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*Citizens and Governance in a Knowledge-based Society*

#### **Deliverable 2.1 Estimating measurement error in Finnish data**

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The non-take-up of social transfers and  
measurement error: Housing allowances in  
Finland

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### **Abstract**

The purpose of this paper is to explore the modelling benefit non-take-up in the Finnish housing allowance program using multiple measurements of the resources that determine benefit entitlement. The paper briefly discusses the statistical issues involved, presents the housing allowance scheme as it applied to the period to be studied and discusses the special version of the Finnish ECHP data set that will be used to illustrate the statistical issues that are involved.

# 1 Introduction

It is well known that many households that are entitled to social benefits do not in fact receive, or even apply, for them. The extent to which this is the case varies across benefits within a country and across countries. Since social benefit rules are by definition constructed to alleviate needs, such non-take-up of benefits can be problematic, either because some of those who society considers in need of a particular type of benefit go without it, or because society has defined someone to be in need of benefits when in fact they are not. Thus, either benefits fail to reach the needy or those who are targeted do not need the benefits. The appropriate policy response depends, of course, on which of these is true.

Research on the non-take-up of social benefits is an important way to gain insights into the reasons for non-take-up (Duclos, 1995, 1997). It is very a difficult research area, not least because the information that is available to the researcher about the relevant circumstances of those persons and households who may or may not be eligible for particular types of benefits can be quite different then the characteristics that *actually* determine benefit entitlement. To mention an important example, the income test in many benefits can take into account very short-term changes in circumstances, such a a brief and temporary decline in income. Since researchers typically have access to income aggregated across a longer period – usually a calendar year – a person who has quite legitimately received a benefit may to the researcher seem ineligible.

The data problems are quite substantial. Researchers will never know all the information needed to decide whether a particular person is eligible for a benefit, even presented with data gathered as part of the administrative process to determine eligibility. The reason is that it is likely that many of those who are eligible never apply for the benefit in the first place, so survey information must be used instead of the administrative information. This means that research on non-take-up must squarely face the problem that there may be substantial measurement and classification error involved in determining who are eligible for a benefit – a necessary step in defining the phenomenon of non-take-up.

Microsimulation models are an important tool for researching the budgetary and distributional consequences of changes to the rules that govern taxes and

income transfers. Here, too, non-take-up can be important. The budget consequences of increasing benefit levels or expanding entitlement criteria may be vastly overestimated if a substantial proportion of those who are entitled to a benefit do not use it. Thus, a better understanding of non-take-up of benefits, including the potential effects of measurement and classification errors, is useful for the future development of more accurate microsimulation models.

The purpose of this paper is to explore the issues involved in light of a particular transfer program in Finland, housing allowances. I am able to use information about economic resources that affect eligibility for housing allowances that have been gathered both from administrative registers and from interviews. This allows me to explore the extent of differences in interview and register sources and to examine numerical estimates based on simple statistical models of non-take-up.

The paper is structured as follows. In Section 2, I briefly review the main approaches to researching non-take-up, with an emphasis on recent advances in modelling in the presence of measurement error. Section 3 describes the benefit that I will examine, housing allowances in Finland. The dataset I use, along with the entitlement simulation, is discussed in Section 4 and Section 5 presents some descriptive and exploratory estimation results. Concluding comments and directions for future research are discussed in Section 6.

## **2 Models of non-take-up and measurement error**

The non-take-up of social transfers is a serious problem for the design of income transfer programs. If the proportion of persons who do not use transfers they are entitled to, this may be a sign that the transfer scheme is badly designed. Modelling take-up behaviour is an important element in trying to estimate the extent to which non-take-up occurs and to identify which groups may be affected. Of course, knowing the statistical properties of non-take-up behaviour does not necessarily point toward better – meaning one with less non-take-up – transfer scheme design.

However, since the non-take-up of transfer may be widespread, methods that are used to model the consequences of changes to transfer programs, in this case, static microsimulation models, can be seriously misleading unless non-take-up

behavior is taken into account. How exactly this is done can be quite tricky, as we shall soon see. However, doing something may be quite a lot better than doing nothing.

Following Hernandez & Pudney (2006), who further develop the approach of Duclos (1995), the structure of the take-up problem can be described as follows. Let the true benefit entitlement of a unit be denoted by  $B^*$ , whereas the program administrator observes

$$B_g = B^* + \epsilon_g, \quad (1)$$

where  $\epsilon_g$  captures errors in the administrators determination of entitlement, such as administrative and assessment errors or possibly fraudulent behaviour by the claimants. Ruling out negative benefits,  $B_g \geq 0$  and  $B^* > 0$ . I shall in what follows ignore the distinction between true benefit entitlement and that determined by the program administrator and focus on the problem faced by the take-up analyst in trying to determine how many of those with  $B_g > 0$  nonetheless do not receive the benefit.

