

# Older people's participation in disability benefits: targeting, timing and financial wellbeing

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## Non Technical Summary

Modern welfare systems encompass a range of cash programs protecting against the consequences of disability. Some programs are meant to provide for the additional needs that the onset of disability implies, such as care and additional goods and services purchased to compensate for disability. In Britain, public financial support for older people with disabilities is delivered through one such benefit, known as Attendance Allowance. Current policy debate in the UK is questioning the role and effectiveness of Attendance Allowance. This paper tries to contribute to the current debate by evaluating a few aspects related to how Attendance Allowance works in practice. In particular it analyses whether benefit payments are successful in reaching disabled people; whether payments are timely after the onset of disability; whether the delivered amounts are actually serving the purpose of enhancing disabled people's financial independence.

The empirical analysis is based on repeated observations of the same individuals over time, so that onset of disability, benefit receipt and later financial wellbeing can all be observed. Results support the idea that receipt is significantly tied to previous onset of disability. In other words, no empirical support emerges for the concern of undeserving healthy individuals receiving the payment. However, there appears to be a sizeable degree of uncertainty in receipt. Also, personal and household characteristics unrelated to disability do affect the probability of receiving the benefit. For example, the presence of other people in the household and familiarity with the benefit system seem to play a major role in facilitating claims. In terms of timing of provision, the evidence of more than four years elapsing on average between onset of possible eligibility and Attendance Allowance receipt suggests that the timing of delivery represents a shortcoming of the current system. In terms of impact, Attendance Allowance is found to make a positive difference to recipients' financial circumstances for several years after first receipt. Overall, there appears to be scope for improving the current UK system of cash support for disability in old age, particularly with respect to timing of provision and outreaching those experiencing higher barriers to pursuing a claim.

# Older people's participation in disability benefits: targeting, timing and financial wellbeing

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## **Abstract**

This paper evaluates the effectiveness of disability benefits for the elderly. Using seventeen waves of panel data, it first analyses the extent to which receipt is responsive to changes in disability status. Second, it investigates the extent of delays in first receipt. Third, it compares later outcomes of recipients and non-recipients, accounting for selection into the program. Results indicate that entry is highly responsive to previous changes in disability, and that the program enhances persistently recipients' financial wellbeing. However, considerable delays in receipt are also found. Besides, the evidence of characteristics unrelated to eligibility influencing the assignment mechanism raises horizontal equity concerns.

**Keywords:** disability benefits, welfare participation, panel data, older people

**JEL codes:** C20, I10, I31, I38, J14

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# 1 Introduction

One of the major challenges posed by the demographic transition in western societies concerns the provision and funding of social care for the elderly. Population ageing involves not only a larger number of people reaching old age, but also, due to medical advancements, longer life expectancy at older ages (OECD, 2009). More than one third of the life span after the age of 65 is typically spent experiencing a disability or chronic illness condition, requiring some form of social care provision.

Modern welfare systems encompass a range of cash programs protecting against the consequences of disability. Some represent earnings replacement for the working age population losing capacity to work (Bound and Burkhauser, 1999); others are meant to provide for the additional needs that the onset of disability implies, such as care and additional goods and services purchased to compensate for disability (Stapleton *et al.*, 2008). This second type of program is the most relevant to the elderly, who are generally not expected to participate in the labour market and enjoy standards of living predominantly determined by previous working-age circumstances. Over the last few decades, several OECD countries have experienced a sustained growth in disability benefits rolls (Bound and Burkhauser, 1999; Disney, 1991). A similar pattern, matched with the anticipation of further rising dependency ratios, is posing a strain on the continuation of current cash provision for disability in older age. For example, in the UK reform prospects include the option of shifting resources from cash programs to direct provision of social care services (CHMSO, 2009), despite the greater control over resources they allow. This idea is supported for example by a recent evaluation of the US ‘Cash and Counseling’ programme, where a randomized group of disabled was offered a monthly allowance, rather than being provided care services directly (Brown *et al.*, 2007).

Despite the fact that several European countries offer extra-cost disability benefits, and the reform prospects under discussion, surprisingly little research has evaluated their operational effectiveness. Several aspects seems worth exploring. One concerns *targeting*, that is

whether benefits in payment are successful in reaching the population of disabled. Previous literature has mostly approached the issue as a problem of ‘tagging’ truly disabled working age applicants - as opposed to individuals using disability benefits as earnings replacement in times of adverse economic conditions or as a form of early retirement (Parsons, 1991; Parsons, 1996; Bound 1989; Diamond *et al.*, 1995). However, in the case of disability benefits for the elderly, the issue of targeting stands in different terms. Receipt of disability benefit involves both the disabled elderly deciding whether to claim or not, and the administration assessing the case, once the claim is received (Pudney, 2009). Both the case of an eligible person not applying and that of a disabled claimant being denied the award represent targeting failures. From a claimant’s perspective ex-ante eligibility is somewhat uncertain, and such uncertainty might in turn affect the decision to apply. In fact, evidence of a detrimental role played by perceived uncertainty on the claiming decision has been stressed in previous studies, although mostly based on working age individuals (Parsons, 1991; Kreider, 1998; Kreider *et al.*, 2000). Other characteristics, unrelated to eligibility, might also make equally disabled individuals more or less likely to apply or to be judged eligible, compromising in practice the horizontal equity that schemes are meant to guarantee.

A related issue concerns the *timing* of provision. Taking again the case of UK, life expectancy at 65 was estimated 16.9 years for men and 19.7 for women in 2004-06, and disability free life expectancy 10.1 and 10.6 years respectively (ONS, 2008). The difference between life expectancy and disability free life expectancy is a crude measure of the number of years an elderly person can be expected to live while disabled: 6.8 years for men and 9.1 years for women. With such a short time horizon, prompt receipt of the cash amount is essential to the program functioning.

A third concern is whether the delivered amounts are actually serving their purpose. ‘Extra cost’ disability benefits aim at enhancing disabled people’s financial independence in a flexible way - as opposed to direct provision of care services. So a change in recipients’

perceived financial wellbeing after program entry represents a key outcome against which the program efficacy is to be judged.

This paper tries to address these three aspects - targeting, timing and later financial wellbeing - focussing on the case of Attendance Allowance (AA), the main ‘extra cost’ cash benefit available to older people with disabilities in UK. The main features of the AA program and claiming process are described in Section 2. The analysis is carried out using seventeen waves of British Household Panel Survey data, collected between 1991 and 2007. This unique data source offers both retrospective information on the onset of disability and prospective information on financial wellbeing and other outcomes after receipt of the benefit has started. Aspects related to the data, such as sample selection, measurement error in reported receipt of AA and variables used, are discussed in Section 3.

The core of the empirical analysis is carried out in the following two sections: a binary model of entry into AA is estimated in Section 4 to assess whether benefit first receipt is promptly responsive to changes in the underlying disability status. Estimates also provide evidence on how other personal circumstances or characteristics, unrelated to eligibility, might affect the probability of receiving the benefit, should the person decide to claim. The second part of Section 4 focuses on the timing of claim, once disability has arisen: count data modeling is used to address horizontal equity concerns again, investigating which personal characteristics are associated with longer claiming delays. Semi-parametric methods are finally used in Section 5 to explore how benefit receipt affects perceived financial wellbeing.

## **2 Claiming and receiving Attendance Allowance**

Attendance Allowance was first introduced in UK in 1971, and still represent the main ‘extra cost’ benefit available to disabled people after the age of 65 (corresponding to the legal male pension age). It is currently paid to about 1.5 million people. Eligibility depends on whether the claimant needs care in order to perform daily activities (bathing, eating,

dressing, using the toilet, communicating needs; or supervision to avoid the risk of danger for self or others) as a consequence of a physical or mental impairment. Awards do not depend on past national insurance contributions and are not subject to means testing. The program delivers a sizeable regular additional income that disabled people can spend as they wish: either a lower rate amount of £202 per month, if care is needed throughout either day or night, or a higher rate amount of £302 per month, if care is needed throughout both night and day (CPAG, 2009). Those who satisfy the same eligibility conditions before the age of 65 receive an equivalent ‘extra cost’ benefit, known as Disability Living Allowance(DLA) and continue to receive DLA after 65, rather than re-claim the same amounts as AA once reaching 65<sup>1</sup>.

The claiming process needs to be initiated by the claimant; after disability has arisen, he or she can request an application form. The form collects information and evidence on diagnosed chronic illnesses, health problems and the amount and type of care needed. Medical checks can be imposed in some cases, but are not a necessary component of the decision process. Once the form is returned, the administration is required to process the claim in 24 working days. If the claimant returns the completed form by 6 weeks from the date of first request of a form, this earlier date counts as the ‘date of claim’, otherwise it is the date when the administration receives the completed form. The ‘date of claim’ is relevant because AA starts to be paid only 6 months after the need for care is reported to have arisen (although an exception is made for the terminally ill). Once a case has been assessed as eligible, the length of an award is decided according to the particular disabling condition and care needs of the case. In practice, indefinite time awards are common, and receipt of AA can be regarded as an *absorbing state*, in the sense that only a negligible proportion of those who start to receive AA will have the award suspended later.

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<sup>1</sup>To be precise, we are referring to the *self-care* component of DLA only. DLA recipients can also receive an additional *mobility* component of DLA, which cannot be claimed under AA. This explains why, for a DLA recipient approaching the age of 65, there is no incentive to switch to AA.

Rejection rates for ‘extra cost’ disability benefits in UK are unsurprisingly higher than for benefits where eligibility can be determined *ex ante* in a more deterministic fashion: about one in five AA claims is rejected in fact (DWP, 2008). If a claim is rejected, it is possible to appeal against the administrative decision. More than 40% of appeals following a rejected claims are subsequently re-assessed in favour of the appealing claimant (NAO, 2003), even in the absence of additional supporting evidence.

Receipt of AA can be taken into account in calculating individual contributions towards the means-tested provision of care services arranged by Local Authorities, the other major component of the social care system for the elderly. However, AA does not reduce entitlement to means-tested benefits in cash, meant to support elderly’s income or help them with particular housing costs, irrespective of their disability status. Rather, receipt of AA triggers additional amounts of entitlement under these benefit programmes: for example, a single pensioner could have his entitlement to general income support (Minimum Income Guarantee or, from 2003, Pension Credit) increased by about £230 per month once AA receipt starts. So low income individuals - if aware of such benefit rules interactions - might have a higher financial incentive to claim, not only in relative, but also absolute terms.

AA rolls have been constantly increasing since the benefit was first introduced. The sustained pattern of growth cannot just be explained by the increased prevalence of disability (Berthoud, 2009): trends in claiming behavior or in administrative rigor are likely to have played a role. The current policy debate in UK is questioning the role of AA and DLA (Berthoud and Hancock, 2008) and concerns have been raised about administrative inconsistencies in adjudication decisions and severe delays in receipt after the onset of disability (Daly and Noble, 1996; Hirst, 1997; Banks and Lawrence, 2005; Nosowska, 2004; Pudney, 2010). The following analysis could offer timely evidence to inform the policy debate on the working and future of AA.



