlated with household composition, which in turn could influence hours of FPC. We use data zone level income deprivation from the Scottish Index of Multiple Deprivation (SIMD) [11]. This variable captures the proportion of the data zone which are determined to be income deprived.

IV models are estimated for the two parts of the 2PM using two data zone level instruments. Two-stage least squares is used for both parts of the model. Table 3.4 shows the key statistics from the IV regressions, first using one instrument and then using both. The table shows that in all cases the instruments are good predictors of unpaid care status. This is indicated by the first-stage Kleibergen-Paap Wald rk F-statistics, which are all above the 'rule of thumb' requirement of 10. When both instruments are included, they also pass the over identification test. Lastly, the Durbin-Wu-Hausman Chi-square statistics for the exogeneity of unpaid care are consistently insignificant at the required 5% significance level, suggesting that the carer variable can be treated

[10] A data zone is a small-area statistical geography in Scotland containing populations of between 500 and 1,000 residents.

[11] The SIMD is a tool developed by the Scottish Government which measures deprivation and poverty in Scotland. The tool is based on a number of deprivation indicators which are used to create different domains, e.g.income, education and employment. Scotland's data zones are then ranked according to those domains, going from the most deprived to the least deprived. (Scottish Government 2016*c*)

Table 3.4: Instrumental Variables Specification Tests

Dependent Variable	Instruments	Strength of Instruments	Overidentification Test	Exogeneity Test
Positive Personal Care Hours	% one person households in data zone	F(1, 5757) = 64.49***	Equation exactly identified	Chi-sq(1) = 0.08
Personal Care Hours	% one person households in data zone	F(1, 4583) = 39.38***	Equation exactly identified	Chi-sq(1) = 0.38
Positive Personal Care Hours	% one person households in data zone; % of married people in data zone	F(2, 5757) = 33.54***	Chi-sq(1) = 0.16	Chi-sq(1) = 0.07
Personal Care Hours	% one person households in data zone; % married people in data zone	F(2, 4583) = 19.80***	Chi-sq(1) = 0.67	Chi-sq(1) = 0.35

as exogenous. The parameter estimates from the second-stage regressions are shown in Table 3.6 in the Appendix.

Furthermore, the models are re-estimated for those clients who appeared in 2016 only. Estimating the models for individuals only present in 2016 acts as a check against reverse causality, assuming that those who were not present in earlier years, were receiving social care for the first time in 2016 and as a result, the decision of their unpaid carer to provide care is less likely to be influenced by the number of hours of care the client is receiving. The results are shown in Table 3.7 in the Appendix and they are consistent with the previous findings.

Overall, the results from the above endogeneity sensitivity checks are consistent with the main model conclusions and consistently find that unpaid carers complement personal care services for the over 65s in Scotland.

Finally, to ensure that the results are not sensitive to the recording of unpaid care information by local authorities, the 2PM (including the full set of need variables) is estimated for the sample of local authorities in which more than 50% of individuals had unpaid carer information recorded. The output from this model is shown in Table 3.8 in the Appendix. Once again, the results are consistent with the previous findings.

3.5 CONCLUSION

The ageing shift occurring in populations across the world has the potential to increase pressures on LTC provision. As individuals continue to live into older ages they are more likely to require care for frailty and chronic conditions, especially if ageing is associated with an expansion of morbidity (Walter et al. 2016, Campolina et al. 2014, Beltrán-Sánchez et al. 2016). This care can be provided through paid care, also known as formal care, or by unpaid carers. Often, formal care services are organised and provided by the state. Thus, any increased pressure on those services inevitably raises concerns regarding the strain of LTC provision on the public purse. If unpaid care substitutes for formal care, governments might consider policies which incentivise unpaid care, in order to reduce the demand for formal LTC services.

However, evidence in the existing literature is extremely mixed. Some pieces of research have found evidence suggesting unpaid care substitutes for formal care, whilst others have found that it actually complements formal care. The influence that unpaid care has on formal care services will undoubtedly have considerable implications on the utilisation and subsequent costs of those

services. It is therefore vital that the relationship between the two is fully investigated, so that LTC policy can be developed to appropriately respond to an ageing population. Scotland provides a particularly interesting opportunity to examine this relationship, where personal care services are free to those aged 65+ receiving care at home, unlike many jurisdictions where the cost of care is borne by the individual and their family.

This paper is the first to utilise a unique administrative dataset in Scotland to investigate the influence that unpaid carers have on personal care utilisation by the 65+. Specifically, it uses data from the SCS, from 2014-2016, and looks at how the presence of an unpaid carer influences the number of hours of personal care the cared for receives in a week. We estimate OLS, GLM and 2PMs. The 2PM is the most appealing estimation procedure in the literature on paid and unpaid care as it accounts for the full marginal effect of unpaid care, given that there are a large proportion of individuals with zero hours of personal care.

The results from the 2PM suggest that unpaid care tends to complement personal care services. In particular, the incremental effect of an unpaid carer is 1 hour 14 minutes per week. A variety of sensitivity analysis are also conducted to check for the extent of endogeneity in the model. The findings from this analysis also finds a complementary relationship between unpaid and personal care. These findings are consistent with the literature supporting the complementary hypothesis (Geerts & Van den Bosch 2012, Litwin & Attias-Donfut 2009), as well as with those finding that complementarity is more likely to exist for those with high levels of need (Bonsang 2009), which the sample of individuals analysed here have since they are already receiving some form of social care. Further investigation into different sub-samples might be useful in determining whether or not a complementary relationship holds for other groups. For example, for social care clients who are receiving home care only, that is help with IADLs, a substitution effect might be more likely.

The finding of complementarity in Scotland for those aged 65+ may be unsurprising given that personal care is free for those individuals. To expand, unpaid care is generally provided by a spouse or an older child. In jurisdictions where personal care bears a financial cost, it might fall on the unpaid carer to finance this. To do this, they might choose to supply more hours in the labour market and therefore devote less time to providing unpaid care. In Scotland, where there is no cost attached to personal care, unpaid carers may be more likely to advocate on behalf of the cared for to ensure they get the care they require, compared to jurisdictions where there is a cost associated with formal care. Thus, the complementary relationship might suggest that unpaid carers are supported by the formal care sector and this is effective in enabling them to remain in employment (Pickard et al. 2015, Brimblecombe et al. 2018). At the same time, it may also demonstrate that unpaid carers are providing a different kind of help to the person they are caring for compared to the formal care sector. For example, unpaid carers might help with the persons finances or simply by helping them to maintain a sense of self (Farina et al. 2017). However, further investigation would be needed to verify this.

The existence of a complementary relationship between unpaid and formal care is concerning in two dimensions. Firstly, it might mean that as the Scottish population ages and family members take on the role of unpaid carers, the pressure on local authorities providing LTC to older individuals will increase as unpaid carers demand services on behalf of the cared for. If this is the case, planning for future social care spending will have to take this into account. Secondly, there is a

concern that there could be unmet need for those individuals who do not have an unpaid carer. This is especially highlighted in the 1st part of the 2PM, in which it is predicted that those without unpaid carers are significantly less likely to receive personal care services in the first place.

There are however, some caveats in this paper which warrant comment. Firstly, concerning the generalisability of the results to the entire population. Specifically, the sub-sample of the population analysed here is already a higher needs group in that they require some form of social care service. Thus, the findings of complementarity between unpaid and paid care might not extend beyond personal care clients. Related to this, the sub-sample of unpaid carers captured in the SCS might be systematically different from unpaid carers in the general population, for example in terms of the care they provide, once again threatening the generalisability of the complementary results reported here.

Secondly, the analysis is somewhat constrained by the sample selection criteria, which in the case of the unpaid care information, is poorly recorded by local authorities. Specifically, there are considerable differences in the proportions of local authorities who record the unpaid care information, which could introduce sample selection bias into the models. As a sensitivity check, the 2PM is estimated for those local authorities who had recorded the unpaid carer information for more than 50% of their social care clients[12]. In addition, a comparison of the main descriptive statistics between the pre-unpaid care selection sample and the final sample was also carried out. This comparison did not reveal any large differences between the two groups apart from in terms of personal care status. Specifically, the pre-unpaid care selection sample had a lower proportion of individuals receiving personal care by around 10%. This finding once again suggests that the final sample analysed here is likely to be a higher needs sub-set of the social care population analysed. Understanding if this selection criteria introduces bias into our sample, is still difficult to tell and future research would benefit greatly from inquiring with individual local authorities to understand more about their recording practices and shed light on the probability that this introduces selection bias.

Thirdly, we acknowledge that the variables which attempt to control for the need/health status of care clients are only proxies and might not fully capture the care needs of formal care recipients. As discussed, the SCS does collect more detailed needs information by means of an IoRN score, but as with the unpaid carer variable, this is optional information and is only available for a very small proportion of social care clients. If need is not fully captured by the included covariates in the model, the unpaid carer variable may act as a proxy for need. For example, it could be that unpaid carers provide care up to the point at which they can no longer meet the needs of the person they are caring for, and after this point, they seek additional help from the local authority. This could result in those with unpaid carers having higher personal care needs compared to those without. Further investigation with more detailed information on individuals need would be necessary to check this.

Lastly, the analysis is limited by the lack of information available on unpaid carers. For example, it is unknown if the carer is a child caring for a parent outside the household, or a partner caring for their other half in their own home. This information would be useful to check if the results would differ depending on the relationship between the cared for and carer, which some

[12] Results are shown in Table 3.7 in the Appendix

evidence suggests is the case (Geerlings et al. 2005, van den Berg & Ferrer-i Carbonell 2007). Moreover, the SCS doesn't contain information on the type of care provided or time spent caring by unpaid carers. Understanding more about the type of care unpaid carers are supplying would offer a further insight into the relationship between unpaid and formal LTC provision. In addition, information on the employment status of the unpaid carer would be useful in determining whether or not the relationship between unpaid and paid care changes with this status. For example, it might be that substitution is more likely when a carer is retired and has time to take on more caring duties themselves.

Finally, thus far we have assumed that the relationship between unpaid and paid LTC might put pressure on formal care services. Specifically, that a complementary relationship could lead to increased demand and subsequent costs to the government for providing formal LTC. However, it is possible that the complementarity between the two, suggests that unpaid carers are being supported in their role as care giver. As a result, they might provide care for longer and prevent the need for increased use of formal care or other forms of formal care such as residential care, and subsequently lower costs to the government overall. At the same time, providing unpaid care may also have negative consequences on carers health, well being and societal productivity (Schulz & Beach 1999, van den Berg & Ferrer-i Carbonell 2007, Bom et al. 2018, Pickard et al. 2018). Future research should therefore understand more clearly the costs that arise due to unpaid caring, to ensure that unpaid carers are properly supported in their role.

Notwithstanding these limitations, this paper has used Scotland's unique SCS to estimate the effect that unpaid carers have on older peoples' use of personal care services. The results consistently suggest that there is a complementary relationship between unpaid care and personal care services in Scotland. These findings are robust a variety of sensitivity checks.