A take-up analyst will almost invariably have less information than the program administrator, so will simulate an entitlement  $B_a$  based, most often, on household survey information to be

$$B_a = B_g + \epsilon_a. \quad (2)$$

The analyst's assessment error  $\epsilon_a$  arises for a variety of reasons, discussed in detail below in the case of housing allowances in Finland in light of the data available in the European Community Household Panel data that I use.

The receipt and non-receipt of the benefit is denoted as  $R = 1$  and  $R = 0$  and the set household characteristics that affect the likelihood of take-up is  $X$ . The take-up probability, conditional on the administrator's eligibility determination and  $X$  is

$$\Pr(R = 1|X, B_g) = p(X, B_g). \quad (3)$$

When the analyst's measurement is imperfect, i.e., the variance of  $\epsilon_a$  is greater than zero, the analyst can not observe  $p(B_g, X)$  directly but must use some method to use  $B_a$  to get rid of the errors  $\epsilon_a$ . The solution that Hernandez & Pudney (2006)

point to is to formulate the likelihood

$$\Pr(R = 1, B_a|X) = \int_{B_g} p(X, B_g) f(B_a|B_g) dF(B_g|X), \quad (4)$$

where  $f(B_a|B_g)$  is the conditional density of the analyst's assessment of entitlement  $B_a$ , given the administrator assessment  $B_g$  and  $F(B_g|X)$  is the distribution of the administrator's entitlement assessment, conditional on the characteristics  $X$ .

Clearly, these conditional distribution functions will depend on the exact details of the benefits being modelled. Moreover, estimation of the parameters in such a complex likelihood function that is based on latent variables, or underlying "true" variables being measured by "indicators" that contain measurement errors, require careful consideration of whether the parameters can be identified from the data. Apart from identification stemming from functional form, we will in general need repeated measurements of the underlying true variables to be able to identify such models.

We should finally note that it might be tempting to apply a simple errors-in-variables strategy to a combination of equations 3 and 2. The simple alternatives usually rely on equation 2 being "classical", i.e., that  $\epsilon_a$  be a random normal variate conditional on  $B_g$ . Since benefit entitlement is a complex non-linear function of the information provided to the administrator, such as the unit's various income sources and assets, as well as in this case housing costs, the measurement model is unlikely to be classical. Even if it were, the statistical model 3 is non-linear in the parameters so simple methods would not be very helpful.

One interesting option might be to take the route pointed out by Gustafson (2003), which is to use Bayesian approach to estimation of the parameters. As the major step here is to specify the likelihood function for the data (rather than the estimation as such), that may or may not be helpful. In the remainder of the paper, I describe the program to be examined, housing allowances in Finland, describe the data that I have access to and present some descriptive statistics as well as some exploratory analysis to characterise the differences in estimation techniques even if I do not, yet, estimate more rigorously the underlying take-up rate that would result from estimation of the parameters in 4.

### **3 Housing allowances in Finland**

Housing allowances are an important income transfer program in Finland. Unlike many large income transfer schemes, it is targeted at low income households. Thus, the overall amount paid are quite small in comparison with several other programs. In 2002, housing allowances accounted 1.1 percent of overall social spending, which, since social spending was 26.4 percent of GDP, means this transfer program was 0.29 percent of GDP (Statistics Finland, 2005). Further, about 160,000 households, or 11 percent of all households, received housing allowances in that year. There are three different housing allowance programs, one for the elderly, one for students and one for all others. It is this last program, known as general housing allowances, that I study.

Housing allowances are administered through the Social Insurance Institution of Finland (KELA). Eligibility for it, and payments, are done on a monthly basis. Housing allowances can be given both to those who rent their dwelling and to those who own it. The rules that determine entitlement are quite complex. Entitlement depends on a large number of variables, such as the geographic location of the household, the monthly rent and other housing costs (for renters) or mortgage interest payments and other costs (owner occupiers), household size and the size (in square meters) of the dwelling. A lone-parent household, or one with member with physical handicaps, get more lenient treatment on the income tests.

In 1995, the year for which this paper will be looking at benefit entitlement, the wealth of the household affected entitlement in that if household wealth, excluding the value of the owner-occupied dwelling, was above a cut-off (the size of which depends on household size), housing allowances would not be paid. The allowance is calculated to cover acceptable housing costs less an own risk. Housing costs are capped (for acceptability) both in terms of how large a dwelling a household is entitled to and how high the associate housing costs can be. Eighty percent of the difference between the acceptable housing cost is subtracted from an “own risk” amount, which in turn depends on monthly income. Finally, the housing allowance must be above a minimum amount – about 17 euros in 1995 – to be paid out at all.

In modelling entitlement, it is important to bear in mind some limitations that

are imposed by the structure of the data to be used. Probably most importantly, since housing allowances are a monthly program, the income and asset tests are applied, in principle, on a month-by-month basis. My income data, however, are annual. Substantial variation within the year will be hard to detect. Annual income, converted to a monthly amount, may be large enough to rule out eligibility, even if the household was entitled to an allowance during some months of the year. For instance, a household with a severe income shortfall caused by the job loss of a main breadwinner who becomes re-employed after some while may appear to fail the income test based income aggregated across the year, even if they were eligible during the months of unemployment the unit did receive the allowance.

