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## Quasi-Normative Approach to Housing Affordability

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## Abstract

The paper attempts to introduce a new approach to housing affordability analysis based on calculation of economic “quasi-normative” on rents in social (rent controlled) housing. Such “quasi-normative” is set on a level of average rent in social (rent controlled) housing that is connected with the lowest total public costs. The effectiveness of housing allowance is also evaluated in this context. Two case studies are analysed: Scotland and the Czech Republic. The extensive econometric simulations of public cost of alternative rent levels in those countries took into account not only the most relevant cost items but also the side effects of housing allowances and general housing policy changes. Behavioural aspects of higher/lower rents, such as tenure choice and employment status change, were also added. The results show that while there was no rational space for further rent increase in Scottish social housing in 1996, the rents in the Czech municipal rent-controlled housing “should” have increased by about 70% in 2001.

## Keywords

Housing affordability, housing policy, social housing, simulation modelling.

## Introduction

The affordability of rental housing has become a common way of summarising the nature of the housing problem in many market-based housing systems. During the 1980s the term “housing affordability” became very popular among policy makers and during the 1990s the growing number of housing researchers were engaged into the study of this concept and its methodology, mostly in a very critical way (Bramley 1994, 1991, Hallet 1993, Hancock 1993, Stone 1990, Whitehead 1991, Hulchanski 1995, Hills et al 1990, Freeman et al 1997, Linneman and Melbolugbe 1992, Maclennan and Williams 1990).

There are two main types of affordability measure for rental housing: the rent to income ratio and the residual income measure. The first varies according to whether gross or net income is used, whether gross rent or rent net of housing allowance is used and whether utilities or charges are included in the rent.<sup>1</sup> The latter type is calculated as net income, less the rent, less a minimum income amount laid out in the country’s welfare system (Income Support in Great Britain). The net rent to net income ratio is generally used as the appropriate tool for the international comparisons because it shows the real share of household income spent on housing costs. However, in the UK environment (with specific UK housing allowance model) it identifies the peak ratios at the income level where tenants cease to be dependent on housing benefit. That is why “this approach can be misleading, in that peak ratios do not identify those tenants that literally have the greatest affordability problems.” (Housing Corporation 2001).

Contrary to the European continental models of housing allowances, UK housing benefit covers the full rent of the lowest income household (their net rent to income ratios are thus zero) while, based on household income growth, the amount of allowance is sharply withdrawn with each earned pound above the level of income support (Ghekiere 1996). This may be the reason why residual income measure is more used in UK than in other European countries where net rent to income ratio still remains the main indicator on financial affordability in the sector of rental housing.

According to Hulchanski (1995), both measures are used in six possible ways: description, analysis, administration of subsidies, definition of housing need, prediction of the ability to pay the rent or mortgage and selection criteria. The first three could be considered as “quite valid” (p.475), the rest are all invalid uses. Though using the rent to income ratio for administration of subsidies helps to target housing subsidy to lower income households (and it is quite valid), “the decision as to where to draw the line, that is, what specific definition of eligibility is to be used for a subsidy programme, is a subjective judgement. It cannot be based on an objective scientific determination”. (p.477). Many other housing scientists agree with Hulchanski by making the distinction between actual affordability (what tenants pay) and *normative affordability* (what tenants should pay) (Hancock 1993, Oxley and Smith 1996). “There is much criticism of the use of affordability measures for these normative purposes.” (Freeman et al 1997, 22). According to them, social science cannot offer the answer to the question “What should tenants pay?”. In developed market economies of 1990s with traditional emphasis on individual freedom, this fact would not induce drastic state intervention for greater affordability that would change completely the structure

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<sup>1</sup> The formulae used were: ratio = dwelling rent/net income; ratio = (dwelling rent - housing allowance)/net income; ratio = dwelling rent/(net income + housing allowance); ratio = dwelling rent/gross income; ratio = (dwelling rent - housing allowance)/gross income.

and functioning of housing market. The situation is quite different in transitional countries of Central and Eastern Europe. Many countries applied right-to-buy policy on former state housing but some of them (Czech Republic, Poland) decided to decentralise the decision on housing privatisation to local authorities and this led to much lower speed of privatisation. In those countries the rental housing remained a significant tenure by its share on country total housing stock but a sharp decrease in state subsidies and maintenance of non-targeted “first generation” rent control brought many additional problems (Lux 2000, 2002, 2003; Lowe and Tsenkova 2003).

In the Czech Republic, for example, the state refused to subsidise new housing construction but decided to maintain strong tenant protection and rent control in the overwhelming majority of municipal and private (restituted) rental flats. Since 1994, a market rent was allowed only for new tenancies (vacant or new flats). The low level of controlled rents caused the doors for newly formed households looking for affordable rental housing to be closed. Also, the scale of black market rental contracts grew rapidly. A new type of social injustice has appeared because of segmentation of households according to their housing conditions into two groups: those living in the privileged housing tenure (home-ownership obtained during the previous regime, rental housing with low controlled rents) and those living in unprotected tenure (home-ownership acquired for market prices or “market” rental housing).

Rent control is not well targeted according to household income and flats with controlled rents are occupied by similar share of households from all income deciles. This means that about 10% of the highest income households in the Czech Republic according to net household income distribution used the advantage of controlled rents (Lux et al 2003). Though average rent to income ratio was only about 6–7% in rent-controlled sector in 2002, social science cannot answer the question if it is too much or too low. The goal of this project is, however, to attempt to simulate indirect economic normative on rent settings in social (rent-controlled) housing and via that also on rent-to-income ratio for households living in social (rent-controlled) housing.

The housing affordability problems of lower income households are solved through supply and demand side subsidies in European Union member states. Supply side subsidies (called also *bricks and mortar subsidies*) are represented mostly by social rental housing<sup>2</sup>; the demand side subsidies by different housing allowance models. The shift to demand side subsidies during the 1990s was driven by the need to cut government spending and reshape housing allowance not only as an important housing policy tool but also as the basic instrument to assure financial affordability of rental housing.

Let us define the percentage value of increase or decrease in public (both state and municipal) expenditures as relative public costs. The simulations in this paper are based on measurement of relative public costs for alternative rent settings in social (rent controlled) housing when actual housing allowance model would be assumed to be providing effective assistance to those in need (if it is confirmed).

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<sup>2</sup> Although there is no common housing policy of the EU all the EU member states (with the only exception of Greece) have a social rental housing sector varying between 1% (Spain) and 37% (The Netherlands) of the total housing stock. The sector is non-profitable, it can be public and it is designed mainly for population with lower incomes that could not afford to get housing on the free market. The construction is financially supported by the public authorities (besides The Netherlands); rents in social housing flats are somewhat lower than on market; the allocation of flat depends on fulfilment of certain social criteria (besides Sweden), e.g. income ceiling. In recent years, responsibility for housing policy has been developed to regional or municipal government in several European countries, as central governments have either reduced their responsibility for, or even withdrawn from, this area of social policy (Stephens and Goodlad 1999, Walker 1998).

As can be seen from the preceding paragraph, this methodological approach does not want in any way to compensate for subjective normative judgement of financial affordability of housing in context of other necessary consumption of needy households (traditional normative affordability approach). For the purpose of this study we will, however, assume that welfare safety network based on evaluation of need and consumption prices is incorporated in existing model of housing allowance. The meaning of this means-tested benefit is to help those with insufficient income to cover the housing costs. Such help is based on actual (or expected) housing costs, household income and sometimes household structure. Drawing main eligible lines for housing allowance cannot be provided by more objective scientific tools as it is very much dependent on subjective perception of the role of welfare state and wealth redistribution.

We can only measure economic consequences of side effects of particular allowance model (see below) and test its effectiveness by answering two simple questions: is housing allowance a means-tested allowance modelled in such a way that it helps more lower income households than higher income households (and not the opposite) and, is it set in such a way that even substantial changes in rent prices would not decrease the financial affordability of rental housing for those in need (basically those households who already receive an allowance)? If we are able to answer both question positively then we can assume that an allowance provides a good safety network for those who need help (low income tenants) from social (rent controlled) rental housing.

However, when putting this as an assumption, we can start a discussion on levels of rents in social (rent controlled) housing and we can pursue it by looking at relative public costs for alternative rent levels. It is well known that rent increase in social (rent controlled) housing does not have to be connected only with public savings. Our hypothesis is that there is such break-point from which further rent increase in social (rent controlled) housing would produce higher public costs. This may be caused by side effects of particular housing allowance models that have to be also measured, though assuming that allowance model is optimal with respect to the help those who need assistance.

We take the level of average rent price with the lowest public costs as economic quasi-normative on rents in social (rent-controlled) housing. This is because the benefit system is supposed to provide effective help with housing costs to those who need it (there is no justification for additional public spending) and econometric cost-benefit analysis counted not only with the most relevant public cost/benefit items but also with side effects of benefit systems itself.<sup>3</sup> The “quasi-normative” on average “optimal” rent may be then used to set a “quasi-normative” on average rent to income ratio in social (rent controlled) housing sector.<sup>4</sup>

The relationship between social rents and public costs has been already surveyed by some UK researchers (Wilcox and Meen 1995; Holmans and Whitehead 1997) paying attention to the danger of overshooting in rent price increases. This shows that the quasi-normative approach is not in any sense limited to special interest of transitional economies and can be applied in those Western European countries having still

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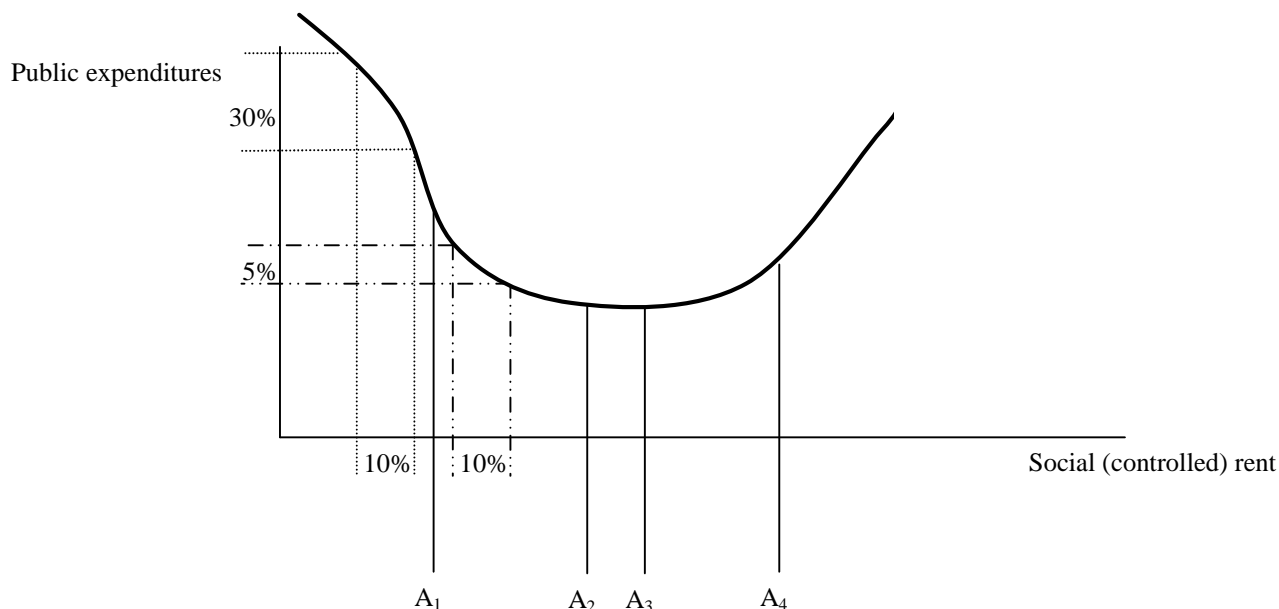
<sup>3</sup> Obviously, there are costs that can hardly be measured because of lack of any data. To simulate consequences of rent increase/decrease we need to put also several assumptions that may be biased. Therefore it is necessary to bear in mind that there are some methodological constraints when making final conclusions.

<sup>4</sup> The average itself has often no practical meaning as there are different households with different incomes and rent to income ratios living in social (rent controlled) housing. However, if simulations are conducted on representative data sets this can produce much more detailed set of “normatives” for each social, professional or income group of households. In this article we use rough averages just because the intention is only to describe the potentials of the quasi-normative approach.

significant social housing stock (France, Sweden, The Netherlands, UK). In this study we used Scotland (1996) and the Czech Republic (2001) as case studies to show how this approach can contribute to the discussion on rent and affordability policies both in existing and accession European Union countries. Both countries are comparable with regard to population and both have substantial social (rent controlled) housing sector: social housing constitutes 34% of housing stock in Scotland (Wilcox 2002) and rent controlled housing around 26% of housing stock in the Czech Republic (Lux 2002).

The main questions we would like to find answers for in this context are: What is the shape of the curve showing the relation between level of social (controlled) rents and public expenses in Scotland (Czech republic)? What are the differences between countries and are there any critical values of  $A_1, A_2, A_3, A_4$  (see Figure 1)?

Figure 1: Public Expenditures and Social (Controlled) Rents



The movement on the curve from the zero stage of simulation to the point  $A_1$  means significant public savings because marginal values of public saving increase. However, from the point  $A_1$  the marginal savings decrease, from the point  $A_2$  the rent increase does not produce any public saving at all and from the point  $A_3$  is the rent increase connected even with absolute public cost increase.