3.6 APPENDIX

Table 3.5: Variable Descriptions

Variable	Description
Gender	0 if male, 1 if female
Age	0 if 65-74; 1 if 75-84; 2 if 85-94; 3 if 95+
Year	2014;2015;2016
SCS Previously	0 if received social care in one year only; 1 if received social care in more than one year
Dementia	0 if client not assigned dementia client group; 1 if client assigned dementia client group
Unpaid Carer	0 if client does not have an unpaid carer; 1 if client has an unpaid carer
No. oth services	Continuous variable from 0-5. Sum of services other than home care that a client is receiving. Those services are: telecare, meals services, self directed support; housing support; social work.
Weekly personal care hours	Continuous variable from 0 to 168.
Multistaff	0 if personal care client had one member of staff looking after them; 1 if personal care client had more than one member of staff caring for them.
Income Deprivation	Average proportion of data zones within the local authority which are income deprived.

Table 3.6: Sensitivity Analysis: IV 2SLS Second Stage Results

	IV_A (P1)	IV_A (P2)	IV_B (P1)	IV_B (P2)
Has unpaid carer	0.522**	-0.203	0.490*	-0.21
	(0.254)	(0.333)	(0.255)	(0.331)
Aged 75-84	0.0425***	0.0103	0.0421***	0.0102
	(0.008)	(0.022)	(0.008)	(0.022)
Aged 85-94	0.0382***	0.0615***	0.0377***	0.0614***
	(0.009)	(0.022)	(0.009)	(0.022)
Aged 95+	0.0449***	0.132***	0.0446***	0.131***
	(0.014)	(0.038)	(0.014)	(0.038)
Female	0.0345***	0.0258	0.0337***	0.0255
	(0.008)	(0.019)	(0.008)	(0.019)
No. Oth Services	-0.00362	0.128***	-0.0029	0.129***
	(0.008)	(0.014)	(0.008)	(0.014)
SCS previously	-0.0228	0.124***	-0.021	0.124***
	(0.017)	(0.022)	(0.017)	(0.022)
Dementia	-0.0445	0.0651	-0.04	0.0659
	(0.038)	(0.047)	(0.039)	(0.047)
Income Deprivation	0.0828**	0.0701	0.0820**	0.0702
	(0.036)	(0.073)	(0.036)	(0.073)
Two or more staff	-	0.991***	-	0.992***
	-	(0.044)	-	(0.044)
2015	-0.247***	-0.0679	-0.243***	-0.0669
	(0.041)	(0.055)	(0.041)	(0.055)
2016	-0.357***	0.0256	-0.351***	0.0266
	(0.045)	(0.059)	(0.045)	(0.059)
Constant	0.581***	-	0.596***	-
	-0.125	-	-0.126	-
Observations	42,009	15,751	42,009	15,751

*Standard errors are clustered at the data zone level and shown in parentheses: * p <0.10, ** p <0.05, *** p <0.01*
Local authority dummies are included but are not presented in output.

Table 3.7: Sensitivity Analysis: 2016 Only Clients

Variable	OLS	GLM	2PM (P1)
Aged 75-84	0.0352	0.0225	0.0225
	(0.033)	(0.028)	(0.028)
Aged 85-94	0.0633*	0.0538*	0.0538*
	(0.034)	(0.028)	(0.028)
Aged 95+	0.101	0.111**	0.111**
	(0.066)	(0.053)	(0.053)
Female	-0.02020	-0.0159	-0.0159
	(0.025)	-0.0206	-0.0206
Has unpaid carer	0.00772	0.0194	0.0194
	(0.035)	(0.030)	(0.030)
No. Oth Services	0.113***	0.0893***	0.0893***
	(0.017)	(0.014)	(0.014)
Demenita	0.872***	0.769***	0.769***
	(0.042)	(0.028)	(0.028)
Multistaff	0.0497	0.0245	0.0245
	(0.036)	(0.030)	(0.030)
Constant	1.515***	1.797***	1.797***
	(0.073)	(0.060)	(0.060)
Observations	4935	4935	14922
Marginal Effect	0.05	0.16	0.46***

*Robust standard errors are shown in parentheses; * p <0.10, ** p <0.05, *** p <0.01*
Local authority dummies are included but are not presented in output.

Table 3.8: Sensitivity Analysis: Local authorities with good unpaid care information

Variable	OLS	GLM	2PM (P1)
Aged 75-84	0.0345	0.0386*	0.0386*
	(0.027)	(0.023)	(0.023)
Aged 85-94	0.0888***	0.0887***	0.0887***
	(0.027)	(0.024)	(0.024)
Aged 95+	0.215***	0.224***	0.224***
	(0.048)	(0.040)	(0.040)
Female	-0.00226	0.00332	0.00332
	(0.020)	-0.0172	-0.0172
Has unpaid carer	0.0557**	0.0758***	0.0758***
	(0.024)	(0.023)	(0.023)
No. Oth Services	0.157***	0.122***	0.122***
	(0.016)	(0.014)	(0.014)
Demenita	0.0525	0.0548	0.270***
	(0.045)	(0.036)	(0.041)
Multistaff	0.734***	0.700***	0.550***
	(0.042)	(0.037)	(0.032)
SCS previously	0.0489**	0.0164	-0.237***
	(0.021)	(0.020)	(0.050)
Eilean-Siar	0.271***	0.270***	-0.221***
	(0.042)	(0.041)	(0.052)
Glasgow City	0.604***	0.550***	0.700***
	(0.033)	(0.032)	(0.037)
2015	-0.269***	-0.237***	0.0164
	(0.056)	(0.050)	(0.020)
2016	-0.257***	-0.221***	0.0548
	-0.0578	-0.0517	-0.036
Constant	1.329***	1.645***	1.645***
	(0.067)	(0.064)	(0.064)
Observations	8,560	8,560	23,175
Marginal Effect	0.40**	0.63***	1.62***

*Robust standard errors are shown in parentheses; * p <0.10, ** p <0.05, *** p <0.01*

4 | The Cost of Unpaid Care: a Standard of Living Approach

Elizabeth Lemmon and David Bell

Abstract

The increase in the average age of the Scottish population has increased the demand for care for older people. Much of this care is provided by unpaid (informal) carers. The provision of unpaid care affects the living circumstances of these carers. Currently, eligible Scottish carers are entitled to claim a cash benefit called the Carers Allowance to offset the additional costs they face due to their care giving role. This paper employs methods used by Morciano et al. (2015), to better understand the effects of caring on the living circumstances of carers. It uses data from the 2013/14 - 2016/17 UK Family Resources Survey (FRS), to estimate the monetary cost of providing unpaid care. This estimate is based on the effect of providing care on a carer's Standard of Living (SoL). We use this estimate to provide evidence on the extent to which the Carers Allowance sufficiently compensates unpaid carers. Our results suggest that caring is associated with a significant reduction in SoL. This reduction is largest for those who live with the person being cared for and according to the best fitting model it is predicted that these carers would need to be compensated by £229 per week in order to reach the same SoL as their non-caring counterparts. This paper concludes that the current Carers Allowance offered to eligible carers is not sufficient to compensate them for the loss in SoL they experience due to care giving. Specifically, it would need to increase to a level that is at least three times higher.

4.1 INTRODUCTION

The structure of the Scottish population, like most Organisation for Economic Co-operation and Development (OECD) countries, has changed significantly in recent decades (OECD 2017). Average life expectancy rose from around 72 years to 79 years between 1981 and 2014 (National Records of Scotland 2017). There were 20% fewer registered births in 2016 compared to 1975 (National Records of Scotland 2017). As a result, the average age of the Scottish population has increased. It is expected that by 2041, 14% of the population will be aged 75 and over, compared to just 8% in 2016 (National Records of Scotland 2016*b*).

Population ageing has led to an increase in demand for long term care for older people. Included in this is increased pressure on family members and friends to take on roles as unpaid or informal carers (Rutherford & Bu 2017). Informal care is defined by Carers UK as unpaid care provided to "family, partners or friends in need of help because they are ill, frail or have a disability" (Howard 2002, pp.4). A recent report on long term care demand and expenditures estimated that over the next 25 years, the number of disabled people receiving unpaid care in England will rise by more than 75% (Wittenberg et al. 2018).

Furthermore, as the population has aged, the prevalence of multi-morbidities has increased (Salisbury et al. 2011). This changes the demands on the types of care unpaid carers need to deliver, often meaning they have to provide intensive personal care to family members with complex needs, having had little or no formal training.

The pressure on family members to take up unpaid caring roles is intensified further by cuts in government expenditure and legislation aimed at promoting care in the community. For example, new health and social care integration policy in Scotland has a focus on enabling older adults to stay in their own homes for as long as possible (Scotish Government 2016). This policy shift has increased pressure on family members to provide unpaid care to older relatives who are living at home.

Unpaid carers are recognised as the most important source of long term care for disabled individuals in OECD countries (OECD 2017). For long term care costs of dementia in the US, it is estimated that 49% of the total costs are made up of unpaid care costs (Hurd et al. 2013), whilst it is around 36% for the UK (Knapp et al. 2007). The costs of unpaid care can be due to unpaid carers juggling both employment and caring responsibilities (Pickard et al. 2018, Pickard 2018). This tension can lead to costs for unpaid carers, their employers and to society, as work absenteeism increases and unpaid carers cut back on working hours or exit the labour market entirely (Krol et al. 2015). Furthermore, costs can manifest themselves in negative health and well-being effects (Hoefman et al. 2013, Schulz & Beach 1999, Bom et al. 2018).

The additional costs faced by unpaid carers are recognised by governments around the world. In particular, in the UK, some carers are given compensation for their care duties by means of a Carers Allowance, which is administered by the government under a set of restrictive eligibility criteria. The benefit is not means tested and is a cash payment paid at the flat rate of £64.60 per week to eligible carers (2017/18 rate) (DWP 2018).

Having said that, it is often the case that the costs of unpaid care are ignored in economic evaluations from a societal perspective, which could lead to inefficient levels of resource allocation and poor policy decisions (Landfeldt et al. 2018, Van Exel et al. 2008, Arora et al. 2018, Krol et al. 2015). In fact, currently in England, the National Institute for Health and Care Excellence (NICE) doesn't usually incorporate the costs of unpaid caring into economic evaluations (NICE 2013). One explanation for the omission of unpaid care costs in such evaluations could be due to the difficulties associated in valuing unpaid care, around which the literature is extensive (Arora et al. 2018).

Often described as the benchmark method (van den Berg et al. 2006) and employed frequently in the literature, is the opportunity cost method (Goodrich et al. 2012, Carmichael & Charles 2003, Chari et al. 2015, Rattinger et al. 2015). This approach values the time spent providing unpaid care using the hourly wage rate that the unpaid carer would receive if he/she were active in the labour market. The idea is that the carer forgoes this wage by spending time providing care instead. A common criticism of this approach is that in many cases, unpaid carers are not active in the labour market. Therefore, valuing their time spent unpaid caring based on the wage rate they would obtain if they were working may undervalue their efforts in providing unpaid care.