In the absence of the monthly incomes of all household members, it is not possible to simulate benefit entitlement exactly. However, it may be possible to treat the variability of income within the year as a source of measurement error in determining entitlement.

Other determinants of entitlement may also be measured by the researcher with error relative to the point in time at which entitlement is determined. Household size and structure may change within the year, the household may have moved to another dwelling after having received housing allowance but before being observed in the survey and so on. However, it would appear to be reasonable to assume that the greatest source of within-year variability and therefore measurement error is within-year variation in income.

Note, also, that while such within-year variability will be impossible to completely control for, it is possible that it can be captured in part by observable characteristics. Many sources of income variability can in principle, and even in practise, be observed. For instance, income losses driven by job losses can in the ECHP data that underlie the analysis be observed.<sup>1</sup>

Using information contained in a static microsimulation model (JUTTA), written by Pertti Honkanen at the National Social Insurance Institute, I have been able to model entitlement. Figure 1, for instance, shows the housing allowance that a family of four who rent at 500 euros per month a 70 square meter apartment in Helsinki would receive based on their market income. A household is entitled to the full cost (rent, plus assumed other housing costs of 100 euros a month less self

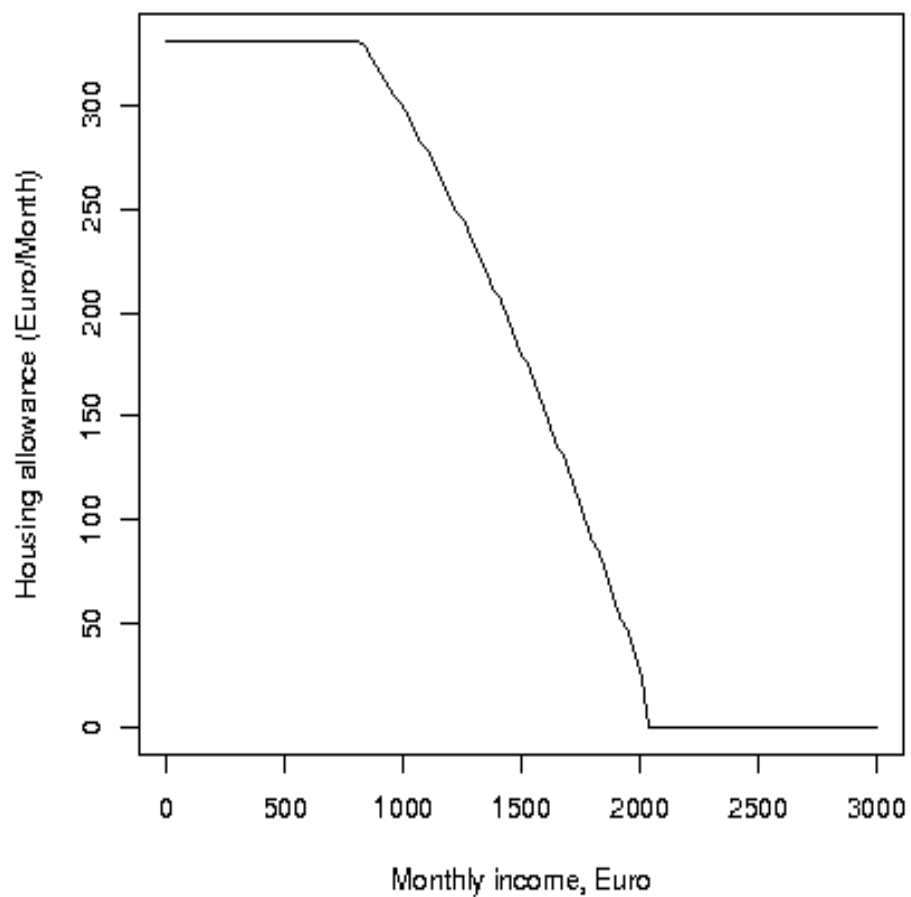
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<sup>1</sup>These considerations are not dealt with in this version, however.

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**Figure 1** Housing allowances as a function of monthly wage income – family of four, renter (500 FIM/mo) in 70 sq.m.

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Source: Author's simulation of the general housing allowance in Finland 1995.

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risk) until about 1000 euros of private income per month. The housing allowance then drops quite rapidly until at just around 2000 euros/month it drops to zero. I use this code to generate in the data for each household the sum of housing allowance they would be eligible for. Thus, I next turn to describe the empirical data that I use.

## 4 Data

The data for this paper are drawn from the Finnish part of European Community Household Panel (ECHP). Finland joined the ECHP in Wave 3, conducted in 1996 and referring to the income year of 1995. The Finnish ECHP data consisted of the first-year panel of the 1995 Income Distribution Survey (IDS; which has a rotating half-panel design). In that wave of the ECHP, as well as in Wave 7 (with income year being 2000), the Finnish ECHP collected information on all income sources from both interviews, as do other ECHP countries, and from registers, as is typically done in Finland.