As we mentioned earlier, we will not question eligibility ceilings of particular housing allowances though we will try to measure all side effects that may be significant from the point of view of public costs computation. It may be assumed that if we plot relative public costs for two different housing allowance models, one more generous than the other, then the curve for more generous benefit system will be placed more to the left from the curve for less generous benefit system. In other words, the more the generous the benefit system is then the lower the space for “rational” rent increase in social (rent controlled) housing is, because every rent increase would produce higher relative public costs (this will be confirmed by our analysis). However, we are not able to discuss the welfare normative of benefit system as it is beyond the scope of “objective” scientific discourse.

Before we will take a current real housing allowance model in selected countries as effective enough to help those who need assistance we will, however, look at the particular model and test whether it helps more lower income than higher income households, and also whether the increase in rents is fully compensated by an allowance for those in need (those already receiving an allowance). The UK housing allowance model is computed according to the following equation (Gibb et al 1999):

$$\text{housing allowance} = R - t(Y - A)$$

where  $R$  is real gross rent,  $Y$  household net income,  $A$  an applicable amount (equal generally to income support) and  $t$  is taper having value of 0.65. If a household is in a receipt of income support (living minimum) then full actual rent is paid by housing allowance. It is supposed that the household will cover its rent by £0.65 from each £1 of household income above the level of income support. This means that allowance is strictly targeted to lower income households. Moreover, every rent increase is for households in receipt of housing allowance fully compensated by an increase in the amount of allowance if everything else (household income) remains constant. We can therefore assume that the allowance provides effective help to those in need.

The amount of housing allowance in the Czech Republic is computed only with respect to household income and real housing costs are not included there. The Czech model uses only the tariff costs and the amount of allowance is calculated according to the following equation:

$$\text{housing allowance} = \text{household costs} - \frac{\text{household costs} * \text{net household income}}{\text{subsistence minimum} * 1.6}$$

Household costs are set in fixed value on the level of the minimum amount to cover housing expenditures. The subsistence minimum (and indeed household costs too) varies according to the size of household. To test the effectiveness of the model we need to rewrite a model into a more formal style:

$$\text{housing allowance} = NC [(MI - RI) / MI]$$

where  $NC$  are normative costs,  $RI$  is real income,  $MI$  is maximum income (equal to 1.6 multiply of subsistence minimum). When real income is equal to maximum income, allowance is zero, when real income is zero, allowance is equal to normative costs. As may be seen from the equation, the taper for those eligible for benefit is 10% (one crown increase in real income is connected with 0.1 crown decrease in an allowance).

It is clear that the Czech housing allowance is a means-tested benefit providing help mainly to those with lower incomes and therefore one condition on effectiveness is fulfilled. However, as real costs are not included in the computation and tariffs reflect only the level of rent prices in 2001, the potential rent increase would be connected with decrease in financial affordability of those in receipt of housing benefit. We assumed therefore that tariffs used in the equation will be "uprated" proportionally to simulated rent increase in each stage of simulation which, we think, reflects the logic of the model itself.

However, although we indexed the normative housing costs to rent price increases, we did not change other important item in an equation: maximum income. If only housing cost tariff part increases in the same way as rents and maximum income remains constant then we assume that with each rent increase the household will pay a higher share of their own income on rent. In other words, rent increase is again not fully compensated by the benefit for those who receive it. Although we did not know how the State would fix the model when rent deregulation was introduced, we made the additional assumption that maximum eligible income is indexed in a same way as housing costs' tariffs and rent increase is fully compensated by benefit to those who



need it most (households in receipt of benefit). Only then are we able to assume that the model provides an effective help in case of rent increase to those who need it and use it for our simulations. By introducing these adjustments we made the Czech housing benefit more generous and therefore there will be less space for “rational” rent increase in rent controlled housing. However, it is obviously fairer than using a current flat tariff reflecting only particular rent levels in 2001.

It is now necessary to identify the main public cost items relevant in context of rent simulations in particular country housing conditions’ context. As we intend to measure relative public costs we select only such cost items that are changing with rent price change. We will count mainly with Housing Support Grants (revenue subsidies for municipal housing), capital grants for Scottish housing associations (capital subsidies for new social housing construction), housing benefit costs and Retail Price Index (RPI) costs in Scotland. RPI costs indicate the additional costs of uprating pensions and benefits when increase in rent prices is reflected in national Retail Price Index.

However, we will add some other cost items that have often been neglected: labour market costs/benefits (see below) and additional costs connected with residualisation of social housing. Among the latter, we include costs via voids of social landlords and management costs of dealing with neighbourhood nuisance. The costs of rent arrears will not be included, as it has been verified they are not dependent on level of rent price (More et al 2003, p. 88; Housing Corporation 1997, p.12). However, the specific UK housing benefit model is the reason why labour market benefits/costs were, on the opposite, included into the analysis. Using several data sets we will simulate move/stay and tenure choice decisions for alternative rent settings, housing benefit dependency, scale of new social housing construction, etc. Details are provided in methodological part of the paper.

In the context of the Czech relative public cost measurement we will monitor following public costs: fictitious revenue subsidies for municipal landlords, housing construction subsidies, housing benefit payments, RPI costs and costs via voids. The specific allowance model in the CR (gentle taper) allows to exclude labour market implications from analysis. Revenue subsidies are fictitious because there are no such subsidies in reality. However, their absence leads to other policy and market distortions with clear effects on public costs – but these effects can hardly be measured (for details please see methodological section).

The quasi-normative on average rent price level will be estimated on year basis (current year of simulation) thus assuming all other income and demographic variables during simulated rent increase/decrease stages being constant. We were not able to simulate the impact of higher/lower rents and RPI increase on wider economy (house prices, GDP, consumption, unemployment) as profound complex macro-economic model would be needed for such purpose.

The impact of rent increase on labour market incentives due to the specific UK housing allowance model with a relatively sharp taper has been the topic of many research studies in UK (Bradshaw and Millar 1991; Wilcox 1993a; Wilcox 1993b; Wilcox 1994; Ford and Wilcox 1994; Ford et al 1995; Kearns et al 1996; Kempson et al 1997; Wilcox and Sutherland 1997; Bingley and Walker 1998; Ford et al 1998; Pryce 1999 and others). It is not the purpose of this article to summarise all the findings but the main discussion is held whether or not the housing benefit system leads to poverty/unemployment trap. Though there are rational economic reasons that this may be the case (studies of Wilcox), analysis of empirical data has shown that such hypothesis does not hold for some types of households (Pryce 1999; Bingley and Walker 1998).

In other words, many unemployed/employed do not respond rationally to working incentives/disincentives made by benefit system because of high commitment to work among some of them (married or cohabiting men with children) or, on the other hand, low commitment to work among others (lone mothers) (Ford et al 1998, p.45; Kempson et al 1997, p.87). Both qualitative studies (most of which are cited here) and quantitative studies (Pryce 1999; Bingley and Walker 1998) have shown that the problem of unemployment and poverty trap is not straightforward. The unemployed generally do not make profound counting of their benefits' withdrawal in case they move into employment but they do estimate their reservation income (resp. reservation wage). A very common case is that reservation income is equal to the sum of housing costs and other necessary costs of households (food, clothes, etc.) because an unemployed person assumes to lose all benefits when taking a job (Ford et al 1995). However, as we mentioned previously, making such a calculation is far from universal for different households and, mainly, people often do not behave according to it because of different attitudes in their commitment to work.

Interesting also was the complex analysis of labour market reactions on rent prices when measuring cross-substitution and income effects of housing costs on work supply carried out by Bingley and Walker (1998). While the first effect reflects a change in trade-off between income and leisure time generated by housing cost growth, the income effect shows, for example, how housing cost growth can influence working incentives in a positive way by encouraging people to work harder. The increase in housing costs reduces real value of income and other household consumption and this is why people are supposed to be more committed to work.

The final conclusion of large scale empirical analysis on the merged *UK Family Expenditure Survey* data sets was that "when we allow for income effect we find that rising rents imply higher labour supply." (p.53). However, we can expect that income effect of rising housing costs may have an influence only on those who are economically active and who are not recipients of housing benefit (otherwise the whole rent rise is compensated by benefit). The majority of households in the Scottish social housing receive housing benefit. When we allow for tenure choice, which was not unfortunately incorporated in the mentioned study, we can also assume that many of those remaining minority households affected by rent growth would move out of the sector of social housing (if user costs of home-ownership start to be lower) instead of spending additional hours in the work.<sup>5</sup>

If we allow for tenure choice this would decrease also the significance of substitution effect in a similar way. It is also not clear from the study whether the data had been adjusted in a way to eliminate the factor that people with higher incomes live in dwellings with higher rents. The merging of files does not lead to the creation of panel data and therefore the authors could find a false relation between income and rents.

As the results of the study were not very convincing we relied more on the literature admitting some, though more complex, negative influence of rising housing costs on working incentives. However, the purpose of our analysis was not to create the best econometric model of labour market functioning in UK. Therefore we followed relatively clear and transparent way of setting "sensitivity probability" assumptions for different people living in different types of households based on main findings from both qualitative and quantitative empirical studies. The probability values vary from 0 to 1 and show how particular person (head of household or his/her spouse,

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<sup>5</sup> The income effect in its extreme expression is obvious non-sense as it would mean that the higher the housing costs are the more the people work.

partner) would, relatively to others, be sensitive to working incentives in context of changes in household housing costs.

In fact, the sensitivity probability indicates the probability for each particular person that two parallel processes will occur: firstly, making the estimation of reservation income (or “escaped” wage for those in employment) and, secondly, behaving rationally according to comparison of financial incomes of being in two employment statuses: full-time employment or unemployed. Part-time employment option has been due to the data restrictions omitted.

Reservation income of unemployed has been set at a level when full housing costs and income support payments are covered by working earnings (if household receives only partial housing benefit, then only this partial benefit was counted). “Escaped” wage has been counted as a wage when employed person would decide to leave his/her employment. More details are provided in the methodological part.

As all models trying to answer the question on “What would happen if?” even our approach has its own obvious limits. Definitely it is not the model that would precisely count the exact public costs of higher/lower rents as behaviour of people can significantly change under the new rent price circumstances. The logit models we used (especially for the Czech Republic case) were not always very robust. We often did not have all needed information in one data set. As we had to transfer the model equations from one data set to another one we could use only those variables that were in both sets thus making the model less reliable. Although we tried to include all relevant cost items, labour market reactions connected with estimation of wage rates for unemployed would be better simulated using *Family Account Survey* data but this would, on the opposite, not give us the best background for price estimates needed for tenure choice simulations.

It is therefore necessary to stress the fact that conclusion drawn in this paper may be perceived as useful benchmarks or framework on public housing policy in the social (rent-controlled) housing and definitely not as the precise forecast of the future processes.

The paper is divided into two further parts. In the Methodology section of this paper we will discuss the methodological approach of relative public costs measurement and provide the results of different linear and logit regression models used for this purpose. In the Conclusion and Discussion sections we will finally show the main findings and provide discussion on the influence of assumptions made during the analysis. We will also discuss the potential effect of some other public costs that could not have been incorporated in computation because of complete lack of reliable data.

## Methodology

### The Case of Scotland

The relative public cost model was simulated in combined *SPSS* and *Excel* software environments using the following data sets: the *Scottish House Condition Survey 1996* (UK Data Archive), housing performance indicators for local authorities in 1996 and 2001 (Scottish Executive) and housing performance indicators for housing associations in 1996 and 2001 (Scottish Homes). Performance indicators' data sets included a full or partial information on rent revenues, average rents per dwelling, costs via voids, number of re-lets, average time to re-let the property, management and maintenance costs, loan repayment costs, housing construction costs and grant rates for housing construction of housing associations or Housing Support Grant subsidies of municipalities for each Scottish social landlord. These data were collected especially under this project with the help of many representatives of responsible institutions and researchers from the Department of Urban Studies at the University of Glasgow.

The *Scottish House Condition Survey 1996* is the second national survey of house conditions in Scotland, commissioned by the Scottish Office. The aim of the survey is to describe both the physical condition of the occupied stock and socio-economic conditions and housing preferences of households in these dwellings. The total survey sample contains 18,158 respondents with whom the full interview was achieved. The sample was designed to yield a nationally representative sample of dwellings in Scotland. After exclusion of those living in private rental housing we obtained 16,844 respondents' sample that was used for our simulations.

The move/stay (tenure choice) and work/unemployment (work incentives) decisions as well as major means-tested benefits were computed on the *Scottish House Condition Survey 1996* data. Though benefits had been imputed already by researchers responsible for the survey, the imputation was rough and in many cases did not reflect the declared household earning. We prepared our own simple **tax-benefit model** relying on declared net earnings of head of household and his/her spouse. The tax-benefit model computes personal allowances, premiums, family credit, income support, housing benefit, gross earnings, taxes and national insurance contributions. Its creation allowed us to simulate changes in earnings and/or benefits when measuring the public costs of alternative rent settings. For the creation of tax-benefit model we used McKenny et al (1995) "*National Welfare Handbook 95/96*".