The proxy goods (or replacement cost) method instead costs an unpaid carers time using the market rate of an equivalent service, for example, the wage of professional carers. It is widely

utilised in the literature (Foster & Fender 2013, Escribano-Sotos & Pardo-García 2015, Langa, Chernew, Kabeto, Regula Herzog, Beth Ofstedal, Willis, Wallace, Mucha, Straus & Fendrick 2001, Deloitte Access Economics 2015, Dunbar et al. 2018, Arno et al. 1999, Carers UK 2015), but is often criticised because it assumes that formal care and unpaid care are perfect substitutes, which may be an unrealistic assumption (van den Berg et al. 2004, Faria et al. 2012, Koopmanschap et al. 2008, McDaid 2001). In particular this implies that there are no differences in the efficiency or quality of care provided and that both the carer and care recipient are indifferent between unpaid care and formal care (Koopmanschap et al. 2008). However, in reality, it is likely that these assumptions do not hold because unpaid carers are usually family members who have known the care recipient for most of their lives. In many cases, this means that unpaid carers know more about the needs and preferences of the care recipient as opposed to formal carers. Furthermore, care recipients might feel more comfortable with a family member caring for them than a formal carer whom they don't know (Brimblecombe et al. 2018). On the other hand, unpaid carers often have no training whilst formal carers do, meaning that certain aspects of the quality of care they provide is likely to differ.

Another problem that is common to both the proxy goods and opportunity cost methods is that neither allows for increasing (or decreasing) marginal disutility of hours spent caring, since each hour of care is valued equally (Koopmanschap et al. 2008). Additionally, both methods ignore the preferences of the carer and the care recipient (van den Berg, Bleichrodt & Eeckhoudt 2005). Hence, stated preference techniques such as Contingent Valuation (CV) (van den Berg, Brouwer, Exel & Koopmanschap 2005, van den Berg, Bleichrodt & Eeckhoudt 2005, Koopmanschap et al. 2008, Faria et al. 2012, van den Berg et al. 2004, Hoefman et al. 2013, Gustavsson et al. 2010), Conjoint Analysis (CA) (van den Berg, Al, Brouwer, van Exel & Koopmanschap 2005, van den Berg et al. 2008, Mentzakis et al. 2011) and Discrete Choice Experiment (DCE) (Arora et al. 2018) have been suggested as ways to overcome this problem with the opportunity cost and proxy goods methods because they incorporate the different circumstances facing carers and more accurately reflect their preferences. However, there are several biases which these preference methods are susceptible to e.g. strategic bias, hypothetical bias and anchoring (Koopmanschap et al. 2008, van Exel et al. 2006, Hoefman et al. 2013, de Meijer et al. 2010). It is generally argued that stated preference models are preferable to the opportunity costs and proxy goods methods when valuing unpaid care (van den Berg et al. 2004, Koopmanschap et al. 2008). The well-being method has also been implemented in the costing unpaid care literature, however it is not superior to the more traditional costing methods (van den Berg & Ferrer-i Carbonell 2007).

Having said this, a further drawback that these costing methods share, is that they focus explicitly on time spent caring. This is problematic for two reasons. Firstly, they rely on unpaid carers accurately reporting the number of care hours that they supply. In practice this is very difficult and subject to significant error. The two key methods of calculating time spent caring that are used in the literature are the Diary and Recall methods. Both have been studied extensively and it has been shown that overestimation, and more often underestimation, is likely (van den Berg & Spauwen 2006). Underestimation occurs when reporting hours of care because carers don't account for joint production, that is, doing several tasks simultaneously, and they often find it difficult to distinguish between caring and non-caring tasks (van den Berg & Spauwen 2006). A

recent study using survey data from England found that both the wording of survey questions and to whom the question is asked can lead to significant under-reporting of unpaid care (Rutherford & Bu 2017). Secondly, this explicit focus on time, results in a narrow view of the trade-offs associated with caring. For example, an unpaid carer might not be able to go on holiday as a result of their care commitments, even if those commitments only involve a small amount of their time each day. That is to say, unpaid caring can be restrictive in other ways, not only on the time a person has available to them.

In this paper, we propose an approach which, unlike the aforementioned literature, does not focus on time spent caring and instead focuses on the material impact of unpaid care-giving. To do this we employ methods used by Morciano et al. (2015) in their paper on the costs of disability, to estimate the monetary cost of being an unpaid carer in terms of the change in a carers standard of living (SoL) associated with providing unpaid care. In doing so, we aim to provide evidence for the extent to which the current Carers Allowance, adequately compensates Scottish carers for the service they provide. We use data from Scottish households in the UK Family Resource Survey (FRS). The econometric method employed to form these estimates is a generalised structural equation model of latent SoL expressed as a function of income, care status and other characteristics, allowing for measurement error in a set of observed SoL indicators.

We contribute to the existing literature in two ways. Firstly, we do not rely on measurements of time spent caring and instead focus on the material impact of unpaid care provision, which has not been done in the previous literature. In this way, the SoL methodology employed in this paper is an addition to the unpaid care costing tool-kit. Secondly, we are the first to offer evidence on the ability of the Carers Allowance to compensate unpaid carers for the additional costs they face due to care giving. We believe that providing this evidence is crucial at a time where several social security benefits, including the Carers Allowance, are being transferred from Westminster to Holyrood under the Scotland Act 2016 (Scottish Executive 2016). At present, there is little evidence to suggest the extent to which the Carers Allowance actually compensates unpaid carers for the additional costs they face due to care giving and it has been recognised that the current payment is not high enough (Work and Pensions Committee 2008, Berthoud 2010).

It is recognised that there is evidence of positive effects that result due to unpaid care giving (Schulz & Sherwood 2008), for example, often family members feel a sense of fulfilment and happiness from providing care to someone they love, however these effects are not the focus of this paper.

The structure of this paper is organised as follows: Section 4.2 describes the methodology, Section 4.3 introduces and describes the data, Section 4.4 outlines the results, and finally, Section 4.5 discusses those results and presents the conclusions.

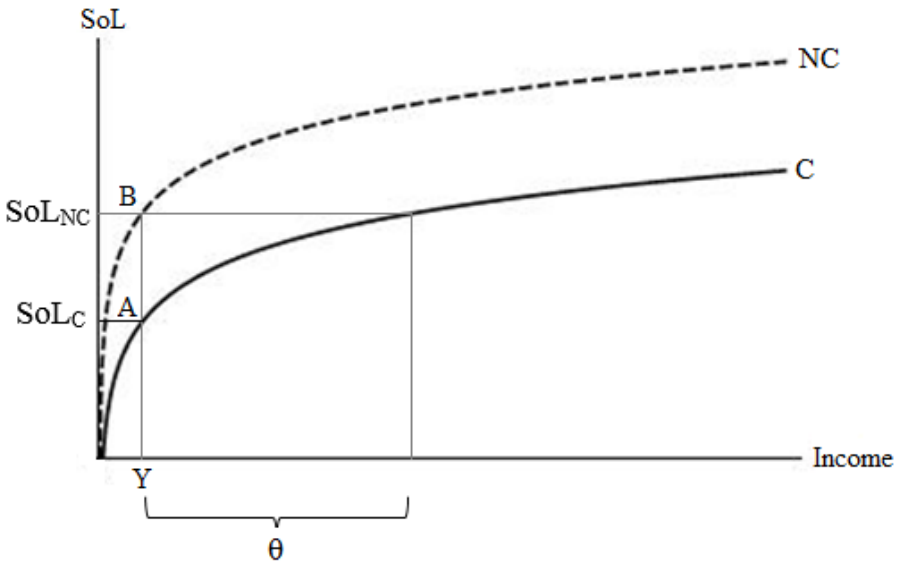
4.2 METHODS

The Standard of Living Method

This paper applies the SoL method used by Morciano et al. (2015) in their paper on the costs of disability, in the context of the costs associated with unpaid care in Scotland.

SoL is defined as the "degree of wealth and material comfort available to a person or com-

Figure 4.1: Standard of Living- Income Profile



munity" (Oxford 2017). The SoL indicators used in this model were designed by the Department for Work and Pensions (DWP) to specifically capture material deprivation in older adults (McKay 2008). Using such measures of material deprivation is appropriate in the unpaid care costing context, as they capture reductions in overall SoL faced by unpaid carers as a result of their role as care givers. Specifically, it is expected that unpaid carers have to divert resources in order to pay for goods and services for the person they are caring for. Compared to the conventional costing methods which have focused on attaching a monetary value to the time a carer gives up in order to provide care, we argue that the SoL approach may capture a wider array of the trade-offs that are involved in providing unpaid care. For example, are unpaid carers less able to afford to go on holiday or to take part in a regular leisure activity? If it is the case that unpaid carers have to invest resources into providing care then they might have less resources to devote to their own needs and wants, resulting in unpaid carers having a lower SoL compared to non-carers. This is shown in Fig. 4.1.

It is expected that across all levels of income, a carer (C) will have a lower SoL than a non-carer (NC). This suggests that for a given level of income, for example Y, the SoL of a non-carer will be higher than a carer. This implies that there is some amount, θ, by which the carer would need to be compensated by in order to reach the same SoL as the non-carer. The SoL costing approach employed in this paper aims to calculate this compensation and thus provide an estimate of the material costs associated with providing unpaid care. In turn, this estimate can be used as evidence for the extent to which the current Carers Allowance appropriately compensates caregivers in their role.

Formally, suppose that SoL is given by an additively separable function of income and care status as follows:

$$SoL = f(Y) - g(C) + h(Z, \epsilon) \tag{4.1}$$

where SoL is standard of living, Y is income, C is unpaid care status, and Z and ϵ comprise all other observed and unobserved individual characteristics that might influence SoL.

Firstly, consider an initial level of income Y_0 where an individual is not providing any unpaid care. Now, assume a change in situation where the individual moves from providing no care to providing some care. What would be the minimum compensation (θ) that would be required to maintain their initial level of SoL? Answering this question involves solving the following optimisation problem:

$$\min \quad \theta \quad \text{s.t} \quad f(Y_0 + \theta) - g(C) \geq f(Y_0) \tag{4.2}$$

In other words, what is the minimum amount of additional income that a carer would need to have an equivalent SoL of a non-carer? To find an analytical solution for this problem, the function f, which gives the relationship between income and SoL must be specified. As in Morciano et al. (2015), we explore three options comprising (1) linear, (2) log-linear, and (3) log-quadratic functional forms.

Consider the first option in which SoL is linear in income, $f(Y_0) = \beta_1 Y_0$, where β_1 indicates the effect that income has on SoL. The solution to the minimisation problem in Eq. 4.2 implies compensation for care provision would be set at:

$$\theta_1 = \frac{g(C)}{\beta_1} \tag{4.3}$$

In addition to calculating the absolute cost of unpaid care giving, it is possible to calculate the corresponding equivalence scale - a scale often used in the income inequality literature to account for household size. In general, the equivalence scale (σ), is equal to $(Y_0 + \theta)/Y_0$. Within the framework of costing unpaid care, the equivalence scale allows one to adjust household incomes for those which contain an unpaid carer. Eq. 4.1 implies an equivalence scale of $1 + \frac{g(C)}{f(Y)}$.