## 3 The British Household Panel Survey data

### 3.1 Sample selection and measurement error in AA receipt

The analysis is based on data from the British Household Panel Survey (BHPS), which collects yearly information on individuals living in private households in Britain since 1991. Individuals interviewed in 1991 became permanent sample members, eligible to be interviewed at any following wave. Individuals joining the household of a permanent sample member became temporary sample members, eligible to be interviewed as long as they are residing with a permanent sample member. Another possible route of entry in the panel was through the regional booster samples added in 1997, 1999 and 2001 (Lynn *et al.*, 2006; Taylor *et al.*, 2006). With seventeen consecutive years of data collection (1991-2007), the BHPS offers an unique source of micro-level longitudinal information on a range of topics, including socio-demographic characteristics, health and disability conditions, receipt of state benefits and financial circumstances.

The sample of interest for analysis includes respondents potentially eligible to receive AA: individuals aged 65 years old or above, and not in receipt of DLA (because in this second case they would keep on receiving DLA after 65 years old). A first complication arises from the chance of measurement error in reported receipt of AA. In fact, because both AA and DLA entail equivalent eligibility rules and pay out equivalent amounts, it is not unlikely that recipients confuse the two. Information about AA and DLA receipt is collected in the BHPS using a showcard that lists a range of government benefits, with DLA preceding AA in the list. The resulting age distribution of self-reported AA recipients (displayed in the top panel of Appendix Figure 2) confirms that a non trivial proportion of cases (mis)report receiving AA despite being aged less than 65 years old. Moreover, about 13% of respondents who start receiving AA at or after 65 years old report receiving DLA in later waves, a possibility that is excluded by benefit rules<sup>2</sup>. The longitudinal information available in BHPS can

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<sup>2</sup>173 cases over the 1320 that start receiving AA at or after 65 years old.

however be used to disentangle ‘true’ receipt of AA and DLA for individuals who join the panel when younger than 65 years old. For such cases, it is possible to use the age at first receipt of disability benefit to identify the nature of the benefit received (AA or DLA)<sup>3</sup>. For individuals who instead join the panel at or after 65 years old, information about whether the first receipt happened before or after 65 is not necessarily available. Therefore DLA recipients are recoded as AA recipients only if the first DLA receipt is reported after the first interview (happening at or after 65 years old)<sup>4</sup>. The resulting age distribution of AA recipients (displayed in the bottom panel of Appendix Figure 2) shows an increase in AA receipt from 65 years old onwards, up to the point where mortality rates reverse the age pattern. From a starting sample of 30,846 individuals, the exclusion of those not potentially eligible to AA, either because they are receiving DLA (2,337 individuals) or because they are never observed while aged 65 or above (22,857 individuals) leaves a sample of 5,652 individuals.

A further sample restriction concerns 318 cases where the time of entry into AA could not be identified because they were not observed in the year prior to their first reported AA receipt. This includes, for example, cases already receiving AA when joining the panel. If the reason for not being observed prior to first receipt was correlated with the health problem underlying AA eligibility, this would represent an endogenous selection. The concern arises if one considers that non-response could be related to an underlying health condition. However, the same concern would fade if the reason for not being observed prior to the first reported AA receipt depended only on the individual being ineligible for interview at that time. An investigation of the 318 cases confirms that only a trivial proportion (about 1% of the total sample) is excluded in a potentially endogenous way. Other excluded cases correspond to individuals whose absence prior to first AA receipt was due to ineligibility for interview rather than to genuine non response. This applies, for example, to individuals in receipt of

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<sup>3</sup>Among the 26,752 individuals joining the panel before 65 years old, 98 self-reported DLA recipients, whose receipt started after 65 years old, are recoded as AA recipients.

<sup>4</sup>365 individuals among the 4,094 who join the panel after 65 years old.

AA when interviewed in wave 1; or when first interviewed as part of the later booster samples (see Appendix, Table 9). The resulting sample consists of 5,334 individuals, corresponding to a total of 35,096 observations, increasing from 1,693 observations in wave 1 to 2,386 in wave 17 (see Appendix, Table 10). Individuals are observed for an average of 6.57 years; 1,009 experience a transitions into receipt of AA.

## 3.2 Variables

Each BHPS respondent is asked about receipt of a range of state benefits at time since the previous year, so that the full monthly history of AA receipt can be reconstructed. However, the time unit for the following analysis will be the year, rather than the month. This is both because information related to eligibility is collected only yearly, and because of the ‘seam effect’ (Jäckle 2008): the evidence of spikes in receipt spells starting exactly at the seam between waves, questioning the reliability of monthly level receipt information. About 18% of individuals in the sample ever receive AA. Those who receive it, receive it for about half of the waves they are observed.

Survey information about health problems, disability, and care received cannot exactly match the eligibility-related information available to the administrative assessor through the application form, additional documents produced and possible further medical checks (Morciano *et al.*, 2009). Nonetheless, the BHPS offers a variety of disability indicators available in each BHPS wave. A long-standing debate in health economics has questioned the respective flaws of self-reported versus objective measure, without reaching any unanimous view. Besides comparability issues, self-reported measures have been charged with introducing a ‘justification bias’ (Baker *et al.*, 2004; Bound and Burkhauser, 1999; Currie and Madrian, 1999; Benitez-Silva *et al.*, 2004): individuals would tend to report a worse health status after receipt of a disability benefit to ‘justify’ receipt to others or even themselves. On the other hand, objective measures might be biased if they are imperfectly correlated with the actual disability relevant to the economic analysis (Bound, 1991). Several types of indicator are

available in BHPS. Self-reported measures include a subjective assessment of health status over the past 12 months, compared to most people of the same age; whether health limits Activities of Daily Living (ADLs) (Katz *et al.*, 1963) and if so, which type of activity (eg. related to mobility - such as climbing the stairs or walking around - or to personal care - such as getting dressed). Respondents are also asked whether they consider themselves to be disabled (from wave 12 onwards) or (before wave 12) whether they are registered disabled with the Local Authority (implying receipt of local-level support, but not determining AA eligibility); and whether they have any health problem among a list presented in a showcard<sup>5</sup>.

More objective (but self-reported) measures available in BHPS include a number of service usage indicators (times consulted the GP, days spent in hospital as inpatients, and receipt of domiciliary health services) and the number of serious accidents experienced in the past year. Other information can be regarded as more objective in the sense that is not self reported: this includes informal care received from other household members (reported by the carer, rather than the recipient) and the interviewer's assessment of physical or cognitive difficulties displayed by respondents during the interview. The GHQ summary measure of mental wellbeing (Goldberg, 1972) is used as an indicator of mental distress. It is derived from a battery of 36 questions, recorded as part of a separate self-completion questionnaire. The rest of the health and disability indicators are instead collected as part of the main questionnaire, with questions preceding those on AA and other benefits receipt.

Table 1 presents descriptive statistics of possible eligibility indicators for AA recipients and non-recipients. A consistent pattern of higher prevalence of disability indicators among AA recipients is evident. The BHPS also offers other information on personal characteristics not affecting eligibility, but potentially affecting individuals' claiming behavior (descriptive

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<sup>5</sup>The list includes: 1 Problems or disability connected with: arms, legs, hands, feet, back, or neck (including arthritis and rheumatism); 2 Difficulty in seeing (other than needing glasses to read normal size print); 3 Difficulty in hearing; 4 Skin conditions / allergies; 5 Chest / breathing problems, asthma, bronchitis; 6 Heart / high blood pressure or blood circulation problems; 7 Stomach / liver / kidneys or digestive problems; 8 Diabetes; 9 Anxiety, depression or bad nerves, psychiatric problems; 10 Alcohol or drug related problems; 11 Epilepsy; 12 Migraine or frequent headaches; 13 Cancer (from wave 11 onwards); 14 Stroke (from wave 11 onwards); 15 Other health problems.

statistics for such variables are reported in Appendix, Table 11). Beside basic demographic characteristics, they include indicators of living standards (income, home-ownership, receipt of income support) and of familiarity with the benefit system (again receipt of income support and partner’s receipt of an extra-cost disability benefit).

Table 1: Prevalence of eligibility indicators among recipients and non recipients.

	Non recipients		Recipients	
	<i>Mean</i>	<i>Std. dev.</i>	<i>Mean</i>	<i>Std. dev.</i>
Mental distress (GHQ) <sup>1</sup>	10.4	4.5	12.6	5.5
In receipt of informal care	.036	.187	.157	.364
Self-reported disabled <sup>2</sup>	.068	.251	.317	.465
Health limiting self-care ADLs <sup>3</sup>	.018	.134	.097	.296
Interviewer: physical difficulties	.097	.296	.195	.396
Times consulted GP in last year <sup>4</sup>	1.6	1.2	2.1	1.3
Days as hospital inpatient in last year	1.3	6.8	3.8	13.9
User of home help services in last year	.035	.184	.152	.359
User of health visitor/nurse services in last year	.073	.259	.201	.401
Number of self-reported health problems	1.722	1.329	2.5	1.6

*Source: BHPS, 1991-2007 pooled waves.*

1 Measured on a 36 points scale, increasing with mental distress.

2 ‘Registered disabled with Local Authority’ until wave 11; then ‘considers to be disabled’.