The computation of housing benefit by tax-benefit model allowed us to test a logistic model on **take-up of housing benefit** in Scotland. The eligibility for a benefit computed by the tax-benefit model has been compared with an actual receipt (households with imputed benefits were excluded). Annex A presents the results used for our further public costs' simulations: more than 80.6% of predicted cases were correct and the model explains almost 20.5% of variability of dependent variable (Nagelkerke  $R^2$ ). Among the most important factors influencing the take-up of benefit are family status (married couples have lower take-up than other marital statuses), number of dependent children, value of housing benefit (and its squared value), employment status of head of household and whether household is a single parent household or not. The take-up is higher among singles/divorced (especially single parents), among households with higher number of children and among those with sick or unemployed heads of households. Generally the take-up rate was relatively high (almost 80% of eligible households living in social housing). The special variable *ERREN* controlled the validity of data and indicated if rent was provided by the respondent or imputed by researchers. As the take-up has been measured in context with 1996 rent levels it may not be accurate to use it for substantially higher rent price

simulation and therefore we used low cut-off probability (0.3) to decrease its influence.<sup>6</sup>

For the purpose of tenure choice simulations the **prices of current social housing dwellings were estimated**. The prices of owner-occupied housing were recorded in the survey together with relatively extensive additional information on different housing attributes. The hedonic OLS regression on natural logarithm of 1990–1996 house prices (RTB purchases were firstly excluded) has been run correcting for sample selection bias in tenure by using Heckman’s two step method in STATA software. The results of the predictive model are in Annex B: adjusted  $R^2$  for OLS model is 0.53 while Nagelkerke  $R^2$  for corrected logistic model on tenure choice is 0.43, Heckman’s lambda is statistically significant. Next to dummy variables for years of purchase the equation includes ln of total floor area (the most significant variable), ln of number of rooms, ACORN classification of neighbourhoods, dummy variables for detached housing, urban location and existence of vacant spaces and vandalism in the neighbourhood. Although total floor area and number of rooms are correlated with each other, collinearity statistics has shown tolerance above 0.2 usually applied ceiling and VIF under 4 ceiling value.

For the same purpose the **potential “social” rents of current owner-occupied dwellings were estimated**. As estimated rents will be used only as referential points for tenure choice of home-owners and there is surely not the same variety of different types of dwelling in social housing sector as in owner-occupied sector (with respect to house and location attributes), the correction via Heckman’s lambda was not necessary (moving household will not often be able to find a social housing flat reflecting the same housing attributes as its current own housing). The results of OLS regression model on ln of weekly rent price in local authority housing (only when reported directly by respondents) are detailed in Annex B. As rent prices in municipal dwellings are explained more by social characteristics of household and do not reflect often in any way the property value of building the final hedonic model after several alterations remains relatively weak explaining only 14.8% of variability of weekly local authority rents (adjusted  $R^2$ ). If we run a regression model on ln of housing association rents we would be able to obtain higher robustness with adjusted  $R^2$  equal to almost 21%.<sup>7</sup> However, as local authority housing is more preferred for potential movement, we used estimation of local authority rents.<sup>8</sup>

For the purpose of working-unemployment choice simulations **the estimation of potential gross earnings** for those in unemployment and/or carrying for home has been processed. The natural logarithm of gross hourly wage rate of head of household (among them 1.200 women) was regressed in the same manner as house prices (using Heckman’s procedure) and the results are presented in Annex C. The corrective logistic model controlled for sample selection bias reflecting particularities of non-

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<sup>6</sup> Another reason is connected with several methodological problems when computing take-up in this manner. The notice of income and benefits is always very problematic in surveys that are not especially designed for such a purpose. During detailed data control we found out large number of mistakes (or not very clear information) even for those respondents that declared their earnings and benefit themselves.

<sup>7</sup> It is clear that both price and rent models (as well as a move/stay regression model presenting below) would receive higher  $R^2$  scores if we analyse more thoroughly different regional/area characteristics. However, it is probable that the more precise estimates would not change the main conclusions from relative user costs’ analysis counting with several cost items.

<sup>8</sup> There are some interesting outcomes from both regressions. It seems that the rents in housing associations’ dwellings constructed between 1965–1982 are higher than in younger dwellings and are especially higher when households are occupied by pensioners. From the model for local authority rents we can also see that if vandalism occur in the location, rents are higher than if it is not the case (the more logic opposite relation is valid only for housing association rents).

working population. The best OLS model explains only 24.5% of variability of dependent variable ( $R^2$ ) mainly due to the fact that the *Scottish House Condition Survey* does not record education of head of household and his/her spouse. Separate regression for women and men would not produce better results (mainly in the case of a model for men) and therefore we remained with the original model, including the sex dummy variable. Among the independent variables are mainly those that has shown to be influential in other labour market econometric simulations (Bingley and Walker 1998).

The gross hourly wage rate is mainly influenced by SEG of household (provided in the survey even for currently unemployed or caring for home), ACORN classification of neighbourhood of primal residence, dummy variable on type of working contract (full time) and sex of respondent. Other variables, such as the age of the head of the household (including its square value) and dummy variables on type of neighbourhood (urban) and existence of vandalism in the neighbourhood, remained also significant. The corrective logistic model on labour market status get Nagelkerke  $R^2$  equal to 35.8 and 78.7% of model predictions were correct. The logistic model included very similar set of variables used in basic prediction OLS model and dummy variables on having dependent children in different age brackets were only added.

For the purpose of more robust move/stay decision simulations **the long-term (permanent) income** has been computed using methodology of Ermisch, et al (1996) and Gibb and Mackay (2001) based on estimations from household characteristics. The OLS regression model on permanent income is in Appendix D. The ln of household income (only when given by respondent) was regressed on SEG of head of household (the most important factor), marital status of head of household, age and squared age of head of household, sex of head of household, number of dependent children and dummy variables on ethnicity of head of household, his/her employment status (employee) and whether either he/she was in long-term sickness. The adjusted  $R^2$  of the model is 0.45 meaning that model explains more than 45% of variability of dependent variable. Permanent household income is lower than actual income for household living in owner-occupied dwellings (by almost 25%) while it is higher for households in both municipal (by 7.5%) and housing association dwellings (by 5%).

Before presenting the move/stay decision logit model results we need to define user cost of capital and relative user cost of capital. Let us use the computation of user cost of capital ( $UC_0$ ) from Hsieh (2002) work on housing tenure choice in Scotland (based also on Gibb and Mackay 2001):

$$UC_0 = [(1-t) * i + d + a - g] * P^h$$

where  $t$  denotes a marginal tax rate of particular householder,  $i$  is the nominal mortgage interest rate,  $d$  is the depreciation rate,  $a$  is the property tax rate,  $g$  is the expected annual rate of nominal house price appreciation and  $P^h$  estimated market house price. The marginal tax rate was assumed to be zero<sup>9</sup> and  $a$  was dropped from the equation due to the data restrictions (Gibb and Mackay 2001, Hsieh 2002). The average nominal interest rate was 6.7%, the depreciation rate 1.2% and price appreciation (capital gain) was set at 3.7% annually (Hsieh 2002). House price nominal appreciation estimate is rough. However, there are many very different estimates made for capital gains of home-owners in Scotland<sup>10</sup> and the discussion on the best

<sup>9</sup> According to Gibb and Mackay (2001, p.13), the erosion of tax relief in the 1990s and its imminent withdrawal means that the flat tax relief owners receive on their mortgages will not impact on their UCC at the margin relative to the other arguments in the function.

<sup>10</sup> Gibb and Mackay (2001) calculated expected capital gain from a three period moving average time series and used estimate of 0.856%. Hendershott, Pryce and White (2003) by using Council of Mortgage Lenders

methodology of measurement is far from over (Di Pasquale and Wheaton 1994). Though more precise estimates would surely increase the reliability of simulations (if methodological discussion would offer reliable approach) there are good reasons to think that they would not change significantly the main conclusions on relative public cost measurement. When counting public expenses we can work only with middle values such as, for example, average housing benefit, and higher distribution in price appreciation rate around the average would not, therefore, significantly change the final average cost estimates.<sup>11</sup>

We will take rent net of housing benefit (net rent) as referential housing costs for social renters ( $UC_1$ ) and predicted rent in municipal housing net of potential housing benefit ( $UC_2$ ) as referential housing costs for home-owners (housing benefit was computed for home-owners in the same way as for renters using the predicted rent):

$$UC_1 = (REN - HB) * 52;$$

$$UC_2 = (PRREN - HB_{pot}) * 52$$

where  $PRREN$  denotes predicted weekly municipal rent,  $HB_{pot}$  potential housing benefit of owner-occupiers,  $REN$  and  $HB$  actual rent and housing benefit of social renters. Let us now define the relative user costs ( $RUC$ ) in following way:

- for home owners:  $RUC_{HO} = UC_1 / UC_0$ ;
- for social renters:  $RUC_{SR} = UC_2 / UC_0$ .

The **move/stay decision model** itself has been tested on a variable showing the intention of the respondent (head of household) to move from the current dwelling.<sup>12</sup> The separate logistic regressions were run for different tenures. Both models are presented in Annex E. The model for current home-owners had Nagelkerke  $R^2$  almost 0.25 and even with relatively low cut-off value (decreasing the discrimination power) there were still almost 61% of model predictions correct. Among the most influential factors are the satisfaction with current housing and type of housing (with households living in own flats – reference category in equation – wanting most to move). Factors such as the age of the head of the household (and its squared value), number of dependent children and if household lived in private inner city (Scottish ACORN category) and urban location were also significant. Younger people with fewer children living in inner cities and in flats would be more likely to move than older people with children living in detached housing. Neither actual nor permanent household income had any significant influence on household move/stay choice for home-owners.

The model for current social renters had Nagelkerke  $R^2$  almost 0.29 and again with low cut-off value of 0.15 still 60.7% of predictions correct. The satisfaction with the current home remained the most significant factor influencing the intention to move, followed by  $\ln$  of permanent household income and dummy variables reflecting sex of head of household and if households live in tenement housing. Age and age squared remained also among significant variables in the final equation.

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five per cent random sample of mortgage loan origination data estimate house price appreciation for each UK region by the backward-looking expectations approach of Ermisch, Findlay and Gibb (1996). Moreover, they use a weight of 0.3 for capital gain in user cost equation.

<sup>11</sup> Though these averages may be disintegrated to regional or exceptionally local level (if data allows it) the same could have been done with all estimates and simulated decisions. Such very detailed regional analysis was, however, not the purpose of this case study.

<sup>12</sup> The complete wording of the question is as follows: How likely is it that you will try to move from this house/flat in the future? Is it 1: very likely, 2: fairly likely, 3: fairly unlikely, 4: very unlikely. For the logistic model, the variable on probability of movement had value 1 for the first two options while value 0 for second two options.

We found out that move/stay decision in both tenures is not significantly influenced by relative user costs (though included in testing logit move/stay models for both tenures it was not significant in both cases) because this decision is more driven by other previously mentioned factors. Many social renters (and home-owners) simply want to move to other social rented flats (owner-occupied dwellings) just because of their dissatisfaction with current dwelling or location. However, we had to deal with the same problem as in case of the model on take-up of housing benefit. We can expect that relative user cost would become significant on move/stay decisions when substantial changes in price regimes would be introduced. The model should give us only the necessary background allowing to prevent from those situations that would not be very probable. Therefore we decreased the discrimination power of the model (see above) and allowed more people to move from current housing.

Though relative user costs do not influence the decision on movement the **tenure choice decision** of social renters seems to be dominantly influenced by relative user costs. 28.6% of respondents living in social housing (head of households or their spouses) answered that is very or fairly likely that they will try to move from current house in the future and half of them preferred to move to the home-ownership sector. The correlation between relative user costs and tenure choice (where homeownership alternative bears value 1) on sample of respondents from social housing sector was relatively high ( $r = 0.25$ ,  $N = 1,612$ ) and significant on 0.01 level of statistical significance. Moreover, if we run a forward conditional logistic regression on tenure choice for those from social housing intending to move (forward method has been chosen because it can better show the significance of each independent variable), the most appropriate model would show that relative user costs form the second most important factor influencing the tenure choice (after  $\ln$  of permanent income). The Nagelkerke  $R^2$  of such model is 0.21 and 66.5 per cent of predictions are correct.

The verified dominant significance of relative user costs on tenure choice of social renters (after household income variable) allow us to avoid using the complex nested multinomial logit models combining move/stay and tenure choice decisions. The nested variant of multinomial logit modelling is recommended because it does not violate the independence from irrelevant alternative choice (though the assumption of hierarchical decision tree is needed). It requires a specific data arrangement, special software and much more complex work with resulting coefficients when needed for simulation purposes.

Next to the fact that move/stay decision is somewhat independent of tenure choice and tenure choice is significantly driven by relative user costs (income constraints will be separately included under mortgage rationing in the whole decision simulation process) there are also several other arguments that allow us to use more simple methodology without nested multinomial logit modelling.

Firstly, if we run a nested logit model on the whole sample, the results would be biased for social renters because of much less significant influence of relative user costs in the final logit equation (there is a lot of home-owners moving to another owner-occupied dwelling for whom the relative user costs are irrelevant). Secondly, the tenure choice logit model (as well as move/stay decision or take-up of housing benefit) reflects the relative weight of factors in 1996. However, when rents are increased/decreased substantially above/under their values in 1996, the weight of relative user costs in the tenure choice (value of  $b$  coefficient) would probably increase even more (in more complex nested multinomial model is not possible to adjust the results by changing cut-off value, as was done for binary logit models of move/stay decision or take-up).

Thirdly, if we run two separate nested logit models for each tenure and if the purpose of the study is to find out the relative values in public costs for alternative rent settings



(and we know that relative user costs form probably the main driver for tenure choice of those in social rental sector) then we can also assume that they would be more or less the same aggregated relations between alternative rent settings and actual (zero stage) rent setting as if we base the tenure choice exclusively on relative user costs comparison (though the variant of two nested logit models can still come up with smoother results). Finally, tenure choice in our case measures only intention, not the real movement. We can assume that there would be many households intending to move out of the social housing sector (the preference for home-ownership is relatively general) in the next few years but not actually doing it immediately just because rents are not so high as to create the incentive to move (and, of course, incentive to pay more on housing, because user costs do not include full loan repayments). Therefore we would still have to add some assumption on the level of break-point from which desire to move becomes much more real.