The benefit of specifying a linear functional form for income is that it results in a compensation which is independent of income. However, the corresponding equivalence scale is dependent on income. Following from Morciano et al. (2015) $f(Y_0)$ is specified as $\beta_1 ln(Y_0)$. Using this functional form, the resulting compensation is:

$$\theta_2 = Y_0\left[e^{\frac{g(C)}{\beta_1}} - 1\right] \tag{4.4}$$

The log-linear specification has the advantage that the corresponding equivalence scale is not dependent on income: $\sigma = e^{\frac{g(C)}{\beta_1}}$. This is the standard form that is used in income inequality analysis to account for differences in the composition of households (Morciano et al. 2015).

The third form used is the more flexible log-quadratic form which is often used in studies of Engel curves (Banks et al. 1997). Morciano et al. (2015) found that the log-quadratic form fitted the data best in their analysis of the impact of disability on SoL. Income is specified as $f(Y) = \beta_1 lnY_0 + \alpha(lnY_0)^2$. The resulting compensation is then:

$$\theta_3 = exp\left[\frac{-\beta_1 + \sqrt{\beta_1^2 + 4\alpha c}}{2\alpha}\right] - Y_0 \tag{4.5}$$

Where $c = \beta_1 lnY_0 + \alpha(lnY_0)^2 + g(C)$. Since $ln(Y + \theta) < 0$ is not consistent with theory, the positive root for the quadratic function is used. Whilst calculating the corresponding equivalence scales for the various levels of compensation may also be of interest, the results presented in Section 4.4 show the absolute compensation values only [1].

Empirical Model

One of the problems encountered when applying the theoretical model to the data is that SoL is a concept which is not directly observable: instead, it involves many attributes of life that individuals combine in different ways. SoL can therefore be represented as a latent variable which can be approximated by a set of observed indicators, I_k, as follows:

$$I_k = \gamma_k SoL^* + \phi_k \qquad , k = 1....n \tag{4.6}$$

where γ_k denotes a $kx1$ vector of coefficients which are the factor loadings of latent SoL^* on the various indicators. A higher factor loading indicates that latent SoL^* explains a larger share of the variation in the indicator I_k . In each of the k indicator equations, latent SoL^* explains part of the variation in the indicator, while the unique residual appears in the error terms ϕ_k. The error terms, ϕ_k, are assumed normally distributed with zero mean and constant variance. It is assumed that $corr(\phi_k \phi_j) = 0, k \neq j$. That is, the left over residual error is unique to each of the indicators and the only shared variance between the indicators occurs through the common SoL^* latent factor.

As in Morciano et al. (2015) the estimation of the empirical model in this paper uses a Generalised Structural Equation Modelling (GSEM) framework which allows the measurement of latent SoL^* to be modelled simultaneously within the structural model. GSEM also accounts for the binary nature of the indicator variables. This approach involves simultaneously solving the following equation along with Eq. 4.6:

$$SoL_i^* = \beta_1 f(Y_i) - \beta_2 g(C) + Z'\beta_3 + \epsilon_i \tag{4.7}$$

Where i indexes observations ($i = 1...N$), $f(Y_i)$ represents the three specified functional forms for income and β_1 their corresponding effects on SoL. The function $g(C)$ once again represents the care status of the individual and β_2 the associated coefficients. All other observable, individual characteristics are captured in $\mathbf{Z}$ and ϵ_i captures other unobserved influences on SoL. The key benefit of SEM over other methods is that it explicitly allows for measurement error in the set of observed SoL indicators (Morciano et al. 2015).

4.3 DATA

The data used in this paper come from the 2013/14 - 2016/17 waves of the Family Resources Survey (FRS) (UK Data Service 2013/14-2016/17*a*). The FRS is a UK-wide cross-sectional survey that collects annual information on households' economic, health and lifestyle circumstances. It also collects detailed information on any unpaid care that is provided by and to household and non-household members. Specifically, the unpaid care schedule of questions in the FRS relates to help

[1] Equivalence scales are available on request

or support received by household members, or provided by household members to people outside the households because they have long-term physical, mental ill-health, or problems relating to old age (UK Data Service 2016/17*b*). In particular, for people living with the person being cared for, the survey asks "In some households, there are people who receive help or support because they have long-term physical or mental ill-health or disability, (or problems relating to old age). Is there anyone in this household who receives any of these kinds of help or looking after?" (UK Data Service 2016/17*b*, p.112). In a subsequent question the survey identifies who is providing that care. For those caring for someone outside the household the survey asks "And how about people not living with you: do you/ (or does anyone in this household) provide any help or support for anyone not living with you who has a long-term physical or mental ill-health problem or disability, or problems relating to old age?"(UK Data Service 2016/17*b*, p.112). These questions are used to determine whether or not someone is an unpaid carer, and if they are caring for someone within or outside their household. We use the sample of Scottish households across the four survey waves.

As in Morciano et al. (2015), we restrict the sample to include only households containing either a single person or couple. This is due to income being measured at the household level. As a result, it is assumed that in the case of a couple, each individuals benefits equally from that income. Further, as we are interested in care provided to older adults as a consequence of ageing, we restrict the sample to exclude carers who are caring for someone aged below 50 [2].

After the sample has been restricted in this way, we are left with a total of 14,706 individuals over the four years.

Descriptives

Table 4.1 shows descriptive statistics for the sample[3]. As indicated in the table, 6% of the total sample are carers, whilst the remaining 94% are non-carers. Of those, about 41% are living with the person they are caring for and 59% are caring for a parent who lives outside the household.

There are some notable differences between the two groups. Specifically, carers are more likely to be retired and they are five years older on average compared to non-carers. Carers are more likely to be married, 74% of carers compared to 50% of non-carers. Furthermore, carers are slightly less likely to have a university qualification or higher compared to non-carers.

In terms of disability, as defined under the core definition in the Equality Act 2010 (Legislation.gov.uk 2010), there is little difference between carers and non-carers. In particular, 32% of carers have a disability compared to 28% of non-carers. At the same time there is little difference in weekly household income between the two groups. Specifically, median income for carers is £560 and for non-carers it is £586.

Standard of Living Indicators

As in Morciano et al. (2015), the household-level material deprivation indicators from the FRS are used to construct individual level-deprivation indicators by assigning the household values to

[2]For carers who live with the person being cared for we drop those caring for someone aged below 50. For those carers who are not living with the person being cared for it is not possible to know the age of the person they are caring for. The best we can do is to exclude those who are caring for someone other than a parent outside the household, and assume that those carers who are aged 34 are most likely caring for a parent who is aged 50 or over.

[3]For a full description of each variable see Table 4.9 in Appendix.

Table 4.1: Descriptive Statistics Carers versus Non-carers

Total Sample: N = 14,706					
		Carers n = 953 (6% of N)		**Non-Carers** n = 13,753 (94% of N)	
	Coding	No. of Obs	% of sample	No of Obs	% of sample
Retired					
Yes	1	657	68.94	7,677	55.82
No	0	296	31.06	6,076	44.18
Married					
Yes	1	704	73.87	6,898	50.16
No	0	249	26.13	4,575	33.27
University					
Yes	1	161	16.89	3,125	22.72
No	0	792	83.11	10,628	77.28
Disabled					
Yes	1	307	32.21	3,849	27.99
No	0	646	67.79	9,904	72.01
Carer					
Yes	1	951	100	0	0
No	0	0	0	13,753	100
Live with/parent carer					
Live with	-	389	40.82	-	-
Parent	-	564	59.18	-	-
Year					
2013/14	0	251	26.34	3,615	26.29
2014/15	1	220	23.08	3,421	24.87
2015/16	2	243	25.50	3,273	23.80
2016/17	3	239	25.08	3,444	25.04
Age					
Mean	Age in Years	58	-	53	-
Income					
Min	£'s	0	-	0	-
Median	£'s	560	-	586	-
Mean	£'s	775	-	762	-
Max	£'s	10,058	-	10,282	-

individual household members. The responses to the material deprivation questions are grouped into two categories. The first category indicates that the person reported that they could not afford the activity/good in question. The second indicates all other possible responses. Each SoL indicator is therefore a binary variable that is equal to 1 if the individual said they could not afford the item in question and 0 otherwise.

Prior to the estimation of Eq. 4.7, an exploratory factor analysis (EFA) was conducted in order to determine whether or not the material deprivation indicators identify the latent factor SoL^*. The EFA identified one factor to be retained with an eigenvalue of 4.32 indicating that approximately 40% of the total variance in all of the observed indicators is explained by the latent factor SoL^*[4]. Similar analysis carried out by DWP in their research into the use of these questions to measure SoL also found that the indicators were identifying the common factor (McKay 2008). A common rule of thumb is to retain those indicators with factor loadings greater than 0.4 and 0.3 as an absolute minimum (Osborne & Costello 2009). Hence, the twelve strongest indicators, i.e. those with factor loadings greater than 0.3, were chosen for the estimation of the model. In fact, all twelve had factor loadings greater than 0.45. Other standard checks were carried out to assess the suitability of the material deprivation indicators including an alpha reliability test of the SoL scale. This test produced a test scale alpha of 0.86[5] for the twelve indicators. This is above

[4] See Table 4.5 and Table 4.6 in Appendix for results from the EFA.
[5] See Table 4.7 in Appendix for results from alpha correlation.

Table 4.2: SoL Measurement Model Descriptive Statistics Carers versus Non-Carers

	Total Sample: N = 14,706			
	Carers		**Non-Carers**	
	n = 953		n = 13,753	
	Response (% of n)		Response (% of n)	
SoL Indicator: Can you afford . . .	Yes, 0	No, 1	Yes, 0	No,1
DECOR: ...to keep your home in a decent state of repair?	91.6	8.4	92.2	7.77
HOLIDAY: ...to go on holiday once a year?	77.5	22.5	78.9	21.13
MONEYSELF: ...to have money to spend each week on yourself?	84.8	15.2	86.1	13.86
FURNITURE: ...to replace worn out furniture?	84.6	15.4	85.1	14.88
CLOTHES: ...to replace worn out clothes with new ones?	91.6	8.4	92.4	7.59
ENDSMEET [6]: Do you have difficulty making ends meet?	85.0	15.0	86.0	14.00
LEISURE: ...to regularly take part in a hobby or leisure activity?	93.2	6.8	93.3	6.71
WARM: ...to keep this property warm?	92.3	7.7	93.4	6.65
SHOES: ...to have two pairs of all-weather shoes?	95.9	4.1	97.0	2.99
BILL: ...to keep up with regular bills and repayments?	96.6	3.4	95.1	4.86
MEATFISH: ...to eat meat or fish every second day?	93.3	6.7	93.9	6.10
COMP: ...a computer?	95.6	4.4	95.7	4.31

the required 0.70 minimum standard (Acock et al. 2013). Adding in other indicators reduced the test scale alpha. Once again, analysis by DWP also confirmed the indicators had a high reliability score (McKay 2008).