3 Getting dressed’ in all waves except ‘Bathing/dressing’ in waves 9 and 14.

4 Visited or consulted; on a 1-4 scale, where 4 stands for ‘four or more’.

## 4 Empirical analysis of receipt: targeting and timing

### 4.1 Who receives AA?

A first research question concerns whether entry into receipt of Attendance Allowance is promptly responsive to - and only to - previous changes in individuals’ disability status. Notation is defined as follows:  $r_{i,t}$  is a binary indicator for first entry of individual  $i$  into AA in time  $t$ , where  $r_{i,t} = 0$  if  $i$  has not yet entered AA in  $t$  and  $r_{i,t} = 1$  if  $i$  enters AA in  $t$ . Observations from periods after first receipt are discarded because receipt of AA is being treated as an absorbing state. For each individual  $i$  we observe a vector of time varying disability indicators  $e_{i,t}$ , reflecting individual disability/possible eligibility to AA and a vector  $x_{i,t}$  of other personal characteristics, not deemed to affect AA eligibility. Given that

receipt can only start after 6 months from the date of claim, and that  $r_{i,t} = 1$  might refer to a receipt spell started in any one month up to previous year interview, variables reflecting personal circumstances at the claiming/assessment time relevant to receipt in  $t$  are those observed in  $t - 1$ , and even before in the case of disability indicators. Disability indicators observed prior to first receipt in  $t$  are also less likely to be flawed by any ‘justification bias’ type of response behaviour than those observe in  $t$ , when receipt has already started. The probability of first entry into AA can therefore be written as:

$$P(r_{i,t} = 1) = \Phi(\alpha + e'_{i,t-1}\beta_1 + e'_{i,t-2}\beta_2 + e'_{i,t-3}\beta_3 + \dots + x'_{i,t-1}\gamma) \quad (1)$$

where  $\beta$  coefficients capture receipt responsiveness to disability onset, and therefore are indicative of program effectiveness in reaching the intended disabled population. Coefficients  $\gamma$  reflect instead the role played by other characteristics, for a given disability stats, in the benefit assignment mechanisms. Perfect targeting would require that, having controlled for disability indicators, the set of  $x$  variables should not have explanatory power. The panel dimension of data further allows us to control for unobserved heterogeneity across individuals: in this case the probability of first entry into AA can be written as

$$P(r_{i,t} = 1) = \Phi(\alpha + e'_{i,t-1}\beta_1 + e'_{i,t-2}\beta_2 + e'_{i,t-3}\beta_3 + \dots + v_{i,t-1}\gamma + z_i\theta + u_i) \quad (2)$$

where the vector of personal characteristics not deemed to affect eligibility to AA, previously denoted as  $x_{i,t-1}$  is divided into a vector of time invariant characteristics  $z_i$  and a vector of time varying characteristics  $v_{i,t-1}$ ;  $u_i$  indicates the individual random effect. In this case consistency relies on the assumption that the individual effect is uncorrelated with regressors. This second probit function is to be regarded as a model of the hazard rate for transition from  $r_{i,t} = 0$  to  $r_{i,t} = 1$ , rather than a conventional dynamic binary random effect model. This is because  $r_{i,t} = 1$  is regarded as an absorbing state and therefore each individual drops out of the sample once the transition from  $r_{i,t} = 0$  to  $r_{i,t} = 1$  has occurred. With the relevant observation window starting at 65 years of age, the likelihood for individual  $i$  who enters AA at time  $t$  can in fact be written as

$$\begin{aligned}
& \left[ \prod_{s=65}^{t-1} Pr(r_{i,s} = 0 | r_{i,s-1} = 0, e_{i,s-1}, e_{i,s-2}, \dots, v_{i,s-1}, z_i, u_i) \right] Pr(r_{i,t} = 1 | r_{i,t-1} = 0, e_{i,t-1}, e_{i,t-2}, \dots, v_{i,t-1}, z_i, u_i) = \quad (3) \\
& = \left[ \prod_{s=65}^{t-1} [1 - \Phi(\alpha + e'_{i,s-1}\beta_1 + e'_{i,s-2}\beta_2 + \dots + v_{i,s-1}\gamma + z_i\theta + u_i)] \right] \Phi(\alpha + e'_{i,t-1}\beta_1 + e'_{i,t-2}\beta_2 + \dots + v_{i,t-1}\gamma + z_i\theta + u_i)
\end{aligned}$$

This can be interpreted in terms of survival analysis, since  $\Phi_{i,t}$  is the hazard rate of AA entry at  $t$  and  $\prod_s(1 - \Phi_s)$  is the survivor function up to time  $t$ .

Both simple probit and random effect probit models are estimated, and yield virtually identical results, reported in Tables 2 and 3. The likelihood ratio test<sup>6</sup> for the proportion of total variance due to the individual effects being null fails to be rejected by the data, suggesting that the panel estimator is not different from the pooled probit estimator. In the language of survival analysis, this means that there is no significant evidence of unobserved individual ‘frailty’ with respect to AA receipt.

The significance and positive sign of the estimated  $\hat{\beta}$  coefficients indicate that experiencing the onset of possible eligibility is strongly associated with later entry into AA. However, the fact that indicators of possible eligibility onset in earlier periods are significant up to  $t - 3$  and in some cases,  $t - 4$ , is suggestive of a timing issue. In other words, the fact that the probability of receiving AA in  $t$  is positively correlated with an onset of disability experienced a few years before hints at delays in receipt, either due to delayed claiming, or to administrative delays (e.g. in case of a denial subsequently reassessed as a deserving case). It could be argued that it takes time for the person’s disability to become serious enough to satisfy the assessors’ severity criterion. In this case, the elapsed time between the onset of possible eligibility and entry into AA should not be interpreted in terms of delay. However, an analysis of cases entering AA three or more years after starting to report either informal care receipt or ADLs limitations suggests that, in about half of such cases, their measured disability has remained stable throughout.

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<sup>6</sup>The test is adjusted for bounded parameter space (Gutierrez *et al.*, 2001).

Table 2: First receipt of Attendance Allowance: estimation results for  $e_{t-n}$  covariates.

$e_{t-n}$ Covariates	<i>Probit</i> coeff.		<i>std. err.</i>
Onset: receive informal care (-1)	.612	***	.109
Onset: receive informal care (-2)	.505	***	.126
Onset: receive informal care (-3)	.516	***	.135
Onset: receive informal care (-4)	.449	***	.135
Onset: health limits self-care ADLs (-1)	.558	***	.099
Onset: health limits self-care ADLs (-2)	.31	***	.119
Onset: health limits self-care ADLs (-3)	.364	**	.142
Onset: health limits self-care ADLs (-4)	.194		.174
Onset: registered/self reported disabled (-1)	.329	***	.092
Onset: registered/self reported disabled (-2)	.295	***	.100
Onset: registered/self reported disabled (-3)	.315	***	.107
Onset: registered/self reported disabled (-4)	.507	***	.099
Onset: receive home help services(-1)	.433	***	.130
Onset: receive home help services(-2)	.389	***	.144
Onset: receive home help services(-3)	.039		.172
Onset: receive home help services(-4)	.029		.159
Onset: receive health visitor/nurse services(-1)	.083		.095
Onset: receive health visitor/nurse services(-2)	.203	**	.094
Onset: receive health visitor/nurse services(-3)	.269	***	.091
Onset: receive health visitor/nurse services(-4)	.073		.100
Onset: interviewer report physical difficulties (-1)	.103		.110
Onset: interviewer report physical difficulties (-2)	.232	**	.105
Onset: interviewer report physical difficulties (-3)	.217	**	.106
Onset: interviewer report physical difficulties (-4)	-.02		.110
GHQ- mental distress (-1)	.027	***	.004
Days as hospital inpatient in last year (-1)	.006	***	.002
Times visited/consulted GP in last year (-1)	.118	***	.018

Source: BHPS, 1991-2007.

\* $p < .1$ ; \*\* $p < .05$ ; \*\*\* $p < .01$



Table 3: First receipt of Attendance Allowance: estimation results for other covariates.

<i>Other Covariates</i>	<i>Probit</i> <i>coeff.</i>		<i>std. err.</i>
Decade of birth	-.005		.007
Wave	.016	*	.009
Age	.025	***	.007
Female	.022		.046
Terminal education age	-.034	*	.017
Partner: Terminal education age	-.032	***	.008
Living with spouse/partner (-1)	.342	***	.121
Home owner (-1)	-.149	***	.047
Living with others in household(-1)	.079		.068
Labour market active (-1)	-.183		.126
Log Income (-1)	-.118	***	.042
Partner started receipt of an extra cost disability benefit(-1)	.526	***	.134
Partner started receipt of an extra cost disability benefit(-2)	.555	***	.140
Started receipt of Income Support (-1)	.134		.103
Observations (individuals)	3,416		
Log Likelihood	-2,054		
LR $\chi^2(41)$	880.37		
Prob > $\chi^2$	.0000		
Likelihood ratio test for panel level variance component not different from zero: P value	.490		

*Source: BHPS, 1991-2007.*

\* $p < .1$ ; \*\* $p < .05$ ; \*\*\* $p < .01$

For example, comparing the year in which they first report either informal care receipt or ADLs limitations with the year prior to AA entry, in the second year about 55% do not report a higher number of health problems, about 62% do not report a higher number of contacts with the GP, about 77% do not report a higher number of days spent in hospital as inpatient and about 57% do not report an expansion in the number of ADLs limitations.

Personal characteristics unrelated to eligibility appear to play a role in the actual AA assignment mechanism, consistently with previous findings (Morciano *et al.*, 2009): for example the probability of first AA receipt, *ceteris paribus*, is significantly lower for the more educated and for those whose partner is more educated. Also, those enjoying higher standards of living are less likely to receive AA, as indicated by the negative sign of estimated coefficients for being a home owner and income. Conversely, the probability of starting to receive AA is higher for older people, people living with their spouse or partner, and for those whose partner has recently started to receive an equivalent type of benefit. This might be interpreted as evidence of some knowledge transfer happening within couples.

Due to the nonlinearity of the probit model, reported coefficients are not indicative of the magnitude of particular covariates effects; predicted probabilities and average partial effects can however be computed. The baseline person is assumed to be a single woman aged 70 years old, born in the 1930s, living on her own in a owned house, who did not go beyond compulsory schooling, is living on median income and experiencing median mental distress. Reassuringly, the model would predict the ‘baseline’ individual to face a less than 1% probability of starting receipt of AA in  $t$ , if in good health in  $t - 1$ . However, if the same person had started in  $t - 1$  to receive informal care or home help, or to report health limiting daily activities or being (registered) disabled, the increase in the probability of receiving AA in  $t$  is statistically significant. If, according to all of the disability indicators, the person had experienced the onset of possible eligibility in  $t - 1$ , she would face approximately a 50% probability of actually receiving AA. Despite the nontrivial and significant increase in probability, uncertainty seems to play a role even when all disability indicators point

consistently at the person having become eligible: about half of such cases would not get AA. The more time has passed since possible eligibility arose, the lower are the chances of receiving AA (negative duration dependence). In other words, those who start experiencing possible eligibility in  $t - 1$  have a higher probability of starting receipt of AA than ‘discouraged’ non-claimants who have been eligible for some years.

The average partial effect for variables other than disability can be informative of the role that confounding characteristics play in the targeting process. For example, the estimated model predicts, for a baseline person experiencing disability onset (according to all the onset indicators) in  $t - 1$ , a 6 percentage points higher probability of entry into AA if not a home owner, and a 3 percentage points higher probability if in the bottom income decile, rather than on median income. Consistent with a ‘standard of living’ interpretation, those in the same bottom income decile and also in receipt of income support -therefore facing a higher financial incentive to claim- would have a 5 percentage point higher probability of receipt. The most sizeable positive average partial effect is however found in case the partner started to receive a similar disability benefit in  $t - 1$  or  $t - 2$ : from the baseline, the probability of receipt would rise by 20 percentage points if the individual’s partner had just started receipt of a similar disability benefit, and of further 5 points if the couple was also getting income support. Familiarity with the benefit system because of previous contact with the administration or a shared family attitude to benefit dependency appear therefore to play a major role in the benefit assignment process. A 10 years older individual, born one decade before, would experience a 11 percentage points higher probability of entering AA, under the same health conditions. Possible explanations include higher awareness/acceptance of disability in older age but also age being in practice regarded as a proxy for eligibility by assessors. All of these raise horizontal equality concerns about how the allocating mechanism works in practice.