We decided upon the three-step methodology of move/stay and tenure choice decisions' calculations. The previously described binary logit move/stay model counting the probability of movement for each tenure is combined with relative user costs comparison and meeting mortgage rationing criteria. Mortgage rationing is a useful instrument not only to reflect the relative weight of income on movement to home-ownership sector but also to illustrate the fact how such intention (preferred tenure) is real with respect to household borrowing capacity. We will assume that relative user costs are the most significant factors of tenure choice (if the other two conditions are met) and that the break-point has been set at level equal to 1 in which the movement from social housing in the basic stage of simulation reflected real turnover in social housing dwellings in 1996.

The same detailed analysis of tenure choice for those households living in home-ownership has shown that relative user costs remain also very significant in potential decision-making there. However, the problem was that only very small number of home-owners intended to move to social housing (only about 3% of those wanting to move). The most appropriate model has shown that relative user costs would be ranked by its significance only after factors of age and long-term illness of head of household. The avoidance of age and illness factors would not in any way affect our main purpose of analysis (relative values of public costs) as they remain constant for all potential rent price levels.

Moreover, factors of age and long-term illness will be part of social housing rationing which will accompany the move/stay probability and relative user costs' comparison in the final simulation syntax (in the same way as mortgage rationing is combined with move/stay probability and relative user costs' comparison for social renters in the final simulation syntax). However, it is necessary to take into account that home-owners would not react to price incentives in the same way as social renters. Therefore we decreased the ceiling value of relative user costs to 0.5 reflecting, again, real movements in 1996.

The tenure choice in following simulations is driven by fulfilment of three necessary conditions:<sup>13</sup>

*for social renters moving to home-ownership:*

- probability of movement measured by move/stay regression is 1;
- household fulfil basic criteria for mortgage loan extension (defined as price-to-income ratio lower than 3.5 and age of head of household lower than 55);
- relative user costs for social renters  $RUC_{SR} \geq 1$ .

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<sup>13</sup> Mortgage as well as social housing rationing conditions were taken from Hsieh (2002).

*for home-owners moving to social housing:*

- probability of movement is 1;
- household holds social characteristics of those entering social housing (also social housing rationing), i.e. it fulfils at least two of following conditions: appearance of any long-term illnesses or unemployment of head or his/her spouse in a household, more than 50% of household income is spent on mortgage repayment, more than 50% of household income comes from state benefits (state pensions excluded), age of head of household or his/her spouse is higher than 65 or it is single parent household;
- relative user costs for home-owners  $RUC_{HO} < 0.5$ .

Following the main conclusions on **employment unemployment decision making** from the Introduction we have assumed probabilities of rational real reaction to working incentives (via benefit policy) for each working and unemployed person (among unemployed also those carrying for home were included). These probabilities varied from 0 to 1 for each head of household and his/her spouse and reflect different sensitivity on working incentives between those in work and those in unemployment. The methodology of probability setting is in Appendix F and is based, generally, on a distribution of probabilities according to the several household characteristics: sex and family status of decisive person (in some cases also his/her age), number of children and, in some cases, the employment status of spouse/head of household also. For example, an employed married man with more than three children has sensitivity to working incentives 0.1 while employed single man without children has probability of 0.5. An employed married woman with more than three children has probability of 0.7 and employed married woman with more than three children and with husband not in employment (either unemployed, ill or 'others') has a probability of 0.9.

The sensitivity of unemployed men rises/decreases in the same way as for employed men while for unemployed women it is very different. An unemployed married woman with more than three children has, on the other hand, a very low sensitivity to work incentives (for example, if her age is more than 45 years and partner is in employment, then her sensitivity probability is 0). Generally, the sensitivity is lower for women than men and the same probabilities were assigned both to heads of households and their spouses. We can expect that sensitivity rises with rent growth as indicated in the study on lone parent families of Bradshaw and Millar (1991). As we were not able to measure its growth/decrease and because several simulation attempts to make additional assumptions have shown to produce unreliable results we did not account for it in the final simulations. We only assumed the ceiling probability from which person became sensitive to working incentives, i.e., he/she would start to count costs/benefits of working status change) and simultaneously will start to behave according to the result of such personal analysis. This has been set at average probability level, i.e. probability of 0.5.

The syntax computes reservation wage for unemployed people as a sum of housing benefit (contribution to cover housing costs) and income support. We assume that those people who become sensitive to work incentives would go into employment if their weekly net wage exceeded the reservation wage (i.e. they would be able to cover basic running costs of household, including full housing costs, from a salary). Net wage has been computed from an estimated gross wage rate multiplied by average weekly working hours (computed from those being in employment separately for men and women but assuming full time employment) minus taxes and national insurance contributions calculated in accordance with tax-benefit model (using, for example, also tax optimisation by allocating the married couple's allowance to the person with the highest gross income, etc.).

If the head of household or his/her spouse decides to take an employment we counted new household social benefits (family credit, income support) and finally generated public budget benefit as the difference between new benefit and original benefit payments plus tax and national insurance contributions from new salary (housing benefit is excluded as the public costs on housing benefit are counted separately).

The syntax also computes the “escaped” wage for people being in employment, as a sum of potential household income support, housing benefit and family credit (if family credit is still being received when one member of household remains in the work) when escaping the employment. In other words, we counted the benefits that household would receive if person sensitive to work incentives would leave his/her job. We assumed that if these benefits would give such person 90% of current net employment earnings then he/she would leave current employment. The public costs were then calculated similarly as the difference between new social benefits and original social benefits plus original tax and national insurance contributions. For both employed and unemployed people the syntax also accounts for the more complex situations when both members of households would like to change their employment statuses.

Finally, we worked out several small OLS regression models separately on **costs via voids** and **management costs due to the residualisation of social housing** on municipal and housing association performance indicators’ data sets. The purpose of those models was not to find out the most reliable relations as they can hardly be statistically very significant due to the very low number of cases in both samples. The purpose was simply to avoid making additional assumptions and to find out probable relations between rent prices and time necessary to re-let the property (influencing costs via voids), and between turnover (or voids) and additional management costs connected with spatial segregation (anti-social behaviour, criminality, vandalism, etc.).

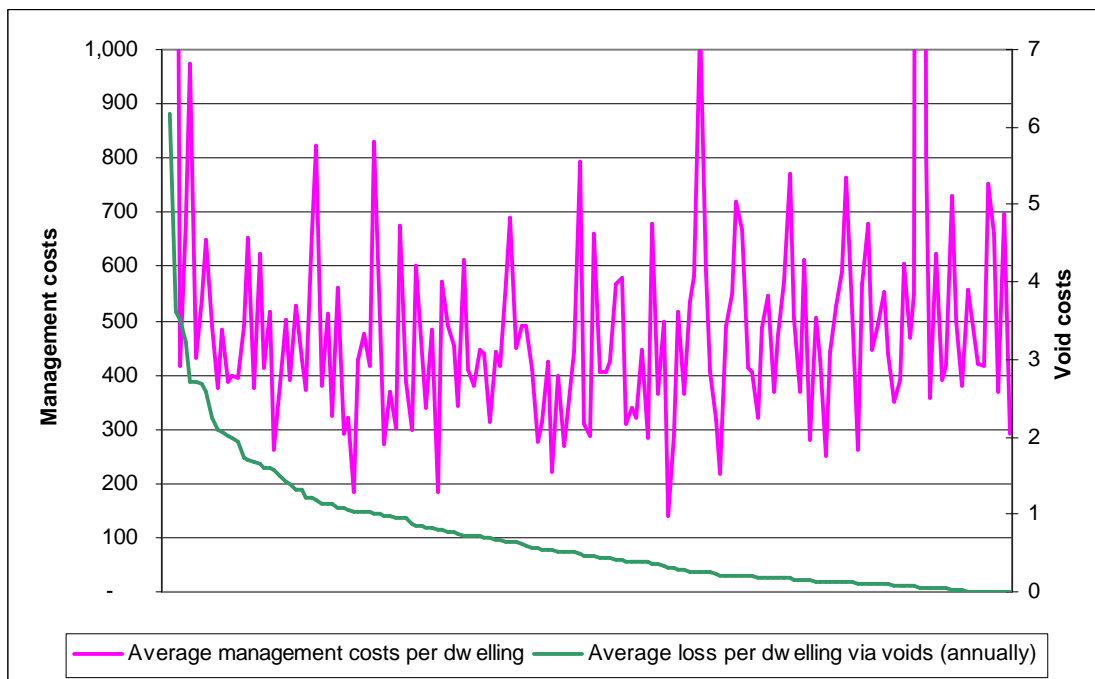
Although we dealt with many gaps in the information on performance of social landlords and some more sophisticated models could not be tested, we found out significant correlation between average time to re-let the property in municipal housing and average rent price ( $r = 0.319$ ,  $N = 32$ ) and we used this relationship in the final simulations. Although the model was tested on 2001/2002 data set (average re-let time has not been measured in 1996), it predicted reliably the costs via voids recorded for local authorities in 1996/97. The direct relationship between rent price and average re-let time was not significant for housing associations. However, the correlation between number of re-lets in a particular year (weighted on one dwelling of a landlord) and total costs via voids as percentage of potential rental income was shown to be very significant ( $r = 0.321$ ,  $N = 160$ ). We therefore modelled this relationship and used it for estimation of costs via voids for housing associations.

As we simulated rent increases for all social landlords (or at least for all landlords of one type, for example, for all municipalities), we suspended the intra-tenure turnover and we increased/decreased the turnover rate from 1996/97 real situation only according to inter-tenure turnover (share of households leaving and/or entering social housing). Inter-tenure turnover is measured already by the SPSS simulation part and no additional assumptions or model is needed.

We also tried to measure the neighbourhood effect of spatial segregation by comparing social landlords’ management costs with costs via voids. We anticipated that, the higher the costs via voids per dwelling were then the higher the management costs per dwelling could be, because of the additional staff time spent on neighbourhood nuisance (for Scotland, Bannister and Scott 2000; for England, More et al 2003). However, as Figure 2 shows this could not be verified by simple comparison as management costs per housing association dwelling differentials reflected probably

many other factors too. We were not able to find out the threshold for measuring of neighbourhood effect, the approach discussed or used (though not in currency unit expression) by other researchers (Galster et al 2000, Atkinson and Kintrea 2001, Ellen and Turner 1997).

Figure 2: Annual Management Costs per Dwelling for Housing Associations, 2001



Source: Scottish Homes

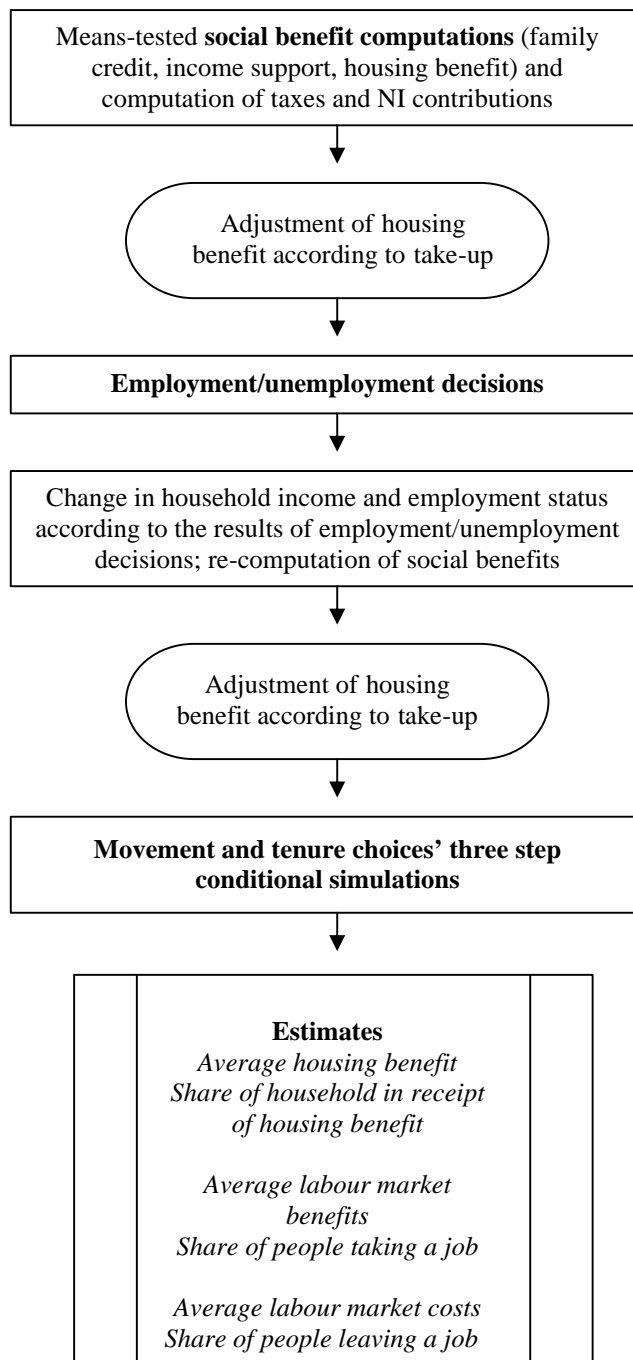
However, the management costs for dealing with neighbourhood nuisance (including anti-social behaviour) has been surveyed by Gibson (1998). The survey included the question on estimation of overall percentage of how much housing management staff time is spent dealing with neighbour nuisance problems. All social landlords were thus divided according to average costs via voids per dwelling into four categories and each category received the average time taken from the Gibson (1998) survey (multiplied by 260 of working days in the year). The very basic model then related number of re-lets per dwelling with dependent time variable separately for municipal and housing associations' data sets. Finally, we computed management costs using number of staff and hourly wage rate for Scottish social landlords taken from Atkinson et al (2000, pp. 208–209).