Statistics Finland originally provided data for a EU-funded project, CHINTEX, which was aimed at examining the quality of ECHP data.<sup>2</sup> An important element in that examination was the study of interview income errors in light of register data. I make use of both interview responses and register information on housing allowances (to examine false non-take-up) and of interview and register incomes in the income sources that determine entitlement for housing allowances. My unit of analysis is the household – the household also being the unit that is or is not entitled to housing allowances – so I aggregate all income information within the ECHP households. The individual characteristics are taken to be those of the household reference person, who is typically the main earner in the household.

The IDS and most other Finnish datasets with information on labour market, demographic and income variables draw extensively on various administrative registers to collect income data. Components of factor income, for instance, are mostly drawn from tax registers. Information about receipt of income transfers is drawn from the government agencies that administer each program. Housing

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<sup>2</sup>Ehling & Rendtel (2004) is the final report of the CHINTEX project.

**Table 1** Housing allowance receipt in interviews and registers – ECHP data for 1995

Housing allowance	Interview=0	Interview>0
Register=0	3655	162
Register>0	189	262

Source: Author's calculations from CHINTEX data for ECHP-FIN 1995.

allowances are administered by the Social Insurance Institution. The IDS contains information on the annual amount of housing allowances received by every household member along with the number of months during which these were received.

Since the register information on housing allowances stems directly from the agency which pays it out, the information on transfer receipt from registers should be accurate. Aside from the issue of the potential within-year variability of the incomes that are included in the income test for housing allowances, discussed above, the income that affects entitlement for housing allowances is defined in the same way as income for taxation purposes. Thus, while it is plausible to argue that both interview and register income are error-ridden measures of the “true” income available to a person, the register income is the income which is used in assessing entitlement for housing allowances. Thus, abstracting from within-year variation, register incomes can be treated as being accurate for the purposes of determining entitlement.

Housing allowances also depend on wealth. The variable that is available to me, taxable wealth, is a substantially downward-biased estimate of household wealth. The main source of this downward bias, however, is that dwellings are valued at a tiny fraction of their true market value and are included only if their tax value is greater than a substantial lower limit. Since an owner-occupied dwelling is not included in the wealth test for housing allowances, this is unlikely to be a big issue here.

Table 1 cross-tabulates whether or not a household unit is deemed to have received housing allowances based on interview or register sources. Conditioning on the register information, we can note that 4 percent [ $189/(189+3713)$ ] of those for whom the registers suggest no benefit was received report having received it

**Table 2** Mean market income by decile group of disposable income – interview and register information

Decile gr of dpi	Interview	Register	Difference
1	3.9	3.6	6.0
2	6.5	5.9	9.3
3	8.3	8.3	0.0
4	9.8	10.0	-2.2
5	12.2	12.3	-0.5
6	14.5	14.8	-1.9
7	16.6	17.8	-7.1
8	19.5	21.2	-8.4
9	23.7	25.8	-8.4
10	34.0	41.8	-20.7

Source: Author's calculations from CHINTEX data for ECHP-FIN 1995.

all the same. Similarly, of those who did, according to the register information, receive allowances during the year, 42 percent [189/(189+262)] did not in the interview report having received any housing allowances. The marginal rates for register and interview incomes, 11 and 10 percent, respectively, are reasonable close. Clearly, however, classification errors in the dependent variable (having positive benefits) is an issue, in particular, but not necessarily only, for the interview information.

The measurement errors involved in market incomes were studied extensively in the CHINTEX project. Following the presentation in Ehling & Rendtel (2004, Table 5, p 70), I show the difference in mean market income by decile grouped of register disposable income. While the magnitude of the relative errors, unsurprisingly, is greatest in the tails of the distribution, the point here is to demonstrate that which source we use is very likely to have a substantial effect of the benefit entitlement. In particular, many of those whose register-based market income is very low and who are therefore quite likely to be, in fact, entitled, will report substantially higher market incomes in the interviews and will therefore be erroneously considered not to be entitled.

Table 3 shows the simulated benefit entitlement cross-tabulated against receipt of housing allowance, both based on either register information on both the deter-

**Table 3** Housing allowance entitlement and receipt – crosstables based on register and interview sources

A. Register incomes and housing allowances		
HA entitlement	Housing allowance	
	Register=0	Register>0
Entitlement (reg)=0	3713	239
Entitlement (reg)>0	104	212
B. Interview incomes and housing allowances		
HA entitlement	Housing allowance	
	Interview=0	Interview>0
Entitlement (int)=0	3693	209
Entitlement (int)>0	151	215

Source: Author's calculations from CHINTEX data for ECHP-FIN 1995.

minants of benefit entitlement and receipt of the allowance (Panel A) and interview information (Panel B). Of those who are simulated to have a positive benefit entitlement, 67 percent  $[212/(104+212)]$  based on register information and 59 percent  $[215/(151+215)]$  also report receiving it.