## 4.2 The timing of first receipt

A second critical aspect of disability benefit provision for the elderly has to do with the timing of receipt, once disability (and therefore possible eligibility) has arisen. AA rules themselves provide for an exception to the ‘6 months waiting’ rule in the case of the terminally ill. Even if not terminally ill, disabled older people are faced with less than a decade of life expectancy. This section focuses on the timing of receipt and analyses how much *delay* there is in first receipt since the onset of disability. While observing the average delay is of interest in itself, available data further allow us to analyse how the observed delay varies with personal characteristics unrelated to eligibility. In the case of AA, claiming delays cannot be regarded as a rational decision in the sense of Coile *et al.*(2002): delaying only has the consequence of retarding receipt of financial support, rather than increasing the level of awards. The outcome of interest is defined as

$$d_i = t_i^r - t_i^e \quad (4)$$

e.g. the number of elapsed years between the time of disability onset  $t^e$  and the time of first benefit receipt  $t^r$ , for individuals who experience both events. A first challenge arises from the measurement of  $t^e$ . Despite the rich battery of possible eligibility indicators available in the BHPS, they do not cover all the information that would be produced in the application form by the claimant and would therefore be available to the assessor. Therefore, as a robustness check, the analysis has been repeated using alternative definitions for the time of disability onset  $t^e$ , each implying a decreasing extent of potential subjectivity in reported disability/possible eligibility. According to the first definition,  $t_i^e$  corresponds with the year when the person starts reporting at least one among: receipt of informal care, receipt of ‘home help’ services, health limiting self-care daily activities and self reported disability status. The second definition identifies  $t_i^e$  with the year when the person starts reporting one among receipt of informal care, receipt of ‘home help’ services and health limiting self-care daily activities. Finally, according to the third definition  $t_i^e$  coincides with the year when the

person starts reporting either receipt of informal care or homehelp services. Although receipt of assistance can be regarded as an objective indicator that assistance is needed, eligibility to AA is based on care needs rather than receipt and individuals might need assistance even if they do not receive it. This is the reason for using also the previous two definitions, despite the increased extent of subjectivity they imply.

To avoid the analysis being confounded by previous potential eligibility to DLA, the sample includes only individuals who experience the onset of disability after the age of 65. This requires excluding individuals not observed before 65 years old, reducing the sample size from 5,334 to 1,870 individuals, and among the remaining, those observed to become possibly eligible before 65 years old. The analysis is then repeated on those becoming possibly eligible (according to each of the three definitions) after 65 years old and receiving AA at some point. While representing a drastic sample size reduction, these restrictions ensure that the dependent variable is correctly measured. The sample mean for the observed delay is about 4.5 years, consistently across the three definitions of  $t_i^e$ .<sup>7</sup>

Given the nature of the dependent variable  $d_i$ , multivariate analysis is based on count data modeling. Because of its restrictive equidispersion assumption, the Poisson distribution for  $d_i$  is discarded (the test of equidispersion is in fact rejected by the data) in favour of a negative binomial specification, allowing for overdispersion (Cameron and Triverdi, 1986). This assumes

$$E(d_i|x_{i,t^e}) = \exp(x_{i,t^e}\phi) \quad (5)$$

and

$$V(d_i|x_{i,t^e}) = (1 + \psi^2 \exp(x_{i,t^e}\phi)) \exp(x_{i,t^e}\phi) \quad (6)$$

where  $x_{i,t^e}$  denotes a set of individual characteristics unrelated to eligibility and observed in  $t^e$ ;  $\psi$  denotes the overdispersion parameter, which the probability distribution of  $d_i$  depends

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<sup>7</sup>Regardless of which possible eligibility definition is used, there are cases of 'negative' time gaps, e.g. individuals reporting the onset of disability only after first receipt of AA has arisen. These cases are discarded from the main multivariate analysis; however as a robustness check, OLS estimates were repeated including them and this did not alter the nature of the findings.

on. The small sample size imposes a limited set of explanatory variables: cohort, age, gender, whether terminal education age was after compulsory schooling, whether home owner, log per capital household income, whether there are other persons in the household and whether partner is in receipt of an 'extra-cost' disability benefit. Maximum likelihood estimates of the  $\hat{\phi}$  parameters are reported in Table 4: each panel refers to a different disability definition. The size, significance and sign of coefficients is robust to alternative possible eligibility definitions. Despite small sample sizes, several coefficients are statistically significant: the delay is significantly longer for individuals enjoying higher living standards, as expressed by the home ownership and per capita household income variables. Delay appears instead significantly lower for older individuals. This might reflect the fact that, for older people, further claiming delay translates into a higher proportion of remaining life not covered by the benefit; but also administrative delays (e.g. in the case of refusal and later re-adjudication of the claim) are perhaps less likely to occur for older claimants.

Having controlled for age, a significantly shorter delay is also found for later cohorts, possibly reflecting a changed claiming attitude of later generations or higher awareness of need; however, because we cannot also control for time, it might also be capturing a trend in administrative strictness.

Shorter delay appears to be experienced also by those educated beyond compulsory schooling. So although less likely to receive AA for given disability, more educated people appear to take less time to claim. Finally, the presence of other people in the household significantly reduces the delay, suggesting a role for the existence of support from other people during the application process.

Estimates were repeated removing the sample restriction on individuals observed since before 65 years old, as a robustness check. The enlarged sample size allowed estimation of zero truncated models as well. Results (reported in Appendix, Table 12) confirm the patterns found on the restricted samples.

Table 4: Delay in receipt of Attendance Allowance after disability onset.

<i>Potential eligibility definition:</i>	<i>Negative Binomial estimated coefficients <math>\hat{\phi}</math></i>					
	<i>Delay</i> <sup>1</sup>		<i>Delay</i> <sup>2</sup>		<i>Delay</i> <sup>3</sup>	
Cohort	-.0015	***	-.0014	***	-.0014	***
Age	-.1893	***	-.1744	***	-.1744	***
Female	-.3095	*	-.1742		-.1742	
Reached compulsory schooling	-.8522	***	-.8379	***	-.8379	***
Home owner	.3641	*	.3414	*	.3414	*
Others in household	-.5681	**	-.6651	**	-.6651	**
Income <sup>4</sup>	.2693	**	.2738	**	.2738	**
Partner in receipt of a disability benefit <sup>5</sup>	-.0476		-.1959		-.1959	
Observations	45		47		47	
Pseudo $R^2$	.178		.178		.178	
AIC	204		210		210	
BIC	222		229		229	
Log Likelihood	-91.8		-95		-95	

*BHPS, 1991-2007.*

*Recipients observed since before 65 years old and first experiencing potential eligibility after 65 years old.*

\* $p < .1$ ; \*\* $p < .05$ ; \*\*\* $p < .01$

<sup>1</sup> Potentially eligible when reporting one among: informal care; homehelp; self care ADLs; disabled.

<sup>2</sup> Potentially eligible when reporting one among: informal care; homehelp; self care ADLs.

<sup>3</sup> Potentially eligible when reporting one among: informal care; homehelp.

<sup>4</sup> Per capita household monthly income.

<sup>5</sup> Either AA or DLA.

Estimated coefficients can be used to predict the conditional probabilities  $P(d_i = d | x_1^e)$  and to simulate the average delay for a person with given characteristics. For example, a single woman aged 68 and born in 1930, living alone in a owned house, who did not reach compulsory schooling and is currently living on median income, is expected to experience on average a delay of about 5 years, corresponding to a non trivial loss of more than £18,000 of cumulative entitlement. The corresponding figures for a man with similar characteristics are an expected average delay of four years and a half, and a loss of more than £16,000. Figure 1 plots the conditional probability distribution of delay duration for such a woman and men.

The hypothetical woman's expected delay would be four years shorter if she were born ten years later or if she were ten years older. Being educated beyond compulsory schooling would reduce the expected delay by about a year and a half. The presence of other people in the household would reduce the expected delay by about two years, corresponding to more

than £7,000 of ‘retrieved’ entitlement: the size of this effect is higher than the difference that a greater financial need (e.g.: income in the bottom decile, rather than median) would imply, suggesting that a single person living on their own might experience particularly high barriers to claim, even if in a more severe state of need.

## 5 The impact of AA

The third research question we address concerns the impact of AA receipt on later outcomes. AA is meant to support disabled older people in facing the extra costs that disability implies. Such costs arise for example from the need for practical help at home, receipt of personal care services, extra heating, specific dietary requirements, equipment and adaptations etc. While analysis of the impact of AA on each specific expenditure item (and particularly on care arrangements, in the light of current UK policy proposal to divert AA funds to direct provision of care services) would be of interest, available data limitations do not allow this to be followed up. The BHPS does not collect detailed expenditure information and no information on formal care or informal care received by people outside the household is available; also, the sample of those for whom informal care provided by other household members is observable would be indeed too small for any impact analysis to be attempted. Qualitative evidence collected from AA recipients (Age Concern, 2008) suggests that in fact care is not the primary item of expenditure for the extra money received: only 24% of recipients spend AA money on care services, while expenditure for practical help at home and extra heating is mentioned by about half of respondents. This is consistent with Berthoud and Hancock (2008) and Wanless (2006) findings, based on Family Resources Survey and English Longitudinal Study of Ageing data respectively, that a non trivial proportion<sup>8</sup> of recipients do not report receiving any care. In fact, AA is not constrained to be spent on care services, nor would the awarded amount be sufficient to pay for the provision of care implied by the eligibility requirements (Berthoud and Hancock, 2008).

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<sup>8</sup>46% (FRS) and 29% (ELSA).



Given the flexible nature of AA provision, unconditional on any particular use of the extra money awarded, perceived financial wellbeing seems a more appropriate outcome to look at, as it encompasses all of the potential uses of extra money, and therefore the one preferred by each recipient. While receipt of AA obviously implies an increase in available financial resources (£202 or £302 per month), it is interesting to see whether this addition results in an improvement of recipients' financial situation actually perceived. The measures of perceived financial wellbeing available in the BHPS will be described in Section 5.2.

## 5.1 Evaluation setting

We are interested in identifying the causal impact of entry into AA on recipients' reported financial wellbeing. As mentioned before, receipt of AA can be regarded as an *absorbing state*: potentially eligible individuals can enter AA receipt at any point in time and, once in, no 'exit' is typically to be expected. In other words, programme participants remain 'indefinitely' in. Because AA is an ongoing programme, rather than a programme administered at a fixed point in time, the assignment of an individual 'at risk' (e.g. aged 65 or older in that wave and who has not yet receive either DLA or AA) to the group of programme participants holds only conditionally on a given point in time and on not having entered disability benefit receipt at least up to then. This is somewhat different from dynamic settings where treatment assignment is conditional on elapsed duration since 'risk' has arisen (Sianesi, 2004). In our setting the probability of AA receipt depends first of all on a 'severity' dimension of disability, that individuals might reach irrespective of the elapsed duration since 'at risk' (e.g. suddenly, as a consequence of a stroke). So the appropriate conditioning seems to rather be on having reached a given *quantum* of disability severity, and therefore probability of receipt, at a particular point in time.