The inclusion of other costs connected with anti-social behaviour was not possible due to lack of data. With the exception of some attempts made by Bannister and Scott (2000); Atkinson et al (2000) and Gibson (1998), no detailed research explicitly investigated the total costs associated with the impact and management of anti-social behaviour in Scotland. Moreover, above mentioned studies provide more recommendations on how to monitor the costs rather than the results of their measurement. Although social landlords were asked about the costs by questionnaire survey, the overwhelming majority of them were not able to answer it.

*The SPSS simulation model*

The SPSS syntax simulate labour market decisions as well as tenure choice. Among the main results from the point of view of the main goal of our analysis belong estimations of labour market costs/benefits and housing benefit costs (average values are used to count the national costs). The following scheme illustrates the process of simulation steps for each level of rent price:

Scheme 1: SPSS Simulations of Public Cost of Higher/Lower Rents in Social Housing



## *The Excel Simulation*

The Excel simulation section summarises the main information from SPSS modelling and by adding housing construction costs, RPI costs, costs of HSG subsidy, costs via voids and management costs of residualisation computes the final value of total public costs. A brief methodology for each additional cost item computation is as follows:

- **HSG subsidy** of local authorities is computed as the difference between the sum of management, maintenance and capital costs of municipalities plus simulated costs via voids and total rental income (adjusted during the simulation by average rent increase/decrease). It can have a negative value, i.e. additional income of municipalities above the level of the costs is perceived as public finance benefit. Similarly, the difference between total rental income and total costs (including simulated costs via voids) is computed for housing associations. The income above the level of the costs is not seen as public finance benefit (housing associations are not public bodies) but it is assumed that 70% of such “profit” must be used to decrease the costs of new housing construction (thus decreasing public expenditures on housing construction grants). On the other hand, if rental income is lower than costs the **revenue subsidy** is counted and added among public costs.
- **RPI costs** are counted in the same way as done by Holmans and Whitehead (1997). The total public costs increase (costs of social benefits indexed to the RPI, public service pensions and indexed National Savings Certificates) connected with 0.1 percent RPI increase was estimated as being £73 mil. Rents had (and still have) a weight of 47 per thousand in the RPI and about half of it should be taken as being for local authority tenancies (Holmans and Whitehead 1997, p.67). Pro rata to the dwelling stock the final weights would be 3.62 per thousand for Scottish local authority housing and 0.61 per thousand for Scottish housing association stock (number of tenancies in UK and Scotland in 1996 is from Wilcox (2002). Though the government would not uprate benefits and pensions after any increase in RPI, we preferred gradual to shock increases in public expenditures in this study (assuming that inflation in prices of other goods would lead to uprating after all).
- **Housing benefit costs** are computed as the average annual housing benefit in the social housing sector multiplied by share of household in receipt of housing benefit (both figures calculated by SPSS simulation part) and multiplied by number of households living in social rented housing in Scotland 1996. Because of tenure choice and impact of relative user costs, the rent increases will lead to movement out of social housing sector and therefore the share of households receiving benefit is computed on lower number of cases than previously. Therefore, we put as an assumption (which we think is close to reality, too) that, though some households leave the sector, the same number of new households will come from the waiting lists and these new-comers will have similar social and income structure as those remaining in the social sector (not-moving to home-ownership). The administration costs of benefit allocation are added by using slightly adjusted figures from Holmans and Whitehead (1997, p.32): annual costs of £65 to tenants receiving full housing benefit and £90 to tenants receiving partial housing benefit.

- **Management costs of residualisation** are computed according to one of small OLS models.
- **Housing construction costs** form a weak point in relative public cost measurement as they influence very much the total public costs and they cannot be simulated without relatively constrained assumption. The important question is: how many new social dwellings are needed? It is clear that higher rents and higher turnover in social housing decreases the new housing need and *vice versa* but the starting level of housing need in the zero stage of simulation is still in question. As it depends on very subjective judgements of social researchers, we assumed in this study that actual new social housing starts in 1996 was the optimum in relation to the share of satisfied households from a total number of households on housing association waiting lists in 1996.

In 1996, the number of new housing starts formed about 3% of total number of households registered on waiting lists of housing associations and we took this 3% share as housing construction normative for alternative rent settings too. If more people leave the housing association sector thus increasing the turnover, the number of people on waiting lists will decrease because of new lettings and consequently the scale of housing construction would also decrease. However, we also assumed that, if the number of people leaving local authority housing were caused by the rent decreases which were lower than the zero stage of simulation, then additional new flats need to be constructed. This additional housing normative is again equal to 3% of the difference between number of people leaving municipal housing in the zero stage of simulation and number of people leaving at particular stage of simulation.

The final housing construction costs on normatively set number of dwellings were also adjusted. Firstly, the average construction costs per dwelling were decreased by additional rental income exceeding management, maintenance and capital costs of housing associations, as described above in context of revenue subsidies. Secondly, the costs were increased/decreased by capital loss/profit ( $CP_t/CL_t$ ) in context of private loan repayment duties. Using the same average interest rate for mortgage loan and expected 30 years maturity we computed additional capital profit from rent increase (additional capital loss from rent decrease) by following equation:

$$CP_t(CL_t) = \frac{\Delta AR_t^{HA} * AR_0^{HA} * 52}{i \left[ 1 - \left( \frac{1}{1+i} \right)^n \right]}$$

Where  $AR_t$  denotes rent at  $t$ -stage of simulations,  $AR_0$  rent at zero stage of simulations,  $i$  is interest rate and  $n$  loan maturity. This equation measures how additional rent increase saves capital subsidies (decrease grant rates) because the larger part of housing construction costs may be covered from private loans. For example, in case of rent increase options it computes, assuming annuity repayment mode, what additional capital for housing construction does not have to be covered via public grants because housing associations will receive additional rental income.

A summary of main assumptions used for simulations in Scotland is outlined as follows:

- We assumed a three-step conditional inter-tenure movement based on probability of movement, mortgage (social housing) rationing and relative user costs' comparison. The relative user costs break-point for tenure choice was assumed 1 for social renters moving to home-ownership and 0.5 for home-owners moving to social housing. Mortgage rationing (constraints) includes price-to-income ratio lower than 3.5 and age of head of household lower than 55. Social housing rationing was based on meeting two social criteria from the list (e.g. illness, high age, low income, etc.). The intra-tenure mobility was not simulated and turnover rate has been changing only by inter-tenure mobility during simulations.
- The new-comers moving to vacant social dwellings have similar income and social structure as those remaining in the social housing.
- Nominal interest rate is assumed to be 6.7%, depreciation rate 1.2%, price appreciation 3.7% and maturity of housing associations' loans is 30 years.
- Housing construction starts are to satisfy 3% of households on associations' waiting lists plus 3% of the difference between number of households leaving municipal housing at  $t$ -stage of simulation and number of households leaving at zero stage of simulation. Housing associations must use 70% of income above their management, maintenance and capital costs for new housing construction.
- The assumed sensitivity probability on working incentives has been distributed among both unemployed and employed men and women according to the social characteristics of their households. The probability varies between 0 and 1 and break-point was assumed to be equal to 0.5. If income from employment is higher than the reservation wage (resp. if benefit income is higher than 90% of actual earnings) the unemployed will take an employment (resp. employed will leave his/her employment). The reservation wage was set as equal to the sum of actual housing benefit (housing costs) and income support.
- The costs of the uprating of benefits and pensions (RPI costs) are increasing gradually with every increase in rent.



## *The Case of the Czech Republic*

Due to the fact that controlled rents are very low in the Czech Republic, we simulated relative public costs only for rent increase stages. Several data sets have been used. The *Family Budget Survey 2001* was main data source for our simulations as there was no representative house condition survey (or housing demand survey) conducted till now. The *Family Budget Surveys* (FBSs) are annual surveys of the Czech Statistical Office aimed at capturing financial and in-kind flows in the management of a selected sample of households. A household, i.e. a group of people living and running a household together, constitutes the reporting unit and the selection unit of the FBS basic sample. The selection is conducted using the quota selection method, which may result in the levelling of various extremes. The basic selection criteria include the social group of a household, the number of dependent members and the net income per person. In the FBSs the number of households in each social group is not determined in proportion to their representation in the total population and therefore weights from *Microcensus* survey are used to compensate for this. The total FBS 2001 sample was 3,710 households.

Using data obtained by an Institute of Sociology survey entitled *Housing Attitudes 2001* we were able to create a logit model to assess the probability of a household moving from the rent-controlled housing sector. This quota survey gathered the information on housing satisfaction, attitudes towards housing policy and monitored past and estimated future housing careers. The total survey sample was 3,564 respondents.

Finally, data of the Regional Development Institute which monitors selected information concerning the housing policy and housing situation in Czech municipalities, and data from the *Local Government and Housing* project, which – using a similar questionnaire survey and aimed to obtain information about the municipal housing stock – will be used to estimate the potential costs of residualisation.

The results of the simulation modelling only apply to municipal flats and not to all rent controlled flats. This is done primarily for methodological reasons because, although we have at our disposal some data about municipal housing stock, we lack statistics concerning other regulated rental flats leased by private landlords. We believe, however, that the results may be generalised and applied to the entire regulated rental housing sector.

The methodology of simulations is very similar to the methodology of simulations in Scotland but because of the specific situation in the Czech Republic, we did not assume any movement from home-ownership to rent-controlled housing (there is almost no chance for such household to obtain rent-controlled dwelling). The movement of households from rent-controlled sector was based again on three-stage conditional approach: 1) the movement to home-ownership is economically beneficial to the household (relative user costs  $RUC_{SR} \geq 1$ ); 2) the household meets the solvency criteria for receiving a mortgage credit in an amount of the acquisition price of a flat (mortgage rationing); and 3) the probability of movement based on the best logit model is equal to 1.

We assumed that all buyers would need a mortgage credit and if, due to income or age limits they do not meet the bank's criteria (in this case, Česká Sporitelna Bank) they would not be able to move out. Credit constraints were much more precisely defined than for the Scottish simulations, using several "bonity" indicators according to the criteria applied by the dominant bank in the field of mortgage lending in the Czech Republic. This is because mortgage loans are unaffordable for majority part of Czech

households and credit constraints form often the main factor influencing the potential movement of households to owner-occupation.

For the purpose of relative user costs' computation we needed to estimate the prices of rent-controlled dwellings. As a rule, the market price of existing flats is usually assessed using the hedonic price function, i.e. a regression model that takes into account various attributes of the flat, its location and neighbourhood. Although this methodology is relatively precise, it requires reliable statistics concerning prices and a wide range of the attributes of the flats sold, which unfortunately we did not have at our disposal. For the purpose of this study, the market price of flats has been estimated using the *KISEB* database of advert prices. The database on bid prices collected from dominant real-estate advert magazines in main regions and cities is operated by the Institute for Regional Information. We were only able to estimate the price per m<sup>2</sup> of floor area of dwelling individually for each region (eight regions) and each size category of municipality (nine categories) in the region. In Prague, the size of the flat (six categories) and the qualitative category of the flats (flats of the 1<sup>st</sup> and 2<sup>nd</sup> category) have been taken also into account. The obtained estimates are relatively flat when comparing values among different locations within one spatial unit (region) but we were not able to achieve higher differentiation because of the lack of information on dwelling and location attributes.

When computing user costs we summed up the average mortgage interest rate in 2001 (7.3%) on 70% of property value, 5% opportunity costs on the rest of property value and depreciation rate on whole property value (1%) and we decreased the total obtained by estimated expected price appreciation. The maximum allowed loan-to-value ratio for mortgage loan was 70% at that time and therefore a household would need a 30% down payment. Because of the Bausparkasse housing saving scheme introduction at the beginning of transition, which became a very popular saving vehicle (also because of the generous state premiums), households might use savings from this product for a down payment. However, we needed to count the opportunity costs of household savings and we used the average interest rate on long-term government bonds for this purpose (5%). We adjusted the interest rate in user costs' computation by a tax deductibility of interests by computing the tax savings when optimal tax declaration in a household is supposed (tax deductibility is used by the member of household with higher income). The expected price appreciation has been computed separately for eight spatial zones created according to the past price increases: in Zone 1 we assumed zero capital gain whilst in Zone 8, where capital city was also included, we assumed expected average annual appreciation of 1.5%.

As there are no data on real housing benefit receipt (this is not even part of the *Family Budget Survey*), we assumed 100% take-up of housing benefit and we adjusted the Czech allowance model in accordance with the "effectiveness" assumption described fully in the introductory part of this article.

Next to relative user costs' comparison (including the estimation of user cost of home-ownership and computation of rent net of housing benefit) and mortgage credit constraints, we will finally need the move/stay probability estimates to simulate inter-tenure movements. The **logit model on move/stay probabilities** run on the *Housing Attitudes 2001* data is presented in Appendix G.<sup>14</sup> The Nagelkerke R<sup>2</sup> is equal to 0.278 and with a low cut-off value (chosen due to the same reason as in the Scottish simulations to allow for higher movements) still 63.3 of predictions correct. Among

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<sup>14</sup> The question used to estimate the probability of future movement was as follows: would you please tell us what would be your desired housing where you would like to have your home and family? The answers: current housing, other housing.

the main factors are the size of household residence (higher probability in bigger cities, mainly in Prague, which was used as referential category in the model), the year of construction (higher probability for those living in older dwellings), the age of head of household and the type of housing. We were able to increase significantly the robustness of the model by adding other relevant variables such as respondent satisfaction rate, neighbourhood quality and others. However, as we had to transfer estimated parameters to the different data set (*Family Budget Survey 2001*) where main simulations on tenure choice were realised, we could use only those variables that were in both sets.