Table 4.2 displays the descriptive statistics for the twelve SoL indicators that are used in this analysis. The table indicates that in eleven out of the twelve indicators, a higher proportion of carers answer that they cannot afford the activity/good in question compared to non-carers. On average, the difference is about 1%. The biggest discrepancy between carers and non-carers is in the MONEYSELF indicator. Approximately 15.2% of carers said they could not afford to spend money on themselves each week, compared to 13.9% of non-carers.

The BILL indicator is the only SoL indicator where carers were less likely to say they cannot afford to keep up with regular bills. Specifically, 3.4% of carers said they could not afford this compared to 4.9% of non-carers. In summary, the descriptive statistics in Table 4.2 suggest that carers might have a slightly lower SoL compared to non-carers.

4.4 RESULTS

This section will outline the results obtained from the GSEM outlined in Section 4.2, hereafter Model 1. The results from an extended model, hereafter Model 2, will also be presented. This model extension allows for differences in SoL to occur between those who live with the person being cared for and those who care for someone outside the household. In this way, the model aims to capture differences in the amount of time spent caring, since co-resident carers are more likely to spend substantial amounts of their time providing unpaid care (Geyer et al. 2017, Beesley

[6]Responses to this question were: with great difficulty, with difficulty, with some difficulty, fairly easily, easily and very easily. The first two responses have been grouped together to indicate significant difficulty in making ends meet, and the others were grouped together to indicate little difficulty

2006). As has been discussed in Section 4.2, accurately measuring time spent caring is fraught with difficulties and cost estimates based on the number of hours spent caring are likely to be subject to significant error. Therefore, without relying on self-reported hours of care provision, the extended model will reflect intensity of care provision and at the same time it is likely to more accurately capture those carers who would tend to underestimate the time they spend caring when reporting the number of hours they care for, i.e. those who live with the person they care for, and hence better reflect the associated costs.

As discussed in Section 4.3, we are interested in care relationships which have likely resulted due to ageing. Unfortunately, for those who are caring for someone they are not living with, it is not possible to determine the age of the cared for. To try and capture those who are caring for someone older than them, we restrict the sample to include children caring for parents or in-laws outside the household, and make the assumption that carers who are aged 34 or over will have a parent who is aged 50 or over. Focussing the analysis on care between those living together, most likely spouses, and children caring for parents is not too restrictive since these are the most common unpaid care relationships (Maher & Green 2002).

Thus, in Model 2, carers are split up into those who live with the person being cared for (LWC) and those who care for a parent outside the household (PC). It is hypothesised that both LWCs and PCs experience a lower SoL than non-carers. However, LWCs provide more intensive care, most likely involving a high number of hours of care compared to PCs, meaning that we would expect LWCs to require a greater compensation than PCs, in order to reach the same SoL as a non-carer.

Both models are estimated in Stata 15 using the `gsem` command with a logit-link function specified. This allows the structural model to be estimated simultaneously with the measurement model that describes the latent, dependent variable SoL^*, whilst taking into account the binary nature of the observed SoL indicators. Output from the measurement models is not shown here though all twelve indicators are consistently significant at the 1% significance level across both models and for each specification of income.

Model 1: Carers versus Non-Carers

Eq. 4.7 is used to estimate Model 1 using the sample from the 13/14-16/17 FRS, where $g(C)$ is simply defined as a binary variable identifying whether an individual is a carer or a non-carer. Table 4.3 displays the output from the structural models for the three functional forms of income.

As expected, income has a positive effect on SoL. That is, those individuals with a higher weekly household income have a higher SoL. In addition, being older, married and retired are also associated with a higher SoL. SoL is also greater for individuals who have a university qualification or above. The linear time trend also shows that SoL has been increasing since 2013/14.

Conversely, Table 4.3 shows that SoL is lower for individuals that are disabled. This finding is consistent with work carried out by Morciano et al. (2015) in their paper on the costs of disability. Moreover, as hypothesised, SoL is lower for unpaid carers.

All covariates are significant at less than the 1% significance level across each specification, except for the married variable in specification 3, which is significant at the 10% level.

When using a linear functional form for income, the structural model predicts that carers would require compensation of around $\theta_1 = £158$ per week in order for them to reach the same

Table 4.3: Model (1) Results Care versus Non-Care

	Specification		
Variable	**(1)**	**(2)**	**(3)**
Income (β_1)	0.00228***	-	-
	(0.000)	-	-
Carer (β_2)	-0.361***	-0.435***	-0.366***
	(0.102)	(0.103)	(0.100)
Disabled	-1.487***	-1.456***	-1.323***
	(0.072)	(0.072)	(0.069)
Retired	1.652***	1.498***	1.695***
	(0.103)	(0.102)	(0.103)
Age	0.0541***	0.0587***	0.0579***
	(0.003)	(0.003)	(0.003)
University	0.738***	0.887***	0.618***
	(0.073)	(0.074)	(0.071)
Married	0.414***	0.312***	0.0911
	(0.056)	(0.056)	(0.056)
Year	0.233***	0.234***	0.213***
	(0.023)	(0.023)	(0.023)
ln income(β_1)	-	1.421***	-2.429***
	-	(0.055)	(0.205)
(ln income)^2 (α)	-	-	0.348***
	-	-	(0.020)
Constant	4.665***	4.761***	4.348***
	(0.295)	(0.299)	(0.273)
AIC	68665.3	68320.7	67850
BIC	68908.4	68563.7	68100.6
θ	θ_1 = £158	θ_2 = £200	θ_3 = £101
N	14,706	14,679	14,679

*Robust standard errors are shown in parentheses: * p <0.05, ** p <0.01, *** p <0.001*

SoL as non-carers. Furthermore, assuming a logarithmic functional form for income, the model predicts that the compensation, θ_2 , that carers require in order to achieve the same SoL as their non-caring counterparts is approximately 35% of their income. At the median level of income of a carer, £560, this works out at about £200 per week compensation. Finally, allowing a more flexible relationship between SoL and income using the log quadratic functional form results in a compensation of θ_3 = £101 per week. The calculation for θ_3 uses the median values of income, log-income and log-income squared [7].

According to the Akaike and Bayesian Information Criteria, AIC and BIC respectively, the better fitting version of Model 1 is Specification 3, which uses the log-quadratic functional form of income.

The findings from Model 1 support the initial hypothesis posited in this paper, which anticipated that providing unpaid care requires the carer to forgo resources in order to provide care and as a result would lead to carers having a lower SoL than non-carers. These figures suggest that the Carers Allowance, currently administered by the UK government, of £64.60 per week, is too low to compensate carers for the reduction in SoL they face due to care giving (DWP 2018). At the same time, the Carers Allowance is only available to those who provide over 35 hours of care per week and Model 1 does not allow for differences in SoL to occur between those who provide a high number of hours of care and those who provide a low number of hours of care. There are a number of studies which have found that carers who live with the person being cared for, or co-resident carers, typically provide a higher number of hours of care compared to those who do not live with the person being cared for (Geyer et al. 2017, Beesley 2006). Therefore, it might be

[7] See Table 4.8 in Appendix for these values.

Table 4.4: Model (2) Results Live with Carers, Parent Carers versus Non-Carers

	Specification		
Variable	**(1)**	**(2)**	**(3)**
Income (β_1)	0.00226***	-	-
	(0.000)	-	-
Live with carer (β_2)	-0.882***	-1.033***	-0.857***
	(0.154)	(0.156)	(0.151)
Parent carer (β_3)	0.0142	-0.0124	-0.013
	(0.133)	(0.133)	(0.130)
Disabled	-1.473***	-1.439***	-1.310***
	(0.072)	(0.072)	(0.068)
Retired	1.680***	1.532***	1.721***
	(0.104)	(0.103)	(0.103)
Age	0.0538***	0.0583***	0.0575***
	(0.003)	(0.003)	(0.003)
Univesity	0.733***	0.878***	0.613***
	(0.073)	(0.074)	(0.071)
Married	0.441***	0.342***	0.117*
	(0.057)	(0.057)	(0.056)
Year	0.236***	0.238***	0.216***
	(0.023)	(0.023)	(0.023)
ln income (β_1)	-	1.413***	-2.404***
	-	(0.055)	(0.204)
(ln income)^2 (α)	-	-	0.346***
	-	-	(0.020)
Constant	4.652***	4.741***	4.335***
	(0.294)	(0.298)	(0.272)
AIC	68647.5	68297.3	67833.6
BIC	68898.1	68547.9	68091.8
θ	θ_4 = £390	θ_6 = £506	θ_8 = £229
	θ_5 = £0	θ_7 = £0	θ_9 = £0
N	14,706	14,679	14,679

*Robust standard errors are shown in parentheses: * p <0.05, ** p <0.01, *** p <0.001*

expected that co-resident carers would experience a higher loss in SoL.

Model 2 offers an insight into this intensity of care provision by allowing SoL to differ between those who live with the person being cared for and children caring for parents outside the household.

Model 2: Live With Carers, Parent Carers versus Non-Carers

Once again, Eq. 4.7 is used to estimate Model 2 using the sample of individuals from the 13/14-16/17 FRS, where $g(C) \in \{0, 1, 2\}$ where zero indicates that the person is a non-carer, one indicates that the carer is living with the person being cared for (LWC) and two indicates that the carer is caring for a parent outside the household (PC). Table 4.4 displays the output from the regressions for the three functional forms of income.

As anticipated, the a priori assumptions about the signs of covariates are confirmed again by Model 2. Income positively influences SoL, as do being older, being retired, being married and having a university qualification or above.

As in Model 1, disabled individuals have a lower SoL. Moreover, as predicted, being a caring who is living with the person being cared for is associated with a lower SoL than a non-carer. Across the three model specifications, these variables are statistically significant at less than the 1% significance level. Contrary to expectations, Model 2 finds that there is no difference in SoL for those caring for a parent outside the household and non-carers.

If the linear specification for income is assumed, Model 2 predicts that LWCs need a com-

pensation of approximately θ_4 = £390 per week to reach the same SoL as non-carers. This result provides support for the hypothesis that carers who live with the person they care for, require compensation for their care giving duties.

If the logarithmic functional form for income is specified, Model 2 again supports this hypothesis in that it suggests LWCs need to be compensated by around 108% of their income in order to reach the equivalent SoL as non-carers. At the median level of LWCs income, £470, this works out at around θ_6 = £506 per week compensation.

Finally, if the log-quadratic functional form of income is used, the compensation required in order for a LWC maintain the same SoL as a non-carer, is somewhat lower than the compensation predicted by the logarithmic model, at θ_8 = £229 per week. The calculation for θ_8 uses the median values of income, log-income and log-income squared of a LWC[8].

Once again, the AIC and BIC in Model 2 suggest that Specification 3 fits the data best. This finding is consistent with the results found in Morciano et al. (2015).