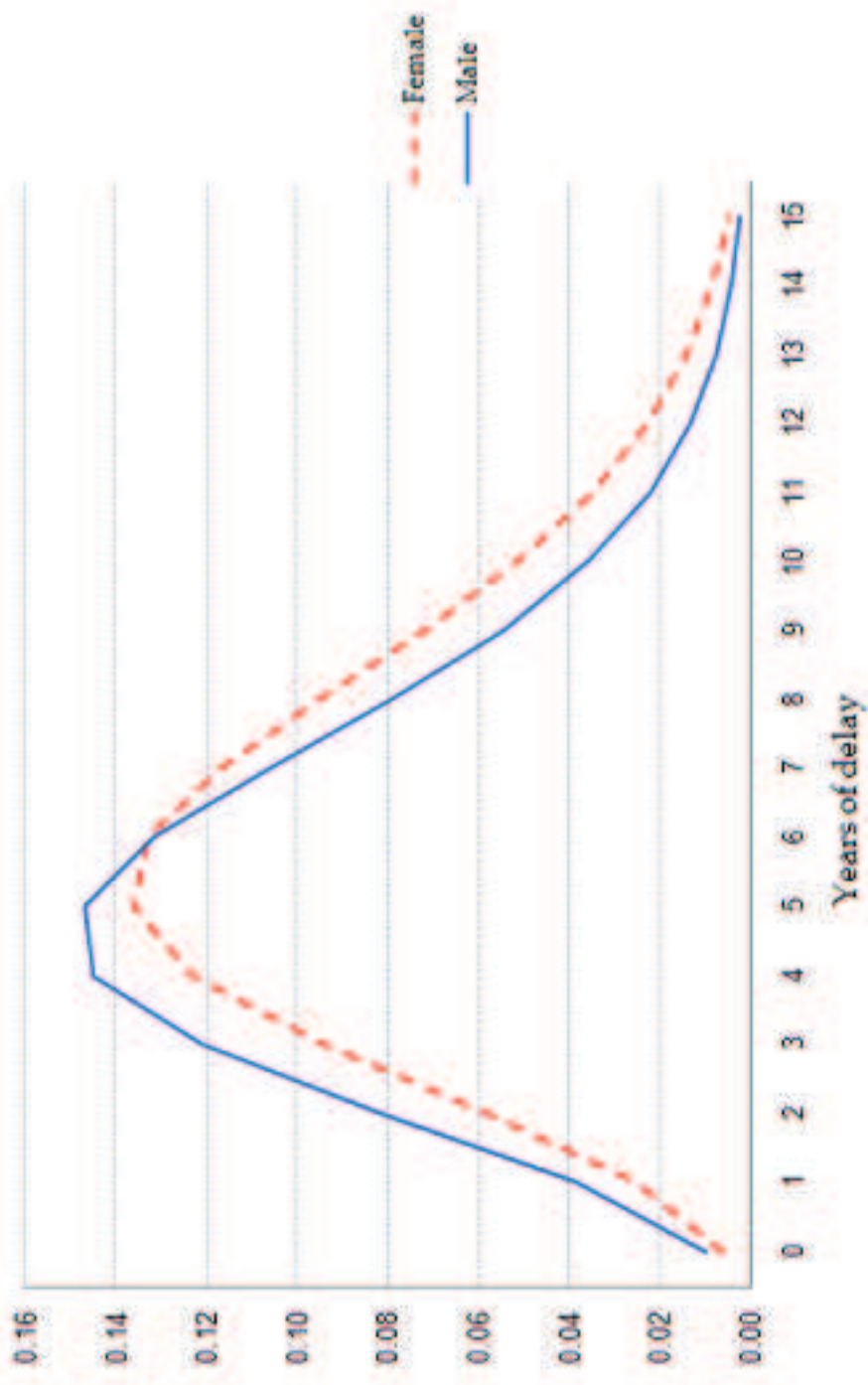


Figure 1: Delay in receipt of Attendance Allowance: estimated probability distribution.

Consider the set of individuals ‘at risk’ of entering AA receipt at time  $t = \bar{t}$ . They are individuals that in  $\bar{t}$  are aged 65 or older and who have not received either DLA or AA up to  $\bar{t} - 1$ . Denote with  $O_{i,\bar{t}+m}^r$  the outcome of interest  $O$  observed for individual  $i$  at time  $\bar{t} + m$ . The  $r$  superscript indicates whether individual  $i$  has entered AA or not in  $\bar{t}$ . For individuals ‘at risk’, the mean causal impact of entry into AA in  $\bar{t}$ , on the outcome of interest after  $m$  years from entry can be written as

$$\Delta_{\bar{t}}^m = E(O_{i,\bar{t}+m}^1 - O_{i,\bar{t}+m}^0) \quad (7)$$

Given that any individual  $i$  at time  $\bar{t}$  either experiences receipt or non receipt, only one of  $O_{i,\bar{t}+m}^1$  or  $O_{i,\bar{t}+m}^0$  is observable, and an appropriate substitute for the unobserved counterfactual outcome is needed.

The imperfect targeting features of AA can be exploited in this respect. As discussed in Pudney (2010), the element of uncertainty in AA administration is such that, from a potential claimant’ point of view, the AA award can be seen as lottery. Also from an analysis of BHPS data it appears that uncertainty plays a role in the assignment of AA to observationally identical individuals ‘at risk’ at a given point in time. Results presented in Section 4.1 have shown for example how a representative individual would face only a 50% probability of entering AA receipt, despite having already experienced the onset of disability according to all of the observed disability indicators.

In other words, at any point in time, it might be possible to observe both individuals entering AA and individuals not entering AA despite being endowed with the same characteristics as those of entrants. This might happen for example because of differences in programme administrators’ subjective assessment of the same claim (NAO, 2003), or because of unobservable variations in claiming probabilities. The 40 to 50% incidence of successfully re-assessed claims among appeals following an initial rejection (NAO, 2003) is indicative about the role played by the subjective assessment component.

Borrowing the same notation used in section 4.1, and denoting with  $r_{i,t}$  the binary indicator for whether individual  $i$  first enters AA at time  $t$ , with  $e_{i,t}$  the vector of disability indicators, and with  $x_{i,t}$  the vector of other personal characteristics determining probability of entry in  $t$  for individuals ‘at risk’, we assume

$$0 < P(r_{i,\bar{t}} = 1 \mid e_{i,\bar{t}-1} = \bar{e}, x_{i,\bar{t}-1} = \bar{x}, r_{i,\bar{t}-1} = 0, r_{i,\bar{t}-2} = 0, r_{i,\bar{t}-3} = 0, \dots) < 1 \quad \bar{e} \in \bar{E}, \bar{x} \in \bar{X} \quad (8)$$

for some subset  $\bar{E}$  and  $\bar{X}$  of the  $e$  and  $x$  supports.

A comparison group for AA entrants in  $\bar{t}$  is then offered by individuals ‘at risk’ who, despite being observationally identical up to  $\bar{t}$ , do not start receiving AA at that time. This approach relies on a standard *conditional independence assumption*, requiring the absence of unobserved characteristics affecting both assignment to AA receipt and perceived financial wellbeing after  $\bar{t}$ :

$$O_{\bar{t}+m}^r \perp\!\!\!\perp r_{i,\bar{t}} \mid e_{\bar{t}-1}, x_{\bar{t}-1}, r_{i,\bar{t}-1}, r_{i,\bar{t}-2}, r_{i,\bar{t}-3}, \dots = 0, \quad m = 1, 2, \dots \quad (9)$$

In other words, it is assumed that conditional on having reached the same probability of receipt in  $\bar{t}$ , given that all the characteristics relevant to such probability are observed, the fact that an individual ‘at risk’ enters AA in  $\bar{t}$  or not, is not correlated with future potential outcomes. This is equivalent to ruling out for example the possibility of assessors awarding AA based on confounding characteristics unobserved in the data or unobserved claimants’ preferences. The soundness of this assumption is to be judged against the available set of conditioning covariates, which will be detailed in section 5.2.

Under the common support and conditional independence assumptions, an estimator for  $\Delta_{\bar{t}}^m$  can be obtained integrating

$$\begin{aligned} (\Delta_{\bar{t}}^m \mid \bar{x}, \bar{e}) &= E(O_{i,\bar{t}+m}^1 - O_{i,\bar{t}+m}^0 \mid e_i = \bar{e}, x_i = \bar{x}) = \\ &= E(O_{i,\bar{t}+m}^1 - O_{j,\bar{t}+m}^0 \mid e_i = e_j = \bar{e}, x_i = x_j = \bar{x}) \end{aligned}$$

over  $\bar{E}$  and  $\bar{X}$ .

Note that the comparison group includes both individuals never entering AA while observed and individuals entering AA at some later point in time. Therefore  $\Delta_{\bar{t}}^m$  will capture the impact of entering AA receipt in  $\bar{t}$  versus not entering *at least up to then*, rather than the impact of entering AA receipt in  $\bar{t}$  versus never entering at all (Sianesi, 2004). Measuring the second would in fact require restricting the control group to those never entering AA while observed, implying a selection based on the future (non entry into AA in periods after  $\bar{t}$ ).  $\Delta_{\bar{t}}^m$  can instead be interpreted as the differential outcome experienced by those who enter AA in  $\bar{t}$  rather than keeping the option of entering at some later point open, or in other words, a measure of the perceived cost of an unsuccessful or postponed claim for potential claimants.

## 5.2 Implementation and results

The BHPS data contain an indicator of perceived financial strain (*STRAIN*), derived from the question ‘How well would you say you yourself are managing financially these days?’ and measured on a five point scale, increasing with the level of perceived difficulty. Respondents are also asked how their financial situation compares with one year ago: this information is used to derive an indicator of financial wellbeing (*CHANGE*), taking value  $-1$  if respondents felt worse off, value  $0$  if they felt about the same and  $1$  if they felt better off. From 1996 onwards (with the exception of 2001), information on respondents satisfaction with income was collected: the corresponding indicator (*SATISFACTION*), takes values increasing with the level of satisfaction with income on a 7 points Likert scale.

Practical implementation of the outlined methodology is based on  $\bar{t}$  corresponding in turn to each wave of panel data collection. For each wave, analysis is carried out on the sample of individuals ‘at risk’ (e.g. aged 65 or older in that wave and did not receive either DLA or AA up to the previous wave), for whom both disability indicators prior to  $\bar{t}$  and outcomes of interest in the following years are observed (leading to the impossibility of using the first and the last wave). Table 5 reports the sample size available in each  $\bar{t}$ , decomposed

into AA entrants in that wave, and the corresponding number of potential controls, e.g. individuals who have not entered disability benefit receipt up to then. In each  $\bar{t}$  considered, the proportion of potential controls for whom a later entry into AA receipt is observed, is less than one third of potential controls.