Finally, we tested several small OLS models on costs of residualisation. In order to create a reasonable **relation between rent price and the number of voids** (or rather loss of rent income due to voids), we have attempted to find an appropriate OLS model in the *Local Government and Housing* study data. The survey among all municipalities having more than 5.000 inhabitants included the question on number of voids in municipal housing. However, the overall average was very low – only 2% from total housing stock.

We have assumed that the smaller the difference between the regulated and market rent values in a given municipality (i.e. the more the housing demand is satisfied from rent-controlled housing), the higher the number of voids (or the loss via voids). Although the correlation coefficient is indeed negative, the relationship is statistically insignificant. Nonetheless, we attempted to find other important relationships (e.g. the relationship to the size of the municipality) but we were unable to find any statistically acceptable model – when a statistically significant relationship came to light, other methodological issues appeared.

In the end, we used the following assumption for simulations: today there are no voids and empty flats will appear only when the number of vacant municipal flats caused by tenants moving out exceeds the number of market rental flats in a given region, multiplied by two. We have multiplied the number of market flats by two in order to include applicants from waiting lists (the total estimated number of registered applicants for a municipal flat is approximately the same as the number of market rental flats in the Czech Republic). We would like to note, however, that in this phase we have taken into account regional differences because vacant flats are far more likely to appear sooner in the region of Northern Bohemia which has a high unemployment rate than the capital city of Prague.

The simulation process itself was again realised in SPSS and Excel software. In the latter one the computation of total public costs included the estimates of housing allowance costs (based on SPSS simulation of tenure choice), costs via voids and following cost items:

- **Revenue Subsidies**

We counted the “fictitious” revenue subsidies amounting to the difference between the cost rent (i.e. rent covering the costs of operation, management, maintenance etc.) and the current/simulated rent price. Though there is no such a subsidy in practice, the logic leading to its introduction is obvious – its absence has clear consequences on the deterioration of the housing stock and low efficiency of housing management. These costs are, however, very difficult to measure.

In compliance with the findings of the Ministry for Regional Development, the cost rent in existing municipal flats has been determined as 2.8% of the re-acquisition price of a flat per year. The re-acquisition price is understood as the current market value of dwellings and we used the estimates made already for the purpose of relative user costs’ comparison. The revenue subsidy may be negative as we assumed during the

Scottish rent simulations. The additional rental income of municipalities above the level of cost rent is thus perceived as public benefit.

- **Consumer Price Index Costs**

The weight of rent price in the consumer basket used for the purpose of uprating is 1.975%. After deducting the weight represented by private housing this amounts to 1.174% and therefore a 10 per cent rent increase in municipal flats will result in a 0.117% increase in the consumer price index (CPI). According to the Research Institute of Labour and Social Affairs (RILSA), a one per cent increase in the consumer price index (living expenditures) results in a subsequent increase of CZK 300 to 330 million in expenditures for the payment of social benefits.

However, changes in the consumer price index are not the only factors determining the uprating of retirement pensions. Real income changes are also included there. The percentage increase of the retirement pension equals the sum of the percentage increase in the consumer price index and one-third of the percentage increase of the real income. In view of the fact that we assume a constant income, we do not take into account income uprating. According to the information provided by RILSA, a CPI increase of 2.5% has caused an increase in expenditures for the payment of pensions amounting to CZK 4.6 billion. A one per cent CPI increase has, therefore, resulted in aggregate expenditures for the retirement pension payment amounting to CZK 1.84 billion.

To sum up these findings, a 10 per cent rent increase could cause additional public costs due to pension and social benefit uprating amounting to CZK 253 billion but it is unlikely that the state would uprate in such a situation. As stated above, if only the rent price increased, then the resulting increase of the CPI would be 0.12% but the state usually uprates pensions and benefit if the CPI increases by more than 1%. Nevertheless, if we take into account the fact that inflation in other areas of household consumption may lead to a cumulative CPI increase of more than one per cent, then the inclusion of these costs is justified. We also used the same assumption in the Scottish case.

- **Housing Construction Subsidies**

As was the case in the relative public costs' simulations in Scotland, the setting of housing construction normative is the most difficult task when simulating public costs of higher rents. Although we were not sure when we put as an assumption that the optimal scale of social housing construction should be a real number of social housing starts in Scotland 1996, we can be sure that the real municipal housing construction in the Czech Republic 2001 was far from the optimum. As one of the reasons of this study is to compare the relative public costs' curves between the Czech Republic and Scotland we will, in the first assumption (to be revised later), set the normative on needed new housing in a way that would reflect a huge difference between turnover rates in the Czech municipal rent-controlled housing and Scottish social housing.

According to the results of SPSS zero stage simulation, only 3% of Czech municipal flats would become vacant in 2001 and this would allow to satisfy 15.8% of applicants from waiting lists.<sup>15</sup> In Scotland, the vacation of social dwellings during the zero stage of simulation would satisfy, on the other hand, 35% of households from waiting lists. If we want to simulate the completely similar conditions for the zero stage simulation

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<sup>15</sup> We do not account for the black market option here. It is common for a household to decide to purchase its own dwelling but to continue to keep the former rent-controlled rental flat. This flat is then illegally rented out for market rents and, because of strong tenant protection, the potential landlord legal action would take several years of legal proceedings. Therefore, the real number of vacated flats is even lower than 3% of the stock simulated by the model.

then we would have to assume that the new housing construction in the Czech Republic would have to satisfy such share of households on waiting list that is equal to the full difference between Czech and Scottish turnover rates, plus the share of households satisfied by new social housing in Scotland.

In view of the fact that the Czech conditions are very different and that it is perhaps unrealistic to demand the same quality of services as in developed countries, we have set the normative on new municipal housing as being equal to 10% of number of households on waiting lists (13,121 flats). However, this normative ratio will not remain constant in the simulations. As the percentage of satisfied applicants increases through the allocation of vacant municipal flats, the housing construction normative will decrease. The speed of this reduction has been linked to the Scottish situation: if 35% of applicants are satisfied from the vacant municipal flats, we expect the normative to fall to 3% of the number of households on waiting lists.

The rents in newly constructed flats will be assumed to be higher in absolute terms than for existing municipal flats but they will be determined using the same percentage share of rent on estimated property market value as it is in the particular simulation stage for existing municipal flats. In other words, if the current regulated rent equals in average to 1.5% of the estimated market price of rent-controlled municipal dwellings, then in the case of new flats the rent will be set at 1.5% of the market price also. Market price for a new flat is, however, higher. This rent amount would not necessarily cover all the costs related to the construction, maintenance and management of new dwellings and therefore capital and possibly also revenue subsidies will be required.

The “cost” rent, i.e. rent covering all above mentioned costs, has been defined as the total of all capital costs (mortgage credit repayments assuming 100% coverage of costs from commercial mortgage credits) and other management/maintenance costs calculated as 2% of the property value.<sup>16</sup> The difference between the collected rent (which reflects the situation in existing municipal flats) and the “cost” rent must naturally be covered by public funds, either in the form of a grant or a qualified credit. We cannot assume that subsidies will be only in the form of capital grants (UK dominant subsidies) as qualified credits from the Czech State Fund for Housing Development may be preferred to grants. Because of allowing for two financial tools (credit and grants) we need, however, to express the values of public subsidies in their net present values. This would clearly differentiate between the amount of state expenditures in the case of a grant and those in the case of a qualified credit.

Finally, we have developed a relatively complex financial optimisation program that seeks an ideal combination of qualified credit, grant and commercial credit for new construction of municipal flats with a given rent amount. It is assumed that the commercial credit has to cover at least one third of the total construction costs (a legal restriction on co-financing from private capital). The optimisation programme then seeks an optimal interest rate of the qualified credit to complement the commercial credit in order to achieve the minimum state expenditures. However, a condition that must be met is that, under the given circumstances, the simulated rent price must not be lower than the cost rent. If this cannot be achieved, then and only then may the grant be used. The qualified credit amount decreases and is replaced with a grant until the cost rent comes to be equal the simulated rent. If the total of the commercial credit combined with the grant on the rest of costs is still generating cost rent higher than

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<sup>16</sup> If the construction of new municipal flats occurred only on a commercial basis then, according to our calculations, the average “cost” rent in new municipal flats would reach approximately 9% of the property price.

simulated rent in the particular simulation stage the revenue subsidy is assumed to cover the difference.

The following is the summary of main assumptions for the simulations in the Czech Republic:

- We simulated relative public costs only for rent increase simulation stages and only on municipal rent-controlled housing (though rents in majority of private rental housing are controlled in the same way).
- We did not assume any movement from home-ownership to rent-controlled housing as this would be unrealistic under current housing conditions and we assumed a three-step conditional inter-tenure movement similar to that used for the Scottish simulations. The relative user costs break-point was assumed 1 for households from rent-regulated municipal housing.
- The new-comers moving from waiting lists to vacant municipal dwellings have similar income and social structure as those remaining in municipal housing.
- Nominal interest rate is assumed to be 7.3%, opportunity costs of own capital 5%, and depreciation rate 1%. The price appreciation rate has been assumed to be distributed according to past house price increases into 8 spatial zone and varies from 0% to 1.5%. Tax deductibility of mortgage loan interest was added.
- We assumed 100% take-up of housing benefit and we adjusted the tariff costs included in the Czech housing allowance model proportionately to simulated rent increase during the simulation.
- We assumed that there are no voids now and that they would appear only when the number of vacant municipal flats exceeded the number of market rental flats in a given region multiplied by two (equal to this difference).
- The “fictitious” revenue subsidy on existing municipal dwellings has been counted as the difference between cost rent and simulated rent price.
- Housing construction starts are to satisfy 10% of households on municipal waiting lists and this normative ratio will decrease in connection with municipal housing turnover increase (by linking it to the Scottish case).
- We assumed optimal state subsidisation of new construction using both qualified credits and grants. Only if capital subsidies are not sufficient to cover the capital, management and maintenance costs of new dwellings, additional revenue subsidies are assumed to cover the difference.
- The costs of uprating benefits and pensions (CPI costs) are increasing gradually with every increase in rent.

## Conclusions and Discussion

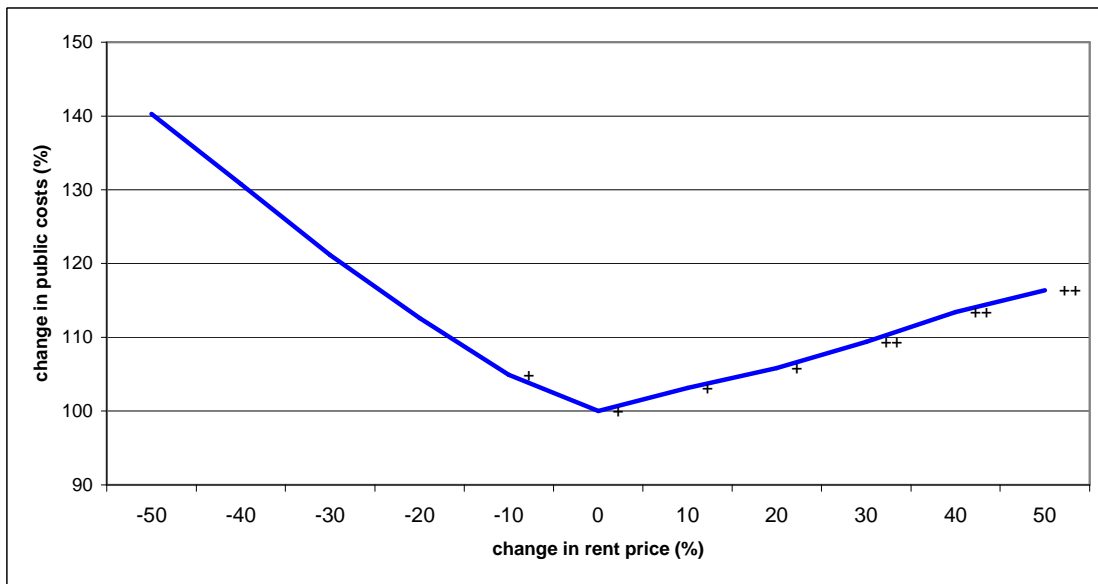
### *The Case of Scotland*

The simulations have shown that additional rent increase in social housing rents in Scotland 1996 would be connected with the growth in total public costs. The alternative settings for mortgage rationing (increase in the price-to-income ratio from 3.5 to 5 allowing for higher movement from social housing to home-ownership) had not any significant influence on this conclusion. This assumption change was simulated mainly because of a sharp decrease in credit constraints following the liberalisation of capital markets in the UK in 1990s. It might be the fact that mortgage lenders applied less restrictive price-to-income ratio in 1996. The increase in price-to-income ratio changed only the slope of the relative public cost curve and the public costs connected with simulated rent increase grew more rapidly.

Figure 3 shows the development of relative public cost curve. We may see that zero stage rent prices (real 1996 rent prices) were probably optimal from the point of public cost/benefit measurement in 1996 and that there was not much room for neither rent increase nor rent decrease in the sector of Scottish social housing.