Given the assumption that those who live with the person they are caring for provide the highest number of hours of care, it is probable that the carer within the household is eligible to receive the Carers Allowance. Evidently, the results from Model 2 imply that the Carers Allowance offered to carers in the UK falls considerably short of being sufficient to cover the associated cost of unpaid care in terms of reduced SoL. Specifically, the Carers Allowance would need to increase to a level that is between three and as much as eight times higher than is currently offered. The findings from Model 2 support the hypothesis that households in which someone is providing unpaid care to a person they live with, experience an increase in material deprivation as resources are reallocated towards care provision.

A variety of sensitivity analysis was performed in order to check the robustness of the results for both models. These included running standard Structural Equation Models (SEMs) instead of GSEMs[9], estimating the models using Ordinary Least Squares (OLS)[10] and predicting SoL scores from a factor analysis[11]. The results from these analyses were consistent with the results presented here.

4.5 DISCUSSION AND CONCLUSION

The ageing population in Scotland has resulted in an increasing number of people living into older ages and with multiple chronic conditions. This change has induced an increased pressure on spouses and family members to provide informal, unpaid care. The Scottish Government has also implemented policy in recent years to shift care into the community and has advocated that older members of the population live in their own homes for as long as possible. This policy change has further heightened the need for family members to step in and provide unpaid care.

The importance of such care and the costs unpaid carers potentially face when balancing employment and caring are well established (Pickard 2018, Pickard et al. 2018). Despite this, the value of unpaid care is often ignored in economic evaluations, which could lead to an inefficient

[8] See Table 4.8 in Appendix for these values.
[9] See Table 4.10 and Table 4.11 in Appendix for these results.
[10] See Table 4.12 and Table 4.13 in Appendix for these results.
[11] See Table 4.14 and Table 4.15 in Appendix for these results.

allocation of resources. As well to allocate resources efficiently, understanding the costs of unpaid care are central to ensuring that unpaid carers are appropriately supported in their role.

Several methods for costing unpaid care have been proposed in the literature over the last two decades. The most popular costing methods have been the opportunity costs, proxy goods, contingent valuation and conjoint analysis methods. Despite the abundance of studies that have employed these methods in the unpaid care costing literature, they each share a common criticism that undermines their ability to appropriately reflect the costs associated with being an unpaid carer. In particular, the current literature bases its calculations on the cost of unpaid care on the number of hours a person spends providing care. This approach has two caveats. Firstly, it relies on unpaid carers accurately reporting on the number of hours they spent caring in some specified time period, which has been demonstrated to often lead to underestimation by carers (Rutherford & Bu 2017, van den Berg & Spauwen 2006). Secondly, it assumes a narrow view of the trade-offs associated with providing unpaid care in that it only focuses on time and ignores other potential trade-offs.

In this paper we attempt to estimate the monetary costs associated with unpaid carer in terms of the change in SoL a carer experiences. In this way, we seek to offer evidence on the extent to which the current Carers Allowance adequately compensates unpaid carers in Scotland. We contribute to the current literature by moving away from relying on an accurate measure of time spent caring, and instead focus on the material deprivation associated with caring. We argue that this approach might capture trade-offs that traditional methods haven't been able to. Thus, the SoL approach is suggested as an addition to the costing unpaid care tool-kit. At the same time, we are the first to offer evidence on the ability of the current Carers Allowance to compensate Scottish unpaid carers for the service they provide. This evidence comes at a crucial time in Scotland when the Scotland Act 2016 transfers powers over Carers Allowance from Westminster to Holyrood (Scottish Executive 2016).

Two GSEMs, each with three specifications for the functional form of income, are estimated. Model 1 estimates the relationship of interest between SoL and unpaid care provision. Model 2 delves further into the relationship between SoL and unpaid care provision by splitting carers up into those who live with the person being cared for, and those who care for a parent outside the household. Due to the difficulties encountered when measuring time spent caring, in particular the under-reporting of hours spent caring by spouses, measuring the impact of caring on the SoL of those who live with the person they care for will potentially give a more accurate reflection of the compensation that is required for those who provide intensive unpaid care, compared to using self-reported hours of care.

Two critical findings emerge from this paper. Firstly, unpaid carers experience a significant reduction in their SoL as direct result of providing unpaid care and this reduction is far greater for those who live with the person being cared for. Those carers who are living with the person they are caring for require compensation of £229 per week, according to the best fitting model. Secondly, the current compensation given to eligible carers by the UK government, i.e. the Carers Allowance, is not sufficient to compensate them for the reduction in SoL they experience as a result of providing care. In particular, in order to fully compensate carers for the loss in SoL that they experience, the Carers Allowance would need to be raised by between 3 and 8 times the current

level.

The findings highlight the value of the service that family carers provide. If unpaid care were not being provided by family members, especially those who are living with the person in need of care, there would likely be an increased pressure on local authorities to assess individuals for their care needs and step in to provide formal care services. Formal long term care services in Scotland are under considerable stress at the moment with continuing budget cuts and in some areas the system has been said to be facing complete collapse (Marsh,S 2017). Thus, it is becoming increasingly important that unpaid carers are appropriately supported financially in their roles to ensure that they continue to offer the help that they do.

The Scottish Government is committed to doing this and has pledged to increase the Carers Allowance in line with job-seekers allowance when it gains control over the benefit under the Scotland Act 2016 (Scottish Executive 2016). This increase will help to compensate unpaid carers for more of the loss they experience due to caring. At the same time, the government should consider the potential additional costs it might face if the increase in the allowance also leads to an increase in the demand for the benefit. Furthermore, Social Security Scotland (SSS) - the body which has been set up by the Scottish Government to manage and deliver those benefits - has committed to putting dignity, fairness and respect at the heart of its practices. This approach could also have implications for the demand for Carers Allowance once it is handed over from Westminster. In relation to this, the Scottish Government should also consider the 'visibility' of carers when forecasting the impact of increasing the Allowance since their estimates on the amount of unpaid care being provided are likely to be underestimates (Pickard et al. 2016).

A further implication of this result concerns the marital status of the LWCs who, in this analysis are almost all married (74%). Given changing trends over the last few decades, namely the increase in the number of single person households, higher rates of divorce and the decrease in marriages (Beesley 2006), it is expected that in the future there will be less married couples living together into older age and as a result less availability of unpaid care from couples living together. This could additionally lead to increased pressure on the government to provide formal care services to the elderly population.

Moreover, the Scottish government should consider the potential implications of these findings for the quality and quantity of care that is being provided by unpaid carers if they are not being adequately supported. In particular, if a carer is experiencing a significant reduction in their SoL due to their role as an unpaid carer and is not being sufficiently compensated, this could impact on the quality of care they provide. If the quality of care provided is negatively affected there could be knock on effects on health and well-being costs of the carer and cared for. Furthermore, if the compensation is not sufficient to cover the costs associated with caring in terms of reduced SoL, some carers might decide not to live with the person who needs care, or they might make a decision not to provide care to the person they live with (Pezzin et al. 2007). These possibilities could be detrimental to the older person who requires care, potentially increasing their health care costs and increasing pressure on formal long term care services.

Nevertheless, some limitations are acknowledged in this paper. Firstly, the SoL costing approach cannot capture other costs of unpaid care provision, for example, physical and mental health effects, or other long-term negative effects on SoL. It could be that providing unpaid

care impacts on the physical and/or mental health of carers and results in them utilising more health care resources than non-carers (Savage & Bailey 2004, Vlachantoni et al. 2016, Barrow & Harrison 2005, Maher & Green 2002), which of course could increase the associated costs of caring. At the same time, we have not distinguished between different needs of the cared for. It might be that the costs associated with unpaid care are greater depending on the condition of the person being cared for. For example, evidence from the Netherlands shows that there are differences in the consequences of caring for someone with depression compared to schizophrenia (Van Wijngaarden et al. 2009). Therefore, the SoL method might only provide a partial measure of unpaid care costs.

At the same time, we have ignored any positive effects of care-giving (Schulz & Sherwood 2008). Such positive effects, for example well-being effects, could have been included in the latent measure of SoL. It might be expected that including such positive effects would reduce the required compensation for caring compared to a measure which focuses solely on material deprivation. Such an approach might offer a more holistic measurement of the effects of unpaid caring.

Secondly, the data cannot capture care networks. A care network refers to the team of individuals who provide unpaid care to a person. For example, several siblings often provide care to their parent or parents. It is possible that being a carer who belongs to a wider team of carers might mean that caring responsibilities are shared across the network and this could result in less of a negative impact on SoL due to caring. Controlling for these types of networks would be beneficial, as it would separate out those carers who are the sole providers of unpaid care and those who are in a care network and allow the identification of the effect of caring on their SoL. However, this is not possible with the data at hand.

Furthermore, a monetary payment has been suggested in this paper as a means to compensate unpaid carers. However, it could be argued that this is not enough to fully compensate carers. They might benefit from other types of help such as support groups or respite care. Mentzakis et al. (2011) found that for younger individuals monetary compensation is a significant determinant of care provision, however, this was not the case for older individuals, they tended to provide unpaid care regardless of monetary compensation. This conclusion implies that older unpaid carers, who in this analysis tended to be those who live with the person they care for, might prefer other forms of compensation. At the same time, it might be argued that the SoL methodology does not apply to middle and higher income households who can afford formal care services.

As with much of the literature, this paper also suffers from selection and identification problems. Specifically, we only observe the care decision of those who have chosen to be unpaid carers and we do not observe the factors which influence a person's decision about caring. For example, it is likely that opportunity costs/outside opportunities and possible future bequests will play a role. Including such information in the models could change the results. Future research would benefit from insights into care provision decisions.

Notwithstanding these limitations, the empirical evidence presented here has shed light on the material costs associated with providing unpaid care in terms of SoL. We find evidence that unpaid carers must reallocate their resources into providing unpaid care, resulting in a lower SoL. This reduction in SoL is especially large for those who live with the person being cared for and

the findings suggest that the current Carers Allowance falls extremely short of appropriately compensating these carers. As the Scottish population continues to age, and the demand for unpaid care increases further, it is critical that the government appropriately considers the costs associated with providing unpaid care, particularly intensive unpaid care, and implements the necessary policies to support these carers.