However, the simulated entitlement appear to generate plenty of errors. Using register information, of 53 percent  $[239/(239+212)]$  households report having received benefits even if their simulated entitlement is zero, while using the interview information,  $209/(209+215)$  or 49 percent are likewise simulated not to be entitled to a benefit but report receiving it all the same. It is not easy to know how to treat these cases. Some may be due to changes in household circumstances within the year. For instance, household structure may have changed for some cases within the year such that the household in place at the time of the interview was not the unit within which some current member received allowances. Also, there may be some misreporting involved in the interview housing allowances. All the same, the cases with zero simulated entitlement but positive allowances are suspiciously frequent.

## 5 Estimation results

In this section, I show results from estimating quite simple regressions that relate the receipt of housing allowances to entitlement, using varying specifications and input into the determination of entitlement.

In Table 4, I report estimation results of probit regressions of receipt of housing allowances as a function of entitlement only. There are four regressions using using register and interview information on both housing allowance receipt and benefit entitlement for two different samples with a slight variations in the functional form. Panel A shows results for the full sample, including those who are ineligible for the benefit, while Panel B shows the same specification – with the entitlement amount entering linearly – for only those with positive benefit entitlement. Panel C shows for those with positive entitlement the more usual functional form of including the natural logarithm of the entitlement amount. Each column represents a different combination of register/interview housing allowance receipt being regressed on entitlement based on register/interview information to determine the amount of housing allowance entitlement.

Starting with Panel A, we see that when all households are included, entitlement matters a great deal for the receipt of housing allowances. The estimated coefficients are largest when regressing register housing allowance receipt on register benefit entitlement. As one might expect (based, loosely, on classical measurement error models), when we use interview entitlement, the magnitude of the coefficients shrinks substantially. The coefficient estimates are statistically significant by a wide margin.

The more interesting cases are shown in Panels B and C. Focusing on the log-specification in Panel C, we see that the results vary substantially depending on the combination of interview/register information on either housing allowance receipt and entitlement. For instance, when regressing register housing allowance receipt on register entitlement (column 1 in Panel C), the coefficient is positive and statistically significant. I show the plot of the partial effect of that model in Panel A of Figure 2, where we can clearly see that an increase in the amount of entitlement is associated with a substantial increase in the likelihood of receipt.

This contrasts the combination of interview receipt and entitlement, shown in

**Table 4** Take-up of housing allowances – probit regressions with entitlement based on register and interview incomes

A. All households				
	Reg. HA	Int. HA	Reg. HA	Int. HA
	5	6	7	8
HAEntitlement.int/1000	NA	NA	1.266 (0.074)	1.206 (0.072)
HAEntitlement.reg/1000	1.877 (0.111)	1.689 (0.102)	NA	NA
(Intercept)	-1.451 (0.029)	-1.479 (0.030)	-1.431 (0.029)	-1.463 (0.030)
n	4270	4270	4270	4270
k	2	2	2	2
Dispersion	1	1	1	1
AIC	2.39e+03	2.33e+03	2.51e+03	2.43e+03

B. Eligible households (linear)				
	Reg. HA	Int HA	Reg. HA	Int HA
	1	2	3	4
HAEntitlement.int/1000	NA	NA	-0.067 (0.109)	-0.306 (0.110)
HAEntitlement.reg/1000	0.300 (0.138)	-0.151 (0.131)	NA	NA
(Intercept)	0.218 (0.125)	0.604 (0.127)	0.280 (0.117)	0.493 (0.119)
n	318	318	368	368
k	2	2	2	2
Dispersion	1	1	1	1
AIC	399	396	500	492