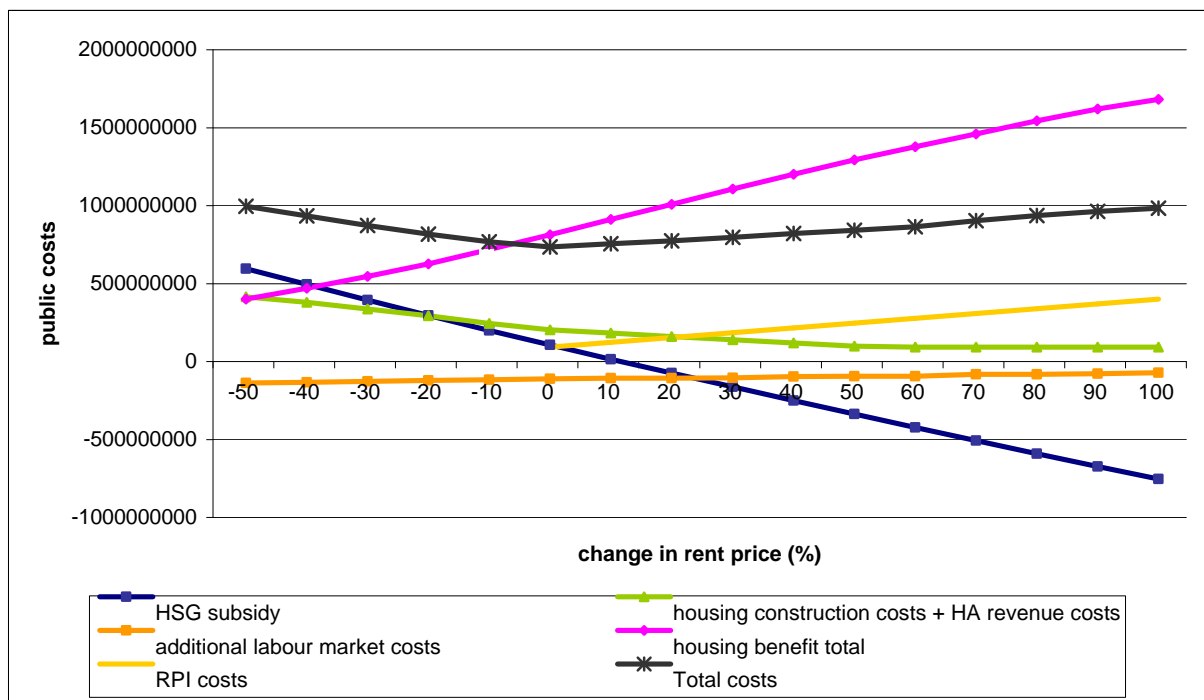
It is very difficult (perhaps impossible) to account for all the costs of social housing residualisation, especially to estimate the neighbourhood effect on criminality and vandalism. However, it is clear that benefit dependency is one of the main indicators. In our case, the share of households receiving housing benefit varies from 48.6 (50% rent decrease) to 77.2 (100% rent increase). If we suppose that 60% and higher benefit dependency share may result in the additional costs following from anti-social or criminal behaviour (marked as “+” in Figure 3) and 70% and higher benefit dependency share may increase it even further more (marked as “++” in Figure 3), the space for any further rent increase seems to be really limited. The structure of public costs/benefits including the development in labour market costs/benefits is presented in Figure 4.

Figure 3: Relative Public Cost Curve for Alternative Rent Settings in Scottish Social Housing, 1996



Source: own calculation

Figure 4: Structure of Public Cost/Benefits for Alternative Rent Settings in Scottish Social Housing, 1996



Source: own calculation

We see from Figure 4 that labour market costs have negative values even at the zero stage of simulation (i.e. 1996 rent prices should produce relatively to other simulation stages higher public benefits than costs related to labour market). The reason may be in the wrong setting of sensitivity probabilities, i.e., on the supply side of labour market. However, the bias may be also due to the demand constraints on labour market. In other words, there are not enough jobs offered by the market but the model

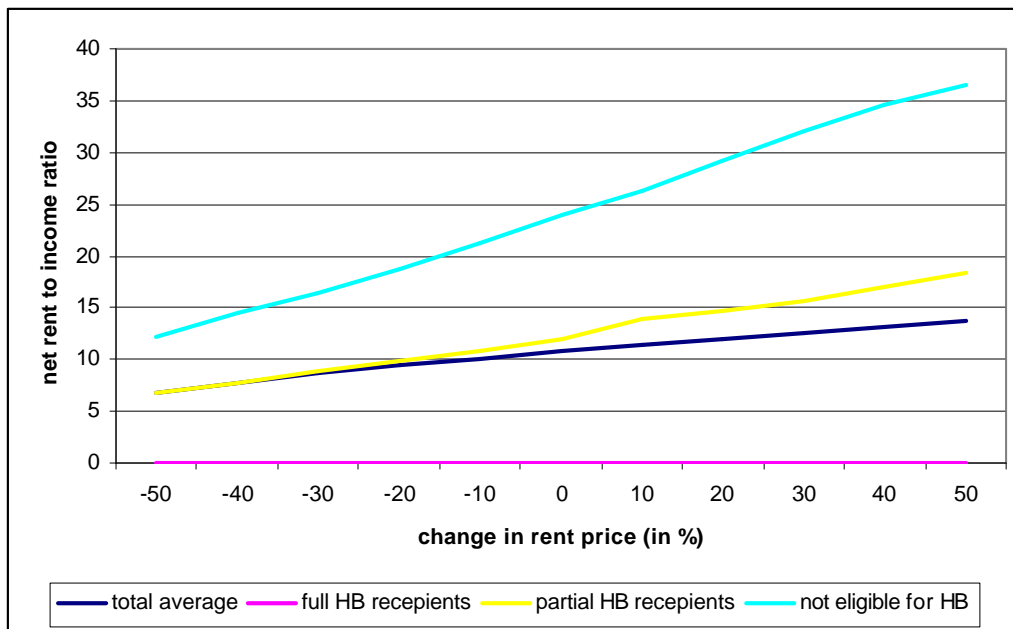


did not take into account labour market constraints. However, as we intend to analyse the “net” relative impact of rent changes the exclusion of demand constraints is not breaching the main purpose of the analysis. The rent decrease creates the potential for the decrease in public costs connected with unemployment though there are not enough jobs at the particular time. Such potential may be realised with a delay, sometimes in time  $t_1$ , but if it appears in situation  $t_0$  it is rational to count it as the consequence of social processes in  $t_0$ .

Secondly, we measure relative public costs and therefore the absolute values of costs are much less important than their marginal values. It is clear from the Figure 4 that labour market benefits fall with simulated rent increase, though the changes are relatively slight. This relative development is one reflected in the final relative public cost curve.

The break points on the relative public cost/benefit curve (Figure 3) are not as clear as we assumed in our hypothesis in the introduction. The main break points, from which public costs are increasing with further rent increase ( $A_2$  and  $A_3$ ) are both at level of 1996 rents, i.e. at a level of rent prices at zero stage of simulation. The “quasi-normative” on rent price (optimum average rent price) is thus equal to real 1996 average rent in social housing sector and therefore the “quasi-normative” on average housing affordability (net rent to income ratio) in the Scottish social housing is equal to about 11% (Figure 5).

Figure 5: Average Rent to Income Ratio for Alternative Rent Settings in Scottish Social Housing, 1996

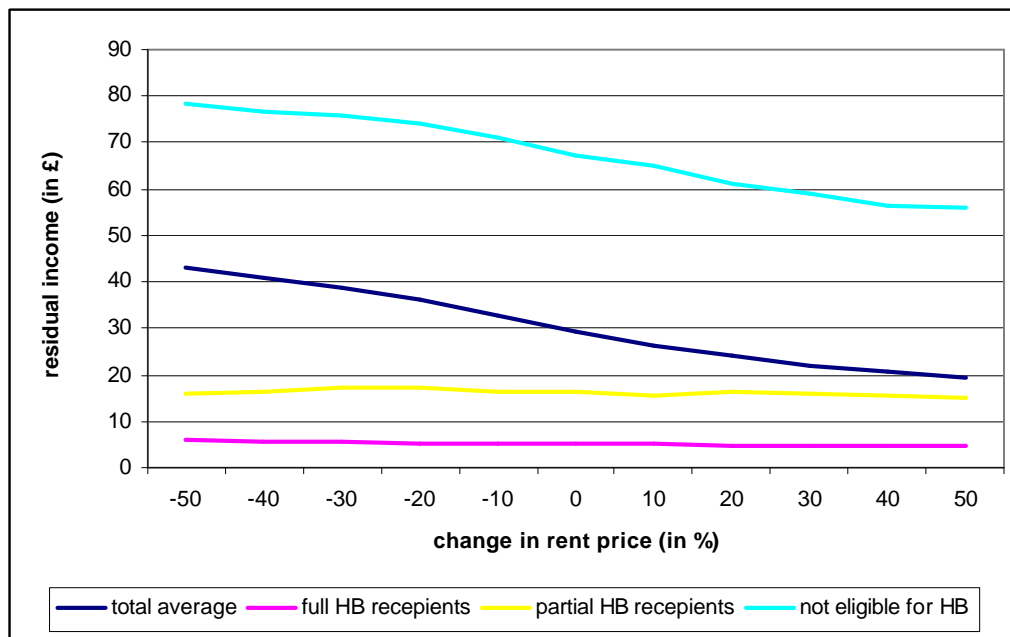


Source: own calculations, Scottish House Condition Survey 1996

As we see from Figure 5, the gap in value of net rent to income ratio between housing benefit recipients and those not eligible for housing benefit is increasing with each rent increase (especially when full housing benefit recipients not paying any rent are taken into account). It is not the aim of the study to discuss social justice norms

incorporated in the UK housing allowance model but following figure (Figure 6) shows how the effectiveness of an allowance may be evaluated from different perspective using a different affordability measure – residual income. According to the comparison, those not eligible for housing benefit are still much more better off than those on benefits even when rents increase by 50%.

Figure 6: Average Residual Income for Alternative Rent Settings in Scottish Social Housing, 1996



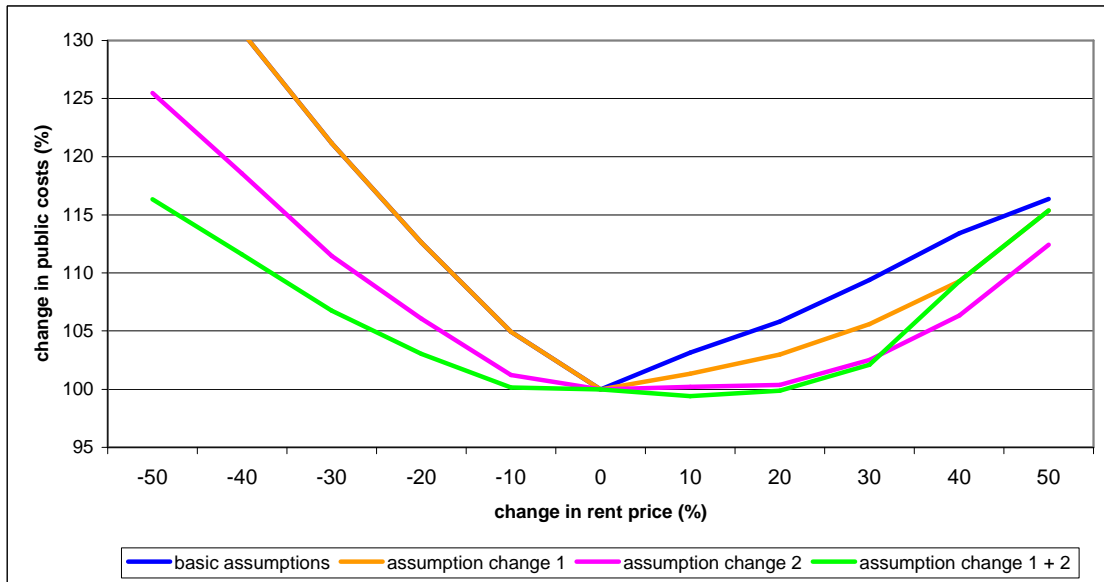
Source: own calculations, Scottish House Condition Survey 1996

Let us change some of the assumptions concerning housing construction and RPI costs that may be logic and may lead to the change in the shape of final relative public cost curve drawn in Figure 3.

- Firstly, assume that the total of additional rent revenue from rent increase above management and maintenance costs of housing associations has to be used for new housing construction (the original assumption counted only with 70% of additional revenue).
- Secondly, assume that the increase in turnover (during simulated rent increase) in the local authority housing will have the same impact on number of needed new housing as it was originally only during the decrease in turnover (simulated rent decrease). In other words, if rent decrease by 10% from zero stage rent price in local authority housing will vacate additional 1,000 flats, the number of needed housing will decrease by 31 flats (3.139% of 1,000). According to our original assumptions, the rent decrease in local authority housing connected with higher turnover had no impact on new housing construction of housing associations while rent increase had it. This change may bring higher equilibrium in construction assumptions. Let us also assume that RPI costs can have a negative value, i.e. rent decrease by decreasing RPI and inflation would in some way save public finance spent otherwise on uprating pensions and benefits.

As Figure 7 shows, while neither the first step nor the second one did not change separately the optimum of rent price level in the zero stage of analysis, the introduction of both of them would move the optimum to the level of 10% increase in the Scottish social housing rents.