4.6 APPENDIX

Table 4.5: Exploratory Factor Analysis

Factor	Eigenvalue	Difference	Proportion	Cumulative
Factor 1	4.31679	4.06181	1.0759	1.0759
Factor 2	0.25498	0.14982	0.0635	1.1394
Factor 3	0.10516	0.00881	0.0262	1.1656
Factor 4	0.09635	0.04766	0.024	1.1896
Factor 5	0.0487	0.03475	0.0121	1.2018
Factor 6	0.01395	0.02315	0.0035	1.2052
Factor 7	-0.0092	0.01127	-0.0023	1.2029
Factor 8	-0.02047	0.0134	-0.0051	1.1978
Factor 9	-0.03387	0.01905	-0.0084	1.1894
Factor 10	-0.05292	0.03359	-0.0132	1.1762
Factor 11	-0.08652	0.00738	-0.0216	1.1546
Factor 12	-0.0939	0.02245	-0.0234	1.1312
Factor 13	-0.11634	0.0059	-0.029	1.1023
Factor 14	-0.12224	0.01238	-0.0305	1.0718
Factor 15	-0.13462	0.01878	-0.0336	1.0382
Factor 16	-0.15341	.	-0.0382	1

Table 4.6: Factor Loadings

Indicator	Loading onto Factor 1
FURNITURE	0.6838
CLOTHES	0.6823
MONEYSELF	0.667
HOLIDAY	0.6432
DECOR	0.683
LEISURE	0.6202
ENDMEET	0.5816
WARM	0.5502
MEATFISH	0.4905
SHOES	0.5135
BILL	0.5026
COMP	0.4511
WASH	0.1689
PHONE	0.1693
DENTIST	0.1199
MEDICAL	-0.0334

Table 4.7: Alpha Correlation

Item	Obs	Sign	Item-Test Correlation	Item-Rest Correlation	Average Interitem Covariance	Alpha
FURNITURE	14,706	+	0.7347	0.6424	0.0252	0.8455
CLOTHES	14,706	+	0.7051	0.6339	0.0271	0.8467
MONEYSELF	14,706	+	0.7217	0.6291	0.0255	0.8464
HOLIDAY	14,706	+	0.7187	0.6048	0.0247	0.8510
DECOR	14,706	+	0.725	0.6403	0.0258	0.8453
LEISURE	14,706	+	0.6602	0.5802	0.0275	0.8501
ENDMEET	14,706	+	0.6246	0.5452	0.0281	0.8525
WARM	14,706	+	0.5933	0.5094	0.0284	0.8545
MEATFISH	14,706	+	0.5343	0.447	0.0291	0.8581
SHOES	14,706	+	0.5316	0.4703	0.0300	0.8582
BILL	14,706	+	0.5406	0.4645	0.0294	0.8574
COMP	14,706	+	0.4917	0.4147	0.0299	0.8599
Test scale	-	-	-	-	0.0276	0.8630

Table 4.8: Median Incomes

Carer	Live With Carer	Parent Carer	
Income	560	470	713
ln(income)	6.314	6.134	6.547
ln(income)^2	39.86	37.672	42.86

Table 4.9: Variable Descriptions

Variable	Description
INCOME	Weekly benefit unit income. This is equal to the sum of EARNS (Total income from earnings), PENINC (Total income from other pensions), OTHBEN (Total income from other benefits, INV (Total income from investments), RINC (Total income from remaining sources), SEINC (Total income from self-employment), DISBEN (Total income from disability benefits) and RPINC (Total income from retirement pensions plus income support).
CARE	A dummy variable which is equal to 1 if the individual is a carer and 0 otherwise.
LIVEWITH	A dummy variable which is equal to 1 if the individual is a carer and is caring for someone else in the household and 0 otherwise.
PARENT	A dummy variable which is equal to 1 if the individual is a carer and is caring for a parent or in law outside the household and 0 otherwise.
YEAR	A dummy variable which is equal to 0 if the year was 2013/14, 1 if it was 2014/15, 2 if it was 2015/16 and 3 if it was 2016/17.
RETIRED	A dummy variable which is equal to 1 if the individual is retired and 0 otherwise.
DISABLED	A dummy variable which is equal to 1 if the individual is classified as being disabled and 0 otherwise.
UNIV. QUAL	A dummy variable which is equal to 1 if the individual has a university qualification or higher and 0 otherwise.
MARRIED	A dummy variable which is equal to 1 if the individual is married and 0 otherwise.
AGE	A continuous variable which indicates the average age of the individual. For privacy issues age is censored at 80+.

Table 4.10: Sensitivity Analysis: Structural Equation Model - Model (1)

	Specification		
Variable	**(1)**	**(2)**	**(3)**
Income	0.0000564***	-	-
	(0.000)	-	-
Carer	-0.0186***	-0.0187***	-0.0174***
	(0.005)	(0.005)	(0.005)
Disabled	-0.0862***	-0.0768***	-0.0748***
	(0.003)	(0.003)	(0.003)
Retired	0.0648***	0.0678***	0.0743***
	(0.004)	(0.004)	(0.004)
Age	0.00240***	0.00268***	0.00264***
	(0.000)	(0.000)	(0.000)
Univesity	0.0399***	0.0321***	0.0253***
	(0.003)	(0.003)	(0.003)
Married	0.0423***	0.0197***	0.0162***
	(0.003)	(0.003)	(0.003)
Year	0.00984***	0.00927***	0.00884***
	(0.001)	(0.001)	(0.001)
log(income)	-	0.0753***	-0.0402***
	-	(0.002)	(0.010)
log(income)^2	-	-	0.00985***
	-	-	(0.001)
AIC	440925.1	238319.5	292842.4
BIC	441259.3	238653.6	293184.1
θ	θ_1 = £330	θ_2 = £158	θ_3 = £116
N	14,706	14,679	14,679

t statistics in parentheses p <0.05, ** p <0.01, *** p <0.001*

Table 4.11: Sensitivity Analysis: Structural Equation Model - Model (2)

		Specification	
Variable	**(1)**	**(2)**	**(3)**
Income	0.0000559***	-	-
	(0.000)	-	-
Livewith Carer	-0.0444***	-0.0432***	-0.0392***
	(0.008)	(0.008)	(0.008)
Parent Carer	-0.00113	-0.00207	-0.00268
	(0.007)	(0.007)	(0.007)
Disabled	-0.0856***	-0.0762***	-0.0744***
	(0.003)	(0.003)	(0.003)
Retired	0.0662***	0.0692***	0.0755***
	(0.005)	(0.004)	(0.004)
Age	0.00238***	0.00266***	0.00263***
	(0.000)	(0.000)	(0.000)
Univesity	0.0396***	0.0319***	0.0252***
	(0.003)	(0.003)	(0.003)
Married	0.0434***	0.0208***	0.0172***
	(0.003)	(0.003)	(0.003)
Year	0.00995***	0.00937***	0.00893***
	(0.001)	(0.001)	(0.001)
log(income)	-	0.0750***	-0.0392***
	-	(0.002)	(0.010)
log(income)^2	-	-	0.00974***
	-	-	(0.001)
	421092.4	218559.7	273064.9
	421434.2	218901.4	273414.3
θ	θ_4 = £794	θ_6 = £366	θ_8 = £250
	θ_5 = £0	θ_7 = £0	θ_9 = £0
N	14,706	14,679	14,679
t statistics in parentheses p <0.05, ** p <0.01, *** p <0.001*			

Table 4.12: Sensitivity Analysis: Ordinary Least Squares - Model (1)

		Specification	
Variable	**(1)**	**(2)**	**(3)**
Income (β_1)	0.000682***	-	-
	(0.000)	-	-
Carer (β_2)	-0.225***	-0.226***	-0.211***
	(0.064)	(0.062)	(0.062)
Disabled	-1.034***	-0.920***	-0.897***
	(0.037)	(0.036)	(0.036)
Retired	0.773***	0.810***	0.889***
	(0.053)	(0.052)	(0.052)
Age	0.0294***	0.0328***	0.0324***
	(0.001)	(0.001)	(0.001)
Univesity	0.493***	0.401***	0.318***
	(0.040)	(0.039)	(0.039)
Married	0.514***	0.241***	0.199***
	(0.033)	(0.034)	(0.034)
Year	0.120***	0.113***	0.108***
	(0.014)	(0.013)	(0.013)
log(income) (β_1)		0.910***	-0.490***
	-	(0.023)	(0.115)
log(income)^2 (α)	-	-	0.120***
	-	-	(0.010)
Constant	8.302***	3.017***	7.060***
	(0.073)	(0.160)	(0.363)
θ	θ_1 = £330	θ_2 = £158	θ_3 = £116
N	14,706	14,679	14,679
t statistics in parentheses p <0.05, ** p <0.01, *** p <0.001*			

Table 4.13: Sensitivity Analysis: Ordinary Least Squares - Model (2)

		Specification	
Variable	**(1)**	**(2)**	**(3)**
Income (β_1)	0.000676***	-	-
	(0.000)	-	-
Livewith Carer (β_2)	-0.540***	-0.526***	-0.477***
	(0.098)	(0.095)	(0.095)
Parent Carer (β_3)	-0.011	-0.0223	-0.0297
	(0.081)	(0.079)	(0.079)
Disabled	-1.027***	-0.914***	-0.892***
	(0.037)	(0.036)	(0.036)
Retired	0.790***	0.827***	0.903***
	(0.053)	(0.052)	(0.052)
Age	0.0292***	0.0326***	0.0323***
	(0.001)	(0.001)	(0.001)
Univesity	0.491***	0.397***	0.316***
	(0.040)	(0.039)	(0.039)
Married	0.527***	0.254***	0.210***
	(0.034)	(0.034)	(0.034)
Year	0.121***	0.115***	0.109***
	(0.014)	(0.013)	(0.013)
log(income) (β_1)	-	0.906***	-0.478***
	-	(0.023)	(0.115)
log(income)^2 (α)	-	-	0.118***
	-	-	(0.010)
Constant	8.30***	3.038***	7.032***
	-0.073	-0.16	-0.363
θ	θ_4 = £798	θ_6 = £370	θ_8 = £252
θ_5 = £0	θ_7 = £0	θ_9 = £0	
N	14,706	14,679	14,679
t statistics in parentheses p <0.05, ** p <0.01, *** p <0.001*			

Table 4.14: Sensitivity Analysis: Predicted SoL via Factor Analysis - Model (1)

		Specification	
Variable	**(1)**	**(2)**	**(3)**
Income (β_1)	0.000292***	-	
	(0.000)	-	
Carer (β_2)	-0.0966***	-0.0972***	-0.0906***
	(0.028)	(0.027)	(0.027)
Disabled	-0.451***	-0.402***	-0.392***
	(0.016)	(0.016)	(0.016)
Retired	0.338***	0.354***	0.387***
	(0.023)	(0.023)	(0.023)
Age	0.0124***	0.0138***	0.0137***
	(0.001)	(0.001)	(0.001)
Univesity	0.208***	0.167***	0.132***
	(0.017)	(0.017)	(0.017)
Married	0.222***	0.104***	0.0862***
	(0.015)	(0.015)	(0.015)
Year	0.0513***	0.0483***	0.0461***
	(0.006)	(0.006)	(0.006)
log(income) (β_1)	-	0.392***	-0.202***
	-	(0.010)	(0.050)
log(income)^2 (α)	-	-	0.0506***
	-	-	(0.004)
Constant	-1.103***	-3.377***	-1.664***
	(0.032)	(0.070)	(0.158)
θ	θ_1 = £331	θ_2 = £158	θ_3 = £116
N	14,706	14,679	14,679
t statistics in parentheses p <0.05, ** p <0.01, *** p <0.001*			

Table 4.15: Sensitivity Analysis: Predicted SoL via Factor Analysis - Model (2)