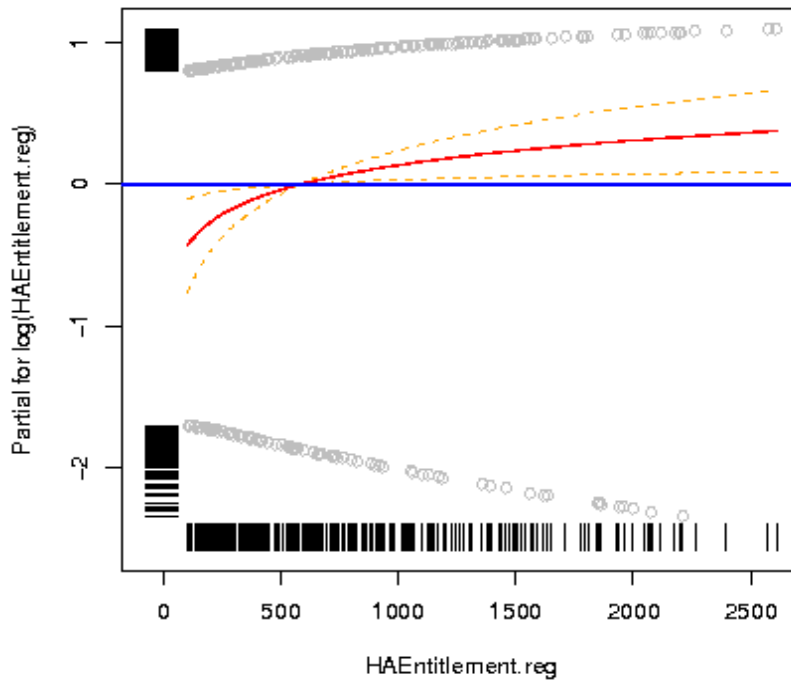
  

C. Eligible households (log)				
	Reg. HA	Int HA	Reg. HA	Int HA
	1	2	3	4
(Intercept)	-1.151 (0.612)	1.054 (0.619)	-0.001 (0.554)	1.332 (0.563)
log(HAEntitlement.int)	NA	NA	0.034 (0.084)	-0.170 (0.086)
log(HAEntitlement.reg)	0.251 (0.096)	-0.089 (0.096)	NA	NA
n	318	318	368	368
k	2	2	2	2
Dispersion	1	1	1	1
AIC	397	396	500	496

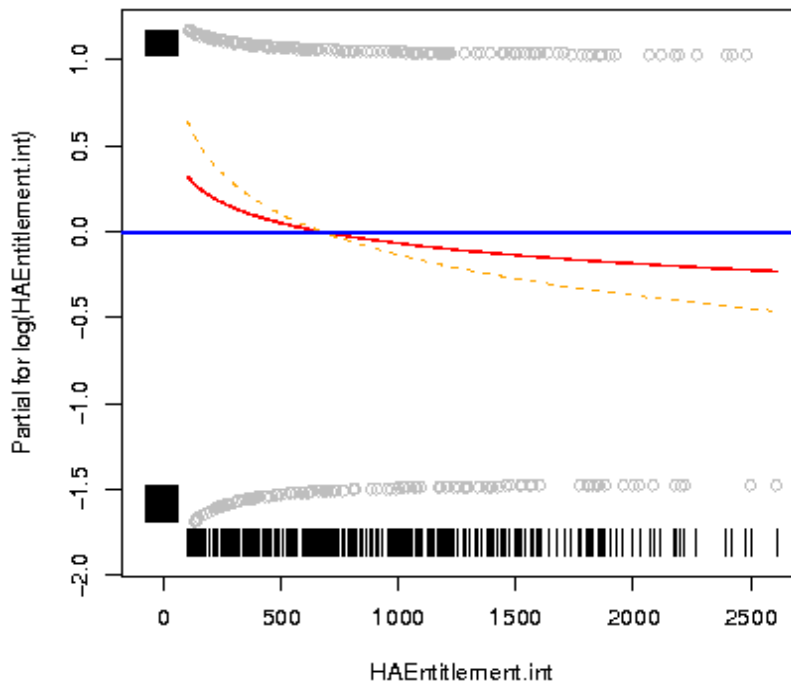
Source: Author's calculations from CHINTEX data for ECHP-FIN 1995.

**Figure 2** Effect of housing allowance entitlement on take-up – no additional controls

A. Register information



B. Interview information



Source:

Author's calculations from CHINTEX data for ECHP-FIN 1995.

Column 4 of Panel C, with the plot of the partial effect shown in Panel B of Figure 2. Now the effect of entitlement is statistically significant and negative. The “cross-combinations”, with the dependent variable and explanatory variable being based on difference sources (Columns 2 and 3) result in statistically insignificant coefficient estimates. Given that the point estimates can be seriously biased, these *t*-ratios should be viewed with substantial caution, however. Inspection of column 2 suggests that when housing allowance receipt is measured in interviews, the effect of entitlement is negative.

For illustration, I include also estimation results that add control variables, such as age (6 categories), household type (single person, lone parent, two parent, childless couple and other type of household) and the number of children. I estimate two sets of results, models that do not and do include market income, defined either through interview or through register income. The results are reported in Tables 5 and 6.

Adding the age and family structure controls, but not including market income (Table 5) results in the point estimates on entitlement being very small and nowhere near statistically significant. However, the point estimates based on interview entitlement are larger in absolute value than those based on (the probably more accurate) register benefit entitlement.

Once I control for market income (Table 6), this pattern is strengthened. Using register incomes to determine benefit entitlement and for market income (columns 1 and 2), *neither* entitlement *nor* market income appears to matter, in that point estimates are small and standard errors are large – even though we should bear in mind that these models are known to be bad and therefore we should not over interpret the standard errors. When we move to entitlement and market income based on interviews, shown in columns 3 and 4, maybe somewhat surprisingly the coefficients on both entitlement and market income are positive and large relative to their estimated standard errors. This may be quite spurious, but the estimated coefficients and their associated standard errors are quite similar for both register and interview measurements of housing allowance receipt.