To implement the conditioning on  $x$  and  $e$  characteristics, a propensity score matching methodology is adopted. This relies on the parametric estimation of the conditional probability of AA first receipt in  $\bar{t}$ ,  $P(r_{i,\bar{t}} = 1|e, x)$  (the so-called *propensity score*) and the following nearest neighbour matching of entrants and controls based on their estimated propensity score. The advantage of this methodology is that it allows to summarize in a score the distribution of the full vector of conditioning covariates (Rosenbaum and Rubin, 1983). The resulting estimator can be written as

$$\Delta_{\bar{t}}^m = \frac{1}{N_{\bar{t}}} \sum_i O_{i,\bar{t}+m}^1 - O_{j(i),\bar{t}+m}^0 \quad (10)$$

where  $N_{\bar{t}}$  represents the set of AA entrants in  $\bar{t}$  successfully matched; subscript  $i$  indexes entrants in  $\bar{t}$  and  $j(i)$  represents the matched control (not entering at least up to  $\bar{t}$ ) whose predicted probability of AA entry in  $\bar{t}$  is the closest to  $i$ 's.  $P(r_{i,\bar{t}} = 1|e, x)$  is estimated parametrically by maximum likelihood, adopting a probit specification. The set of conditioning covariates used is listed in Table 6. It includes a set of socio-demographic characteristics as of  $\bar{t} - 1$  and indicators of possible eligibility as of  $\bar{t} - 1$ ; lagged covariates values are used because they provide a picture of personal circumstances closer to the relevant time than current covariates (for the reasons already explained in Section 4.1).

The set also includes the lagged outcome of interest as of  $\bar{t} - 1$  and  $\bar{t} - 2$ , to control for outcome dynamics; and the time average and time trend for the number of days spent in hospital, meant to capture further unobserved underlying health conditions/trends. Because their value depends also on the number of days spent in hospital after AA receipt has started, the inclusion of these last two explanatory variables relies on the assumption that AA receipt in itself bears no effect on them.

Table 5: Number of AA entrants and potential controls, by wave of entry into AA.

$\bar{t}(wave)$	Sample size	AA entrants	Potential controls
2	1,310	23	1,287
3	1,284	39	1,245
4	1,259	23	1,236
5	1,265	35	1,230
6	1,254	38	1,216
7	1,237	27	1,210
8	1,507	48	1,459
9	1,441	48	1,393
10	2,024	91	1,933
11	1,726	60	1,666
12	1,965	81	1,884
13	1,919	75	1,844
14	1,864	71	1,793
15	1,829	54	1,775
16	1,848	74	1,774

Source: BHPS, 1992-2006.

Table 6: Propensity Score matching - list of conditioning covariates.

Terminal education age	
Gender	
Age	$\bar{t}-1$
Partnership	$\bar{t}-1$
Labour market active	$\bar{t}-1$
Log of per capital household income	$\bar{t}-1$
Household size	$\bar{t}-1$
Mental distress (GHQ)	$\bar{t}-1$
In receipt of informal care	$\bar{t}-1$
Health limiting self care ALDs	$\bar{t}-1$
Number of reported health problems	$\bar{t}-1$
Outcome of interest	$\bar{t}-1$
Outcome of interest	$\bar{t}-2$
Days as hospital in patient	<i>time average</i>
Days as hospital in patient	<i>time trend</i>

Given the free of charge nature of hospital admission in the UK, it appears a reasonable assumption; rather than AA recipients becoming more likely to be admitted to hospital, it seems more the case of hospital admission generating an AA referral.

Estimation of the propensity score has been repeated for each outcome measure separately and for each wave taken in turn as  $\bar{t}$ . After estimation, nearest neighbour matching has been performed for each outcome and wave with no replacement. To ensure a satisfactory matching quality, a 0.05 caliper is imposed on the maximum acceptable distance between each AA entrant and its matched control propensity scores, in order for the matched pair to be retained and used in estimation of  $\Delta_{\bar{t}}^m$ , at the cost of a reduced sample size. The resulting figures (numbers and proportions) of successfully matched AA entrants by wave of AA entry are reported in Appendix (Tables 13 and 14 respectively). With the only exception of the *SATIS* indicator, the estimates of  $\Delta_{\bar{t}}^m$  could be obtained for each wave  $w \in (2, 16)$ .

Table 7 presents the resulting estimates for the considered outcomes measures up to  $m = 4$ . Rather than reporting  $\Delta_{\bar{t}}^m$  for each wave, a summary measure for the impact is obtained by averaging over time  $\bar{t}$ , as in

$$\Delta_m = \frac{1}{\sum_{\bar{t}} N_{\bar{t}}} \sum_{\bar{t}} \Delta_{\bar{t}}^m \quad (11)$$

For each outcome, the second and third row report the standard error and the P-value for the two-tailed test for  $H_0 : \Delta_m = 0$ , e.g. the null hypothesis of no statistically significant difference in the outcomes of AA entrants and matched controls.

Table 7: Estimates of AA receipt impact on financial wellbeing.

<i>Financial wellbeing outcome:</i>		$\Delta_{-2}$	$\Delta_{-1}$	$\Delta_0$	$\Delta_1$	$\Delta_2$	$\Delta_3$	$\Delta_4$
STRAIN	<i>Ni</i>	571	588	586	588	508	457	416
	$\Delta_m$	-0.060	-.087	-.336	-.213	-.226	-.197	-.192
	<i>se</i> ( $\Delta_m$ )	(.060)	(.059)	(.055)	(.055)	(.059)	(.063)	(.066)
	<i>Pvalue</i> <sup>1</sup>	.320	.140	.000	.000	.000	.002	.004
CHANGE	<i>Ni</i>	567	583	578	583	499	450	413
	$\Delta_m$	-0.005	.000	.363	.209	.158	.162	.179
	<i>se</i> ( $\Delta_m$ )	(.033)	(.033)	(.037)	(.033)	(.036)	(.039)	(.041)
	<i>Pvalue</i> <sup>1</sup>	.872	1.000	.000	.000	.000	.000	.000
SATISFACTION	<i>Ni</i>	255	255	207	255	182	140	110
	$\Delta_m$	-0.004	.078	.319	.361	.291	.321	.509
	<i>se</i> ( $\Delta_m$ )	(.162)	(.164)	(.170)	(.153)	(.183)	(.216)	(.251)
	<i>Pvalue</i> <sup>1</sup>	.981	.633	.063	.019	.113	.139	.045

*Source: BHPS, 1991-2007.*

<sup>1</sup> P value for the two-tailed test of  $H_0 : \Delta_m = 0$ .



The null hypothesis is never rejected for  $m = -1$  and  $m = -2$ , suggesting that the matching has succeeded in controlling for the outcome history prior to AA entry. Instead,  $\hat{\Delta}_m$  becomes significantly different from zero in all the years following receipt for STRAIN and CHANGE. A significant effect is registered, for all measures, for the year when AA receipt starts. As to the sign and size of the effect, perceived financial strain becomes significantly lower for AA recipients as opposed to matched controls, in each of the receipt and following four years. The reduction in financial strain registered in the year of receipt corresponds to about the 15% of its  $\bar{t} - 1$  average value of 2.2, and persists in the following four years. Consistently, the *CHANGE* indicator points at a sizeable improvement: the differential between treated and controls is almost four time larger than its  $\bar{t} - 1$  average value of  $-.09$  in the year of receipt, and persists, although smaller in size, up to  $\bar{t} + 4$ .

Also satisfaction with income after AA receipt increases significantly in the year of AA receipt, by about 7% of its average  $\bar{t} - 1$  value. Although remaining positive, the effect loses significance after  $\bar{t} + 2$ .

These findings can be interpreted as consistent evidence of a loss in perceived financial wellbeing resulting from ‘missed’ entry of potentially eligible individuals. ‘Missed’ entry might depend either on a potential claim not being pursued or on an unsuccessful pursued claim. Both instances could be regarded as targeting failures. Far from unexpected (given that each year of ‘missed’ receipt translates into at least £2,400 lost), these results make the case for improving AA targeting (encouraging claims, reducing errors in assessment, and speeding up adjudications) stronger.  $\Delta_m$  can in fact also be interpreted as the gain that an eligible non recipient would experience if brought promptly into AA receipt. Beside, paired with the evidence of AA not being primarily used to pay for care, these findings suggest that the current policy proposal of transferring AA resources to direct provision of care services, might reasonably be expected to worsen potential AA recipients perceived living standards, because of other ‘extra-cost’ needs remaining uncovered.

Table 8: Estimates of AA receipt impact on health indicators.

		$\Delta_{-2}$	$\Delta_{-1}$	$\Delta_0$	$\Delta_1$	$\Delta_2$
<i>'Objective' Health Indicators</i>						
ACCIDENTS	<i>Ni</i>	566	584	584	584	516
	$\Delta_m$	-0.030	-0.015	0.021	0.034	0.037
	<i>se</i> ( $\Delta_m$ )	(.022)	(.024)	(.026)	(.028)	(.031)
	<i>Pvalue</i> <sup>1</sup>	.172	.172	.431	.226	.233
INTERVIEWER: PHYSICAL DIFFICULTY	<i>Ni</i>	560	576	576	576	502
	$\Delta_m$	.000	-.005	-.012	-.002	-.006
	<i>se</i> ( $\Delta_m$ )	(.021)	(.022)	(.023)	(.024)	(.026)
	<i>Pvalue</i> <sup>1</sup>	1.000	.811	.595	.942	.816
INTERVIEWER: COGNITIVE DIFFICULTY	<i>Ni</i>	508	520	520	520	439
	$\Delta_m$	-.002	-.012	-.004	.014	.005
	<i>se</i> ( $\Delta_m$ )	(.009)	(.010)	(.012)	(.013)	(.014)
	<i>Pvalue</i> <sup>1</sup>	.828	.257	.746	.297	.746
TIMES CONSULTED GP	<i>Ni</i>	536	553	553	553	482
	$\Delta_m$	-.058	.031	.052	-.062	-.033
	<i>se</i> ( $\Delta_m$ )	(.072)	(.065)	(.069)	(.070)	(.076)
	<i>Pvalue</i> <sup>1</sup>	.424	.637	.448	.380	.660
<i>Self reported health</i>						
SELF REPORTED (BAD) HEALTH	<i>Ni</i>	567	584	584	584	510
	$\Delta_m$	-.005	.039	.045	.111	.122
	<i>se</i> ( $\Delta_m$ )	(.043)	(.039)	(.039)	(.045)	(.047)
	<i>Pvalue</i> <sup>1</sup>	.903	.309	.254	.014	.010

Source: BHPS, 1991-2007.

<sup>1</sup> P value for the two-tailed test of  $H_0 : \Delta_m = 0$ .