	Specification		
Variable	**(1)**	**(2)**	**(3)**
Income (β_1)	0.000289***	-	
	(0.000)	-	
Livewith Carer (β_2)	-0.230***	-0.223***	-0.203***
	(0.043)	(0.042)	(0.041)
Parent Carer (β_3)	-0.00623	-0.0112	-0.0144
	(0.036)	(0.035)	(0.034)
Disabled	-0.448***	-0.399***	-0.390***
	(0.016)	(0.016)	(0.016)
Retired	0.345***	0.361***	0.393***
	(0.023)	(0.023)	(0.023)
Age	0.0123***	0.0137***	0.0136***
	(0.001)	(0.001)	(0.001)
Univesity	0.206***	0.166***	0.131***
	(0.017)	(0.017)	(0.017)
Married	0.228***	0.110***	0.0911***
	(0.015)	(0.015)	(0.015)
Year	0.0518***	0.0488***	0.0466***
	(0.006)	(0.006)	(0.006)
log(income) (β_1)	-	0.390***	-0.197***
	-	(0.010)	(0.050)
log(income)^2 (α)	-	-	0.0501***
	-	-	(0.004)
Constant	-1.103***	-3.369***	-1.676***
	-0.0318	-0.07	-0.158
θ	θ_4 = £794	θ_6 = £364	θ_8 = £248
	θ_5 = £0	θ_7 = £0	θ_9 = £0
N	14,706	14,679	14,679
t statistics in parentheses p <0.05, ** p <0.01, *** p <0.001*			

5 | Conclusion

In summary, this PhD has utilised a variety of data sources to conduct empirical analyses on the provision of Long Term Care (LTC) to older adults in Scotland. This research contributes towards adding to the understanding of the provision of paid and unpaid LTC in Scotland. The need to add to this understanding is crucial at a time when Scotland is undergoing significant demographic shifts, austerity measures and policy changes. Specifically, three avenues of LTC provision are examined in this PhD. In Chapter 2, an investigation into the provision of Free Personal Care (FPC) in Scotland is carried out. The analysis in this chapter identifies significant differences in the provision of FPC across Scottish local authorities and finds that those differences are not matched by differing levels of need. Overall, the exploration suggests that there might be geographic inequity in FPC provision, namely that an individual in need of FPC might be more or less likely to receive it depending on where they reside. This finding is concerning since FPC is a universal benefit that should be provided to any individual in need of such care.

Of course, LTC is not only provided formally but also by unpaid carers. Chapter 3 presents an analysis of how unpaid care and formal LTC services interact, using Scotland's administrative Social Care Survey (SCS). In particular, the analysis offers evidence on how the presence of an unpaid carer influences an older persons use of FPC services in Scotland. The findings suggest that unpaid care complements FPC. That is, individuals who have an unpaid carer helping to care for them at home, tend to receive a higher number of hours of FPC each week. This result perhaps indicates that unpaid carers might advocate on behalf of the person they are caring for in order to increase the level of formal care services they receive. This might be due to the fact that unpaid carers seek additional support from the formal care sector so that they can continue to remain in the labour force. It is also likely, especially for those caring for someone outside the household, that the type of care they provide is quite different to the care that paid carers provide, and in this way the two complement one another.

The finding of a complementary relationship between unpaid and paid care in Scotland is concerning in the sense that it suggests that there might be an underlying unmet need for personal care, for those individuals who do not have an unpaid carer. At the same time, complementarity between unpaid and paid care suggests that any policy or legislative change which encourages unpaid care, could lead to an unexpected increased demand for paid care services.

Finally, Chapter 4 looks at the other side of the coin of unpaid care provision and specifically explores how unpaid carers are affected as a result of care provision. The paper uses Family Resources Survey (FRS) data to model the standard of living (SoL) of adults in Scotland and looks at the difference in SoL between those who provide unpaid care and those who do not. The analysis finds that unpaid carers have a significantly lower SoL compared to non-carers. For

those carers who live with the person they are caring for this result suggests that those individuals would need to be compensated by £229 per week in order for them to reach the same SoL as a non-carer. The results suggest that the current carers allowance of £64.60 per week, falls short of compensating carers for the loss in SoL they experience due to caring. The findings are of direct interest in England and the rest of the UK where the FRS data tells a similar story.

In summary, one of the key issues highlighted by the research carried out in this PhD is unmet need for LTC. It is apparent that unmet need is an area which requires further investigation and inevitably it will be a focus of LTC policy discussions in Scotland and the rest of the UK, in the coming years. In particular, the findings suggest that there is possibly unmet need for FPC in Scotland and that this could potentially be more likely for older people who don't have an unpaid carer helping to access FPC on their behalf. In any case, if the Scottish Government is to succeed in ensuring that older people in Scotland can access quality LTC if they need it, it is crucial that we understand more about how paid and unpaid channels of care operate and interact, and how unmet need could be reduced as a result.

Unfortunately, unmet need is difficult to measure: as Scotland discovered when it introduced FPC in 2002 and saw an unprecedented increase in provision by 62% in the first three years of the policy (Sutherland 2008). A large part of which was thought to be attributed to unmet need (Lillie Wenzel 2018). As discussed in Chapter 2, we only observe met need for FPC. That is, those who actually end up receiving the service. We therefore do not know anything about those who need FPC but do not receive it because they don't meet the local authorities eligibility criteria or they are on a waiting list. We also cannot observe those who need FPC but don't apply, either due to transaction costs, a lack of information on how to access those services, or in rare cases where the person is able to meet the costs of care themselves. At the same time, it might be that those we observe are only having their needs partially met (Brimblecombe et al. 2018). Thus, future research would benefit from exploring how we can measure unmet need in LTC. In turn this would allow us to estimate how much unmet need exists and how we might reduce it to improve health and care outcomes for older people.

The health and care outcomes of care recipients are of course a vital component of LTC provision that have not been considered in this thesis. As discussed, local authorities have limited resources to meet the needs of their populations and as a result they have to make decisions about which individuals to offer services to. In Scotland, this usually means allocating care to the most needy cases by setting eligibility thresholds. Inevitably, this decision involves a trade off in that individuals who don't meet this threshold do not receive care and this could negatively impact their outcomes . Another approach might be to give care to as many people in need as possible, but this would likely involve devoting less resources to the most needy cases so their needs aren't fully met. In order to know which approach to take when allocating scare resources, it is important to understand the distribution of need within local authorities, as well as how care provision affects care recipient outcomes. The Scottish Government collects information on patient outcomes in its biennial Health and Care Experience Survey, as part of the Scottish Care Experience Survey Programme. The aim of the survey is to gather information of the quality of health and care services, specifically from the perspective of the patients, in order to improve their experiences of using those services (Scottish Government 2018). An exploration of patient outcomes as a result

of decisions taken by local authorities surrounding the allocation of FPC resources is certainly of interest for future research, but beyond the scope of this thesis to comment further.

A further issue related to unmet need which is important to consider, is that the Scottish Government might run into similar difficulties to those experienced with the introduction of FPC as it takes on new powers from Westminster, specifically over disability and carers benefits, and as it extends FPC to the under 65s (Scottish Government 2019). Social Security Scotland (SSS) - the body which has been set up by the Scottish Government to manage and deliver those benefits - has committed to putting dignity, fairness and respect at the heart of its practices: an approach which could have implications for the coverage of the benefits once they are handed over from Westminster. The analysis carried out in this thesis helps by focussing on some of the issues surrounding LTC which will directly matter, and an increased understanding of unmet need could help to avoid unexpected increases in demand as in 2002 when FPC was introduced. SSS could use the assessment for disability benefits to identify those individuals who would also be eligible to receive FPC and this could help to close the gap between observed disability and need for LTC. This understanding may also be of interest in England where they too have considered introducing FPC and where the disability benefits and LTC systems are distinct. In addition, if unmet need could be accurately measured, we would be better placed to understand how demographic changes in the future will influence it. This of course could also be used to guide LTC policy in England and the rest of the UK, where similar changes in the demand for LTC are occurring.

The research in this thesis has also highlighted some of the strengths and limitations of working with administrative data. In particular, we have exploited the Scottish Government's SCS. The primary advantage of the SCS is that it captures population level data on LTC provision with no sample selection bias, in a way that traditional survey data cannot. A further advantage is that the data are routinely collected by local authorities as part of the administrative process of care provision, thus researchers benefit from access without having to endure the costs of data collection.

Having said that, although it hasn't been mentioned up until now, an application was also made to access linked SCS and health records as part of this thesis. The process for accessing this data was both lengthy and cumbersome. This was due in part, and rightly so, to the privacy issues surrounding the use of such data, but also due to the infancy of the systems and processes in place for researchers to access administrative records. Unfortunately, by the time access was granted and the data were made available, it was too late to produce meaningful output for the purposes of this research. This process highlighted the real difficulties that PhD students face when applying to use linked administrative data in their research, when they have a limited time frame in which to do so.

Moreover, one of the drawbacks of working with the SCS and administrative data more generally is that they have not been designed with research in mind. This means that they are often missing key variables which would ordinarily be used in research. For example, details on individuals living circumstances, financial situation etc. With this in mind, future research would benefit hugely from using administrative data that is linked to survey data, where this additional information is usually included.

Another limitation of the SCS lies in the way in which the data are recorded. That is, the collec-

tion of the data is carried out at the local authority level. This inevitably gives rise to differences in recording practices which can ultimately lead to differences between local authorities. Specifically, many of the entries for the SCS are not mandatory and some local authorities decide not to collect the information at all. This was apparent in Chapter 3 where we found differences in the recording of certain information between local authorities which meant that some variables, such as the Indicator of Relative Need (IoRN) score variable, could not be used in the analysis. Linked to this, although in theory the SCS is a longitudinal survey, differences in recording practices between local authorities may also mean that it is not possible to rely on this longitudinal element. If this were more reliable, future research would benefit greatly from understanding more about the duration and evolution of peoples care packages as they age.

A further issue related to LTC data which has been identified in this research is the lack of data which includes information on both carers and the cared for. One of the key limitations of the SCS in Chapter 3 is that the data are on the cared for themselves and there is no information whatsoever on the person who is providing unpaid care, other than their presence or non-presence. Whilst survey data, like the FRS, capture information on the person being cared for and their carers, this is only possible for those who are living with the person being cared for. Otherwise, there is very limited information on the cared-for who live outside the household. At the same time, surveys like the FRS can only capture care networks, that is unpaid carers working in collaboration with other family members to provide care to the older adults in the family, if they live within the same household as the person being cared for. If information were available on all unpaid carers providing care to someone outside the household, this would help to build up a much more reliable picture of unpaid care provision, and this in turn might help to understand older peoples use of formal care services and how future changes to Scotland's demography might influence the care that older people get.

Overall, the findings from this PhD have contributed to the existing evidence by enhancing our understanding of LTC provision to older adults in Scotland in both the formal and unpaid care settings. We have identified avenues for future research in this area, which would certainly aid future policy discussions and assist the Scottish Government in implementing its new powers over disability and carers benefits, as well as in achieving its goal of ensuring that older people can access quality services when they need them. The findings may also be of interest to England and the rest of the UK where similar demographic changes, austerity measures and new policy developments are being explored.

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