These exploratory regressions suggest that the modelling challenges to take into account measurement errors in benefit entitlement, the dependent variable and other characteristics, such as market income, will be quite substantial. The

**Table 5** Take-up of housing allowances – probit regressions with entitlement based on register and interview incomes with additional controls (only those with entitlement > 0; does not include market income)

	Reg. HA	Int. HA	Reg HA	Int HA
	5	6	7	8
Age21-30	-0.129 (0.363)	-0.823 (0.536)	-0.336 (0.344)	-0.412 (0.391)
Age31-40	-0.345 (0.403)	-1.559 (0.559)	-0.416 (0.368)	-0.860 (0.411)
Age41-50	-0.203 (0.397)	-1.356 (0.555)	-0.510 (0.372)	-0.762 (0.415)
Age51-60	-0.097 (0.447)	-0.515 (0.624)	-0.407 (0.417)	-0.439 (0.464)
Age61-100	-1.502 (0.686)	-1.248 (0.694)	-1.247 (0.570)	-0.781 (0.567)
children	0.008 (0.105)	0.046 (0.100)	0.080 (0.086)	0.104 (0.086)
(Intercept)	0.119 (0.854)	1.819 (0.927)	1.045 (0.729)	1.436 (0.755)
log(HAEntitlement.int)	NA	NA	-0.109 (0.106)	-0.064 (0.106)
log(HAEntitlement.reg)	0.010 (0.124)	-0.037 (0.122)	NA	NA
TypeChildless couple	0.514 (0.277)	-0.293 (0.283)	0.119 (0.240)	-0.717 (0.244)
TypeLone parent	1.368 (0.307)	0.558 (0.285)	0.986 (0.280)	0.390 (0.276)
TypeOthers	0.295 (0.402)	-0.142 (0.400)	-0.196 (0.334)	-0.891 (0.342)
TypeTwo parents	0.636 (0.287)	-0.148 (0.282)	0.192 (0.261)	-0.540 (0.263)
n	328	328	378	378
k	12	12	12	12
Dispersion	1	1	1	1
AIC	382	384	487	473

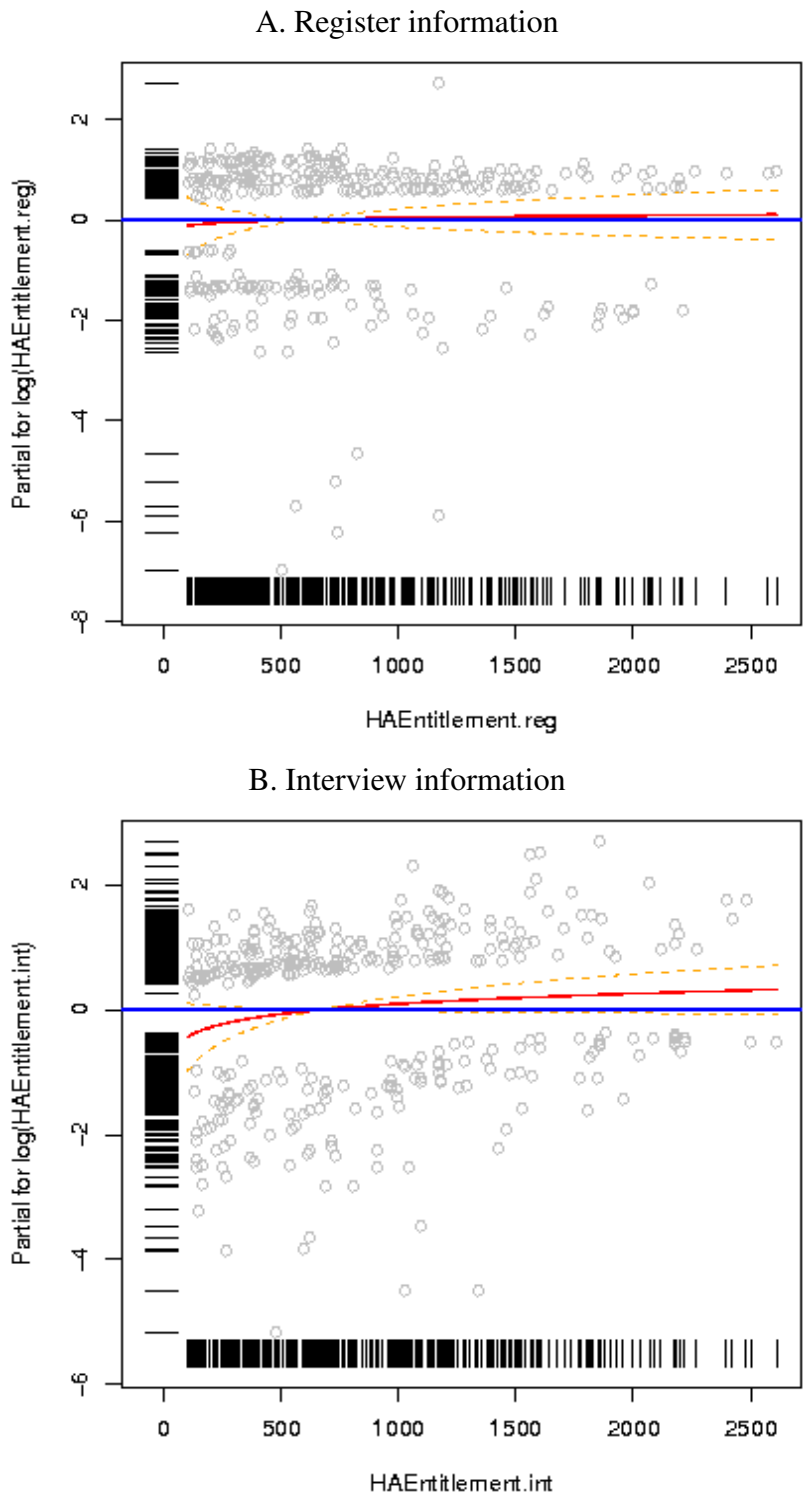
Source: Author's calculations from CHINTEX data for ECHP-FIN 1995.