Given recipients' age and disability, one could not reasonably expect AA to improve their health. However, if we were observing a worsening of health status indicators for recipients, this would signal a failure of our approach in controlling for endogenous selection into AA. Therefore, the impact on health indicators is also estimated for a battery of more and less objective measures. Estimates of  $\hat{\Delta}_m$ , up to to  $m = 2$ , are reported in Table 8. According to all of the objective disability indicators (number of accidents, interviewers report, times visited or consulted the GP), no significant difference is registered across treated and matched controls. Also the number of self reported health problems is unaffected. This finding supports the validity of the adopted identification approach. Interestingly, self-reported health status instead seems to capture a worsening in recipients' perceived health from the year following first AA receipt: this might be interpreted as evidence of justification-bias type of behaviour, or lack of awareness among elderly people of their disability status prior to receipt of the benefit.

## 6 Conclusions

This paper has investigated how extra-cost disability benefits for the elderly perform, both in terms of targeting and timeliness of provision, and of effectiveness in relieving the financial burden that disability might impose. The analysis was based on the UK case of Attendance Allowance, currently undergoing policy scrutiny.

The availability of suitable panel data, collecting relevant information over several consecutive years, has allowed to study Attendance Allowance receipt accounting for dynamic aspects of the process. In particular, information about health and disability prior to first receipt has allowed to investigate *targeting* in terms of responsiveness to an earlier disability onset; and also to circumvent the potential *justification bias* that the lack of disability indicators observed prior to first receipt would have entailed. Besides, the panel dimension of the data has allowed to evaluate a crucial aspect of program effectiveness -given recipients' life expectancy- that is the timeliness of benefit provision; and to assess not only the impact of AA at a single point in time, but also its persistence over time.

A first research question concerned AA receipt responsiveness to the onset of disability, and to other personal characteristics unrelated to eligibility: probit estimate results support the idea that receipt is significantly tied to a previous onset of disability. No empirical support has emerged for the concern of 'undeserving' healthy individuals receiving AA. However, a *targeting* issue arises from the evidence of a sizeable degree of uncertainty in receipt even when all disability indicators point consistently at eligibility. Moreover, personal and household characteristics, unrelated to eligibility, are found to affect the benefit assignment process, threatening horizontal equity of provision. For example, the presence of other people in the household and familiarity with the benefit system seem to play a major role in facilitating claims. The relevance of confounding factors is confirmed by the multivariate analysis of receipt delays, and translates into unwanted differences in obtained financial support worth thousands of pounds.

A second research question concerned the timeliness of provision: probit estimates results suggest that receipt follows to disability onset happened even several years before. Besides, the evidence (robust to the use of different disability indicators) of more than four years elapsing on average between the onset of possible eligibility and AA receipt, confirms that timing of delivery represents a shortcoming of the current AA system.

Postponed receipt translates into a perceived loss of financial wellbeing. The analysis has shown that, had they not entered AA, at least at that point in time, AA entrants would have reported a significantly lower level of financial wellbeing. AA receipt has appeared instead to improve recipients' perception of their financial circumstances, according to all of the available indicators. Moreover, the impact does not fade in subsequent years, neither in terms of significance (with the only exception of SATISFACTION for  $m = 3$  and  $m = 4$ ), nor of size. The soundness of the identification approach appears confirmed by the evidence of no difference registered in objective health indicators between recipients and controls.

Overall, there appears to be scope for improving the current UK system of cash support for disability in old age, particularly with respect to timeliness of provision and outreaching those experiencing higher barriers to pursuing a claim. Such improvement can be reasonably expected to result in an improvement of potential recipients' living standards. Despite several data limitations - sample size, measurement error in AA receipt, imperfect match between disability indicators available in the survey and to actual assessors - the analysis offers informative evidence for the ongoing UK policy debate, and a term of comparison for evaluations of other countries' similar benefit schemes.

# 7 Appendix

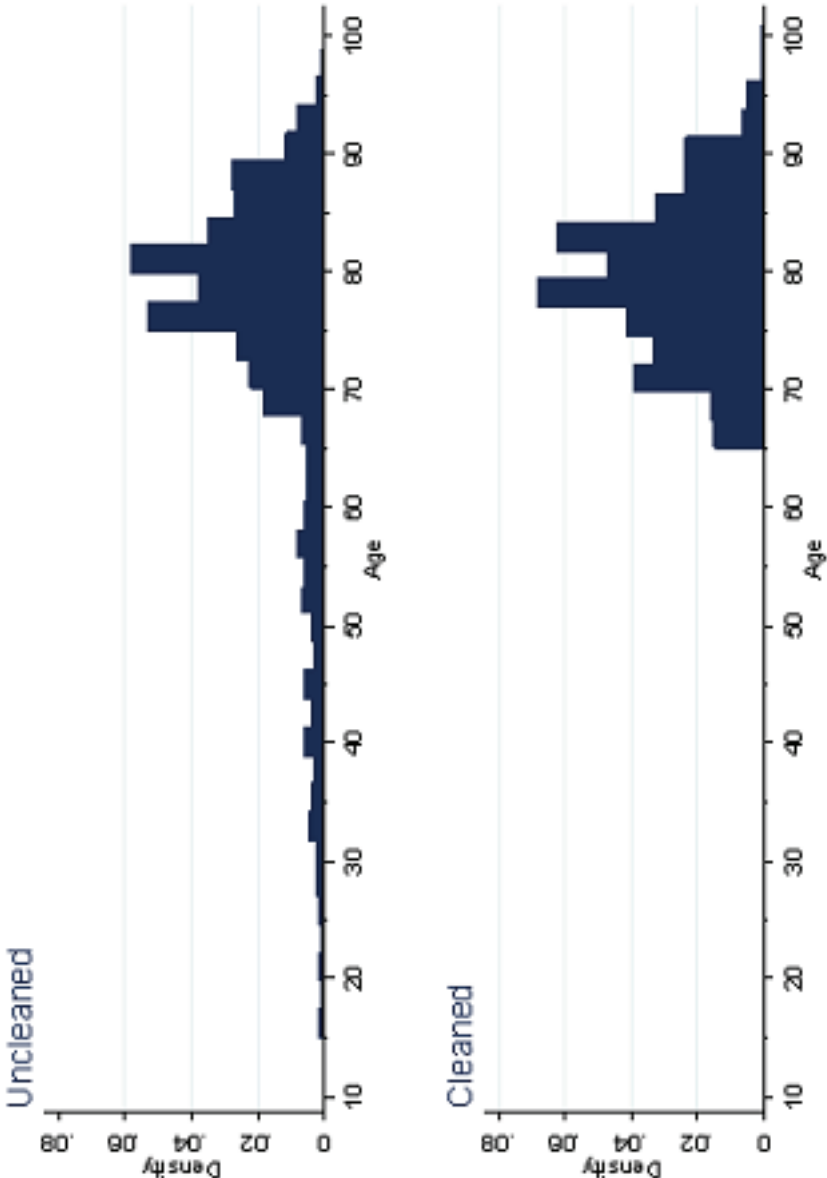


Figure 2: Age distribution of AA recipients, before and after data cleaning.

Table 9: Potentially endogenous sample selection.

	<i>respondents</i>
Aged 65 years old and not in receipt/having received DLA	5,652
Cases Excluded because entering the panel already in receipt of AA	272
Of which : non response before entry	<b>12</b>
non sampled before entry as enter the panel when joining	
the household of a permanent sample member	
entering the target sample at wave 1 or later with booster samples, of which:	<b>16</b>
- Non sampled before wave 1	<i>244</i>
- Sample since w7 as ECHP booster	<i>39</i>
- Sample since w9 as W-S booster	<i>58</i>
- Sampled since w11 as NI booster	<i>52</i>
	<i>95</i>
Cases excluded because unobserved in the year prior to first observed receipt, although observed at some earlier wave	<b>46</b>
Final sample number	5,334

Source: BHPS, 1991-2007.

Table 10: Sample size: individuals observed per wave.

<i>wave</i>	
1	1,693
2	1,566
3	1,461
4	1,473
5	1,455
6	1,453
7	1,823
8	1,786
9	2,538
10	2,488
11	2,847
12	2,473
13	2,486
14	2,403
15	2,370
16	2,395
17	2,386
Total	35,096

*Source: BHPS, 1991-2007*

Table 11: Descriptive Statistics: sample mean and standard deviation.

	Total sample		Recipients		Non recipients	
	Mean	Std. dev.	Mean	Std. dev.	Mean	Std. dev.
Year of birth	1931.9	9.8	1928.2	8.7	1932.8	9.9
Age	74.2	6.6	76.9	6.9	73.3	6.2
Female	.561	.496	.625	.484	.546	.498
White	.991	.093	.991	.095	.991	.093
Terminal education age	14.9	1.4	14.6	1.2	15.0	1.4
Living with spouse/partner	.536	.499	.442	.497	.570	.495
Others in household	.127	.333	.142	.349	.121	.327
Income	707.3	510.1	654.1	476.8	726.4	520.2
Home owner	.700	.458	.611	.488	.731	.443
Labour market active	.062	.241	.023	.149	.076	.265
In receipt of Income Support	.119	.324	.198	.398	.091	.287
Partner in receipt of a disability 'extra cost' benefit	.082	.274	.121	.326	.074	.262

Source: *BHPS, 1991-2007 pooled waves*.

<sup>1</sup> Per capita household monthly income.

<sup>2</sup> Either AA or DLA.



Table 12: Delay in receipt of Attendance Allowance after disability onset - enlarged sample.

<i>Eligibility definition:</i>	<i>Negative Binomial</i>			<i>Zero Truncated Negative Binomial</i>		
	<i>Delay<sup>1</sup></i>	<i>Delay<sup>2</sup></i>	<i>Delay<sup>3</sup></i>	<i>Delay<sup>1</sup></i>	<i>Delay<sup>2</sup></i>	<i>Delay<sup>3</sup></i>
Cohort	-.0011	-.0012	-.0012	-.0011	-.0011	-.0011
Age	-.1474	-.1483	-.1467	-.1291	-.1282	-.1284
Female	.1359	.1629	.1633	.162	.13	.1311
Reached compulsory schooling	-.2075	-.1543	-.1693	-.278	-.2516	-.2645
Home owner	.0441	.0401	.035	-.1258	-.0996	-.1063
Others in household	-.5429	-.3908	-.357	-.5508	-.3821	-.3755
Income1	.1388	.1431	.1331	.1883	.2239	.2245
Partner in receipt of a disability benefit 2	-.0587	-.0613	-.0814	.0044	.044	.0126
Observations	164	170	170	140	145	145
Pseudo R2	.083	.0859	.0868	.0853	.0801	.0821
<i>AIC</i>	753	781	778	626	654	652
<i>BIC</i>	784	812	810	655	684	681
Log Likelihood	-366	-380	-379	-303	-317	-316

*Source: BHPS, 1991-2007.*

*Recipients experiencing potential eligibility after 65 years old.*

\* $p < .1$ ; \*\* $p < .05$ ; \*\*\* $p < .01$

1 Potentially eligible when reporting one among: informal care; homehelp; self care ADLs; disabled.

2 Potentially eligible when reporting one among: informal care; homehelp; self care ADLs.

3 Potentially eligible when reporting one among: informal care; homehelp.

4 Per capita household monthly income.

5 Either AA or DLA.

Table 13: Propensity Score Matching: number of AA entrants successfully matched, by wave of entry into AA.

	<i>fieldwork year</i>														
<i>wave of entry</i>	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
<i>Outcome</i>															
STRAIN	17	31	21	30	33	25	30	42	37	52	42	64	57	47	60
CHANGE	16	32	21	29	34	23	31	42	37	51	41	64	57	46	59
SATISFACTION	-	-	-	-	-	-	29	39	-	42	-	-	46	42	57
NUMBER OF ACCIDENTS	18	30	22	30	34	24	31	43	38	52	42	64	52	46	58
INTERVIEWER: PHYSICAL DIFF.	16	30	22	29	29	22	31	40	37	52	41	63	58	46	60
INTERVIEWER: COGNITIVE DIFF.	12	16	10	18	18	21	29	40	36	52	42	63	56	47	60
TIMES CONSULTED GP	17	28	22	29	32	22	31	39	37	47	33	60	50	46	60
SELF REPORTED HEALTH STATUS	17	28	21	30	34	23	31	43	39	52	39	64	57	47	59

Source: BHPS, 1991-2007.

Table 14: Propensity Score Matching: percentage of AA entrants successfully matched, by wave of entry into AA.

	<i>fieldwork year</i>														
<i>wave of entry</i>	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
<i>Outcome</i>															
STRAIN	74	79	91	86	87	93	63	88	41	87	52	85	80	87	81
CHANGE	70	82	91	83	89	85	65	88	41	85	51	85	80	85	80
SATISFACTION	-	-	-	-	-	-	60	81	-	70	-	-	65	78	77
NUMBER OF ACCIDENTS	78	77	96	86	89	89	65	90	42	87	52	85	73	85	78
INTERVIEWER: PHYSICAL DIFF.	70	77	96	83	76	81	65	83	41	87	51	84	82	85	81
INTERVIEWER: COGNITIVE DIFF.	52	41	43	51	47	78	60	83	40	87	52	84	79	87	81
TIMES CONSULTED GP	74	72	96	83	84	81	65	81	41	78	41	80	70	85	81
SELF REPORTED HEALTH STATUS	74	72	91	86	89	85	65	90	43	87	48	85	80	87	80

Source: BHPS, 1991-2007.

## References

- [1] Age Concern (2008). Transforming lives: Tackling Poverty and Promoting Independence and Dignity through Information and Advice, Age Concern England, London.
- [2] Baker, M., Stabile, M., Deri, C. (2004). What Do Self-Reported, Objective, Measures of Health Measure?, *Journal of Human Resources*, **39(4)**: 1067-1093.
- [3] Banks, P., Lawrence, M. (2005) Transparent or Opaque? Disabled people in Scotland describe their experience of applying for Disability Living Allowance, *Journal of Social Work*, **5(3)**: 299-317
- [4] Benitez-Silva, H., Buchinsky, M., Man Chan, H., Cheidvasser, S. , Rust, J. (2004) How large is the bias in self reported disability?, *Journal of Applied Econometrics*, **19(4)**: 649-670
- [5] Berthoud, R. (2009) The impact of disability benefits. A feasibility study. DWP Working Paper No 58
- [6] Berthoud, R., Hancock, Ruth (2008) Disability benefits and paying for care. ISER Working Paper 2008-40. Institute for Social and Economic Research, University of Essex, Colchester.
- [7] Bound, J. (1989) The Health and Earnings of Rejected Disability Insurance Applicants, *American Economic Review*, **79(3)**: 482-503
- [8] Bound, J. (1991). Self-Reported versus Objective Measures of Health in Retirement Models, *Journal of Human Resources*, **26(1)**, 106-138.
- [9] Bound, J. and Burkhauser, R. (1999) Economic Analysis of transfer programs targeted on people with disabilities, in *Handbook of Labor Economics* vol. 3C, ed. Orley Ashenfelter and David Card, 3309-3416. New York: Elsevier Science.

- [10] Brown, R., Carlson, B L., Dale, S., Foster, L., Phillips, B., and Schore, J. Cash and Counselling: Improving the Lives of Medicaid Beneficiaries Who Need Personal Care or Home-and Community-Based Services. Princeton, NJ: Mathematica Policy Research, Inc., August 2007.
- [11] Burchardt, T. (1999) The evolution of disability benefits in the UK:re-weighting the basket. *CASE PAper 26*, Centre for Analysis of Social Exclusion, London School of Economics.
- [12] Cameron, A. C. and Triverdi, P. K. (1986) Econometric Models based on Count Data: Comparisons and Applications of Some Estimators and Tests, *Journal of Applied Econometrics*, **1**, 29-53.
- [13] Child Poverty Action Group (2008) Welfare benefits and tax credits handbook 2008/2009, Child Poverty Action Group, London.
- [14] Controller of Her Majesty's Stationary Office (2009) Shaping the future of care together, The Stationary Office.
- [15] Coile, C., Diamond, P., Gruber, J., Jousten, A. (2002) Delays in claiming social security benefits, *Journal of Public Economics* **84**: 357-385.
- [16] Currie, Janet, and Brigitte C. Madrian. 1999. Health, Health Insurance and the Labor Market, in *Handbook of Labor Economics* vol. 3C, ed. Orley Ashenfelter and David Card, 3309-3416. New York: Elsevier Science.
- [17] Daly, M., Noble, M. (1996) The reach of disability benefits: an examination of the Disability Living Allowance, *Journal of Social Welfare and Family Law*, **18(1)**: 37-51
- [18] Diamond, P., Sheshinski, E. (1995) Economic aspects of optimal disability benefits, *Journal of Public Economics*, **57(1)**: 1-23

- [19] Disney, R., Webb, S. (1991) Why are there so many long term sick in Britain?, *Economic Journal* **101**: 252-262.
- [20] Department for Work and Pensions (2008) Attendance Allowance Quarterly Statistics: February 2005. Online Statistical Bulletin.
- [21] Goldberg, D. P. (1972) The Detection of Psychiatric Illness by Questionnaire. Oxford. Oxford University Press.
- [22] Gutierrez, R. G., Carter, S., Drukker, D. M. (2001) On boundary-value likelihood ratio tests, *Stata Technical Bulletin* **60**: 15-18.
- [23] Hancock, R., Morciano, M, Pudney, S. Zantomio, F. (2010) Disability Benefits Receipt and Disability Indexes: Evidence from Multiple Surveys, ISER working paper (*forthcoming*)
- [24] Halpern, J., Hausman, J. (1986) Choice under uncertainty: a model of applications for the social security disability insurance program, *Journal of Public Economics* **31**: 131-161.
- [25] Hirst, M. (1997) Variations in the administration of Disability Living Allowance, *Social Policy and Administration*, **31(2)**: 136-156.
- [26] Jäckle, A. (2008) The Causes of Seam Effects in Panel Surveys. ISER Working Paper 2008-14. Colchester: University of Essex.
- [27] Kasparova D., Marsh A. and Wilkinson D. (2007). The take-up rate of Disability Living Allowance and Attendance Allowance: feasibility study. London: Department for Work and Pensions, Research Report No 442.
- [28] Katz S, Ford A. B., Moskowitz R. W., Jackson B.A., Jaffe M. W., Cleveland M.A. (1963) Studies of Illness in the Aged. The Index of ADL: A Standardized Measure of

- Biological and Psychosocial Function, *Journal of the American Medical Association*, **185(12)**: 914-919.
- [29] Kreider, B. (1998) Workers's Applications to Social Insurance Programs when Earnings and Eligibility are uncertain, *Journal of Labour Economics* **16(4)**: 848-877.
- [30] Kreider, B., Riphahn, R. (2000) Explaining Applications to the U.S. Disability System: A Semiparametric Approach, *Journal of Human Resources* **35(1)**: 82-115.
- [31] Lawton MP, Brody EM. (1969) Assessment of older people: self-maintaining and instrumental activities of daily living, *The Gerontologist*, **9(3)**, 179-186.
- [32] Lynn, P. (ed.), with Buck, N., Burton, J., Laurie, H. and Uhrig, S.C.N. (2006) Quality Profile: British Household Panel Survey: Waves 1 to 13, 1991-2003. Institute for Social and Economic Research, University of Essex, Colchester.
- [33] McVicar, D. (2008) Why have UK Disability Benefits Rolls grown so much?, *Journal of Economic Surveys* **22(1)**: 114-139.
- [34] NAO (2003) Progress in improving the medical assessment of incapacity and disability benefits. London, House of Commons: Report by the Comptroller and Auditor General.
- [35] Nosowska, G. (2004) A delay they can ill afford: delays in obtaining Attendance Allowance for older, terminally ill cancer patients, and the role of health and social care professionals in reducing them, *Health Soc Care Community* **12(4)**: :283-7.
- [36] OECD HEALTH DATA 2009, June 09
- [37] ONS , Health Statistics Quarterly, Winter 2008
- [38] Parsons, D. O. (1991) Self-Screening in Targeted Public Transfer Programs, *Journal of Political Economy* **99(4)**: 859-876.

- [39] Parsons, D. O. (1996) Imperfect 'tagging' in social insurance programs, *Journal of Public Economics*, **62(1-2)**: 183-207
- [40] Pudney, S.(2009) Participation in disability benefit programmes. A partial identification analysis of the British Attendance Allowance system, ISER Working Paper 2009-19. Institute for Social and Economic Research, University of Essex, Colchester.
- [41] Pudney, S.(2010) Disability Benefits for Older People: How Does the UK Attendance Allowance System Really Work?, ISER Working Paper 2010-02. Institute for Social and Economic Research, University of Essex, Colchester.
- [42] Rosenbaum, P.R., Rubin, D.B.(1983), The central role of the propensity score in observational studies for causal effects, *Biometrika* **70**: 41-55.
- [43] Sianesi, B.(2004), An evaluation of the Swedish system of active labor market programs in the 1990s, *Review of Economics and Statistics* **86(1)**: 133-155.
- [44] Stapleton, D., Protik, A., Stone, C.(2008) Review of international evidence on the cost of disability, DWP Research report No 542
- [45] Taylor, M.F. (ed.), with Brice, J., Buck, N. and Prentice-Lane, E. (2006) British Household Panel Survey User Manual Volume A: Introduction, Technical Report and Appendices. Institute for Social and Economic Research, University of Essex, Colchester.
- [46] Walness, D. (2006) Securing Good Care for Older People: Taking a Long-Term View. London: King's Fund.