**Table 6** Take-up of housing allowances – probit regressions with entitlement based on register and interview incomes with additional controls (only those with entitlement > 0; includes market income)

	Reg. HA	Int. HA	Reg HA	Int HA
	1	2	3	4
Age21-30	-0.125 (0.363)	-0.827 (0.536)	-0.308 (0.344)	-0.408 (0.394)
Age31-40	-0.363 (0.405)	-1.544 (0.561)	-0.468 (0.369)	-0.931 (0.415)
Age41-50	-0.205 (0.397)	-1.356 (0.555)	-0.553 (0.373)	-0.819 (0.418)
Age51-60	-0.094 (0.447)	-0.521 (0.624)	-0.412 (0.418)	-0.466 (0.466)
Age61-100	-1.490 (0.687)	-1.262 (0.695)	-1.133 (0.569)	-0.721 (0.570)
children	-0.019 (0.118)	0.073 (0.113)	-0.123 (0.101)	-0.051 (0.099)
(Intercept)	-0.290 (1.154)	2.213 (1.200)	-1.590 (0.977)	-0.579 (0.998)
log(HAEntitlement.int)	NA	NA	0.277 (0.142)	0.234 (0.143)
log(HAEntitlement.reg)	0.069 (0.166)	-0.093 (0.163)	NA	NA
MarketIncome.int	NA	NA	0.118 (0.029)	0.092 (0.029)
MarketIncome.reg	0.021 (0.042)	-0.020 (0.039)	NA	NA
TypeChildless couple	0.466 (0.293)	-0.246 (0.298)	-0.154 (0.251)	-0.939 (0.257)
TypeLone parent	1.261 (0.366)	0.664 (0.348)	0.414 (0.312)	-0.080 (0.310)
TypeOthers	0.122 (0.528)	0.024 (0.513)	-0.910 (0.383)	-1.460 (0.391)
TypeTwo parents	0.503 (0.389)	-0.022 (0.373)	-0.427 (0.307)	-1.041 (0.311)
n	329	329	379	379
k	13	13	13	13
Dispersion	1	1	1	1
AIC	384	386	472	465

Source: Author's calculations from CHINTEX data for ECHP-FIN 1995.

**Figure 3** Effect of housing allowance entitlement on take-up – additional controls (incl. market income)



Source:

Author's calculations from CHINTEX data for ECHP-FIN 1995.

challenge next is to develop further the techniques in Hernandez & Pudney (2006) to properly model the likelihood function, and utilize the repeated measurements of the variables that determine benefit entitlement as well as the repeated measurements of housing allowances receipt.

## **6 Concluding comments**

This paper has explored issues involved in analysing the non-take-up of social transfers, using data on housing allowances in Finland. The appropriate approach to non-take-up is to tackle head-on the issue of measurement errors, modelling the full likelihood of the observed data and using repeated measurements of the underlying true variables to identify the parameters that determine the likelihood. The transfer program under discussion, housing allowances in Finland, has benefit entitlements as being a complex non-linear function of the true resources, and true structure and housing costs, of a household. With access to both register and interview data from the Finnish ECHP, both of which can be considered error-ridden measures of underlying true data, it is in principle possible to estimate the true models.

Many problems remain, however. Even if it is possible to construct a true model along the lines of Hernandez & Pudney (2006), we would need to extend the problem to deal with the fact that there is a substantial discrepancy in the households that report they have received a housing allowance and those for whom registers suggest they have. We thus have a problem of multiple measurements of also benefit receipt, not only benefit entitlement. It would also be useful to use information that might allow a better identification of the measurement errors in the analyst's assessment of benefit entitlement, in particular covariates which might help identify which households are likely to have had substantial within-year variation in incomes. These extensions of the model in Hernandez & Pudney (2006) remain the topic of future work.

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