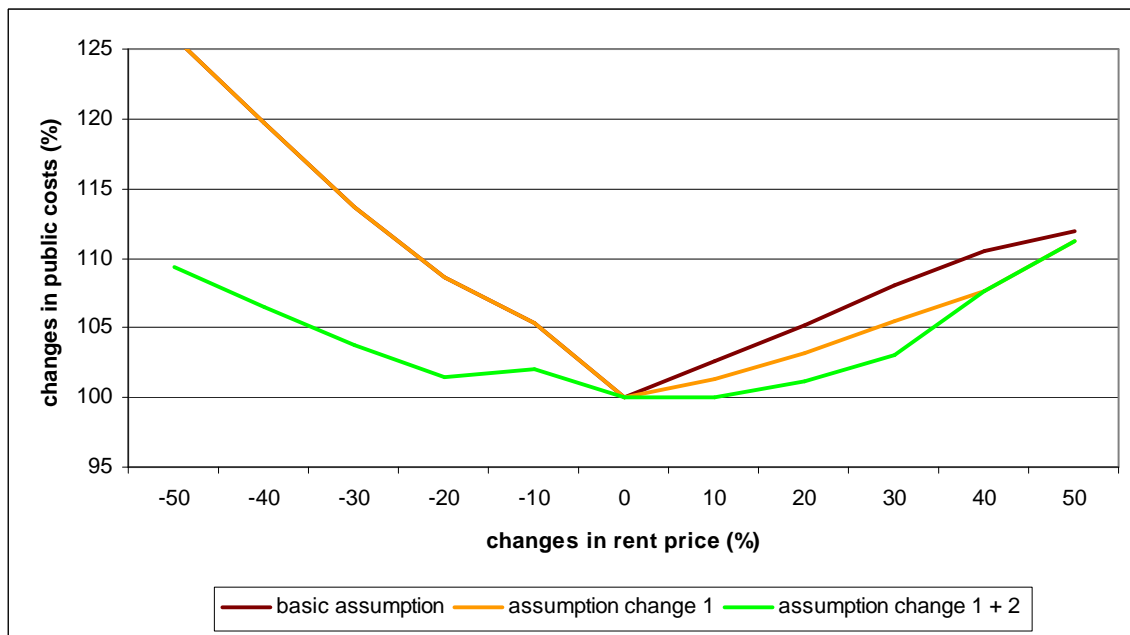
Figure 7: Relative Public Cost Curve for Alternative Rent Settings in Scottish Social Housing, 1996 (after changes in assumptions)



Source: own calculations

The results clearly show how important may be to set some of the assumptions (mainly the assumption on housing construction) on public cost curve shape. However, as we could not count all the costs following from the residualisation of social housing and the “profit” from potential rent increase is relatively slight for the state budget, we still should, in our opinion, hold the results of basic assumption curve with optimum in the zero stage of simulation as the final conclusion. This may be partially confirmed by analysis that did not take into account labour market at all and was only based on user costs analysis (standard approach of evaluating of costs of higher rents in the past). The optimum remains in the zero stage of simulation in case of both assumption adjustments (Figure 8).

Figure 8: Relative Public Cost Curve for Alternative Rent Settings in Scottish Social Housing, 1996 (after exclusion of labour market costs/benefits and assumption changes)



Source: own calculations

There are other reasons why we should be suspicious of the efficiency of further rent increase. The costs of social segregation, including those with anti-social behaviour of young people, may be very significant if we also took into account indirect costs in the form of prevention criminality programmes, costs of introducing new legislation, costs of legal proceedings and costs for other public entities involved such as, for example, police, firemen, public transport companies etc. Moreover, the costs of neighbourhood deprivation may be multiplied due to the socialisation process. Children create their norms of behaviour according to the adults they encounter in the community and this is the basis for additional public costs in the future. Youths living in such communities are likely to underestimate the return on education and when facing unemployment they may conclude that there is no real payoff to be expected from responsible behaviour (Ellen and Turner 1997, p. 838).

There are other factors supporting our opinion that further rent increase would be connected with the public cost growth. Due to the methodology of hedonic price simulations, we are not able to compute the hedonic price for all social dwellings, as some of the variables used for simulation were missing. Then a significant share of households would not move out of the sector as we are not able to find out their potential user costs, though in reality they would leave social housing and the residualisation process would process far more quickly. In the case of rent increase substantially above the rent price covering the operation and capital costs, we may also logically assume the increase in inefficiencies in social landlord performance. As municipalities, sometimes even housing associations, hold the local monopoly on the allocation of rental housing for those in need, they may start to increase the personal costs and/or spending additional income on not very well prepared expensive projects. Though some of inefficiencies may not appear due to the control made by national audit institutions, no control of public spending is ever perfect.

As assumed in the introduction, we do not take into account the wider macro-economic consequences of rent increase as a special profound macro-economic model would be needed for this purpose. However, Wilcox and Meen (1995) used the Joseph Rowntree Housing Model (devised by Geoff Meen of Oxford Economic Forecasting) when calculating public costs of higher rents in England. According to the results, the RPI increase would have a deflationary impact on the economy reflected in reductions in GDP and consumer expenditure, and increased unemployment. The 1 per cent increase in RPI would lead to an increase in annual unemployment related expenditures of £212 mil (pp. 2–3). It is not clear if the authors also took into account the positive macroeconomic impacts of higher rents (multiplication effect of higher local authority and housing association investments on refurbishment as well as higher level of household investments who tend more to avoid to wait on waiting lists if mortgage finance is affordable for them) but it seems very probable that rent increase is connected with additional public costs following from impact on wider economy.

If we look at our assumptions, there may be other reasons why we can expect higher public costs of higher rents. We assumed that new-comers have similar income and social structure as those remaining in the sector. However, according to CORE statistics showing the social and income structure of new floaters into housing associations' dwellings in England, the share of households eligible for housing benefit was higher among new entrants in 1996 than share of housing benefit recipients in housing associations' dwellings during the first stages of rent increase simulations (Holmans and Whitehead 1997, Wilcox and Meen 1995). This may be because social housing started to be stigmatised and perceived as less attractive by middle class in the past years.

#### Additional Simulation Options

In the final section of the Scottish simulations, we would like to present results of simulations when we made several changes in some of the entry parameters. These changes should mainly show what simulations we may proceed once having the model syntax. Let us simulate what would happen if we were to:

- increase rents only in municipal housing leaving the housing association rent prices on their 1996 level;
- re-calculate rents according to the property value of housing;
- change the taper of housing allowance from 0.65 to 0.35.

For the purpose of property value rent (PVR) calculation we used the same approach as Findlay et al (2002). We found out the average rate of return from current rents in social housing on simulated hedonic prices (4.737%) and, by multiplying it with hedonic prices, we obtained PVR for all social dwellings. The “redistribution” effect did not have an impact on average value of rate of return in social housing, though it led to general rent price changes. Rents for municipal dwellings grew, on average, by 6.14%, while rents for housing associations' dwellings decreased, in average, by almost 6%. When evaluated for the whole sector, the rents in social housing increased by only 4% but the consequences on the movement of households and via that on the shape of relative public cost curve were far more significant.

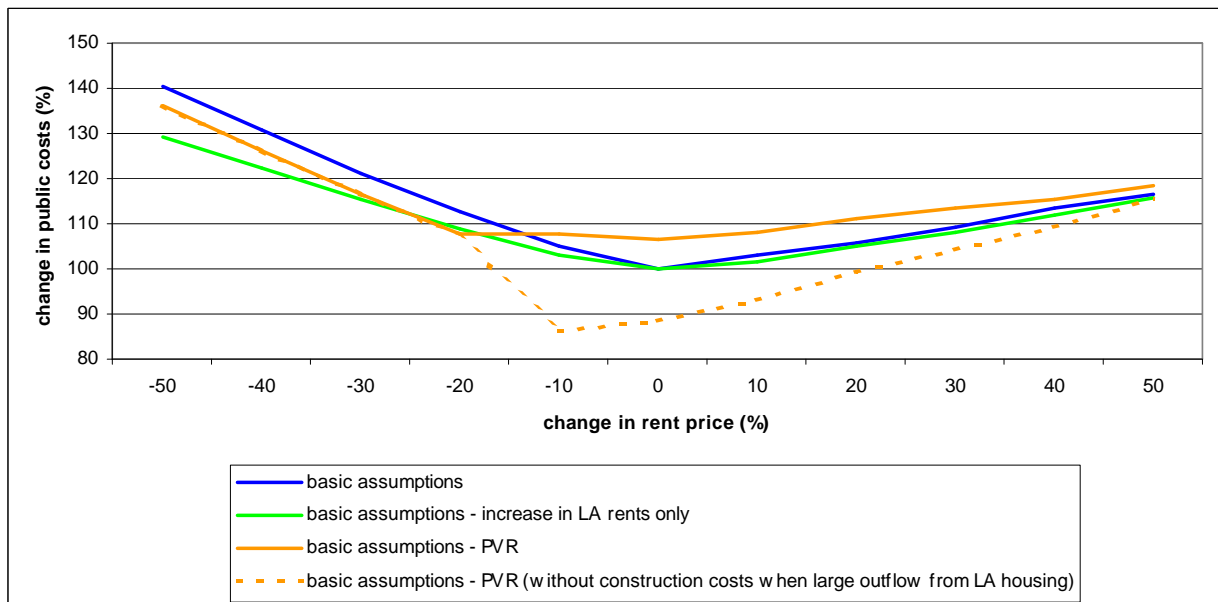
Although from the point of view of average rent increase the introduction of PVR does not mean very significant change, the number of households leaving the municipal housing sector in the zero stage of simulation (only when PVR rents are introduced) would exceed by one third the number of households leaving this sector for 100% rent increase in the case of basic model simulations. In other words, such change would

lead to substantial outflow of large share of current municipal households and this outflow would be higher than if we held the existing rent-price relations and increased rent by 100%. However, the “timing”, as well as the scale of movement out of the sector can be different in reality because we used the assumption on relative user costs’ comparisons that does not necessary reflect the practice.

According to our assumptions, if user costs of owner-occupied dwelling are lower than rent net of housing benefit and if other conditions are met, the household would move to home-ownership tenure. In the case of introduction of PVR according to the above described methodology, the net rents would be higher than user costs for the same housing already in the zero stage of simulation for the overwhelming majority of households who do not receive housing benefit – and this applies also for 10% rent decrease simulation stage. Only after rents fall between 10% and 20% from their zero stage values would the outflow immediately stop to almost none. Although, again, in reality this would not happen in such extreme form, it is clear that PVR approach would lead to the creation of hidden rent ceiling under which few movements would appear and above which the mass movement can probably appear, thus making movements much more dependent on actual house prices and interest rates (like in private rental housing).

In view of the fact of mass movement of household above hidden rent ceiling, our original assumption on housing construction cannot be applied here. In this case, all households from 1996 local authority waiting lists would be immediately offered a social flat. We therefore also drew the relative public cost curve when construction costs are nulled for those simulation stages when such movements appears. The curves (together with relative public cost curve for municipal housing rents increase only) are presented in Figure 9.

Figure 9: Relative Public Cost Curve for Alternative Rent Settings in Scottish Social Housing, 1996 (after changes in entry parameters)



Source: own calculations

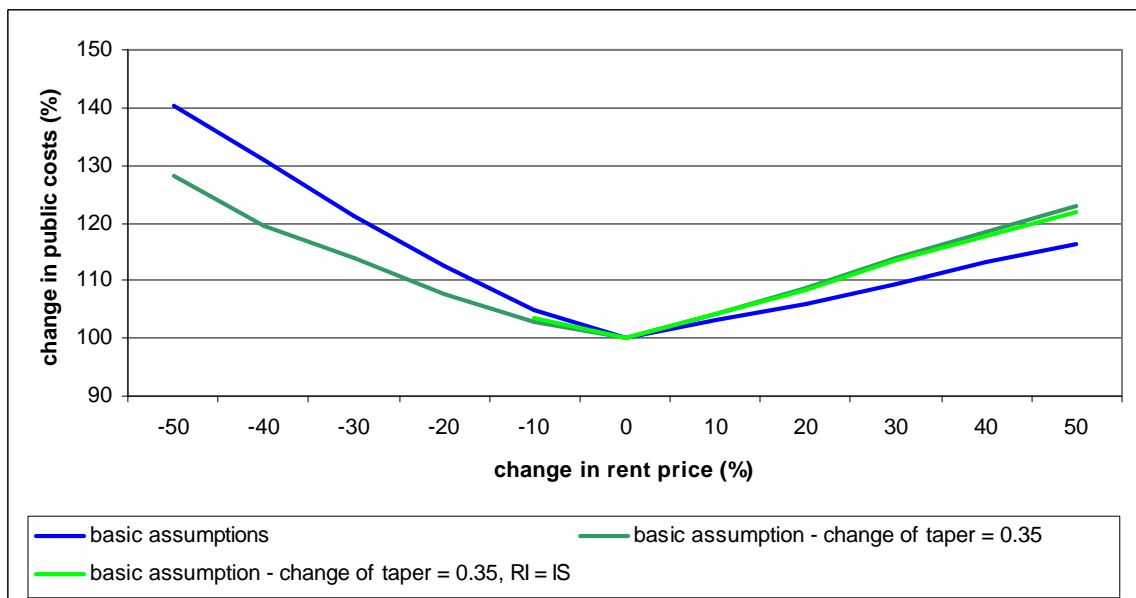
Note: LA means local authority, PVR means rents related to the property value

As we may see, there are no substantial changes in the main conclusions if we simulate public cost consequences of rent increase/decrease only in municipal housing leaving housing association rents at their zero stage level though the slope of relative public cost curve is softer both in case of rent increase and rent decrease. The opposite is true

when introducing PVR. The optimum rent price level would move to 10% rent decrease (when applying housing construction cost adjustment) and a significant breakpoint would appear between 10% and 20% rent decrease (resp. between 20% and 30% rent decrease). The PVR curves do not have the value of 100 for the zero stage of simulation because we already took into account the changes in costs in relation to the zero stage of simulation of the basic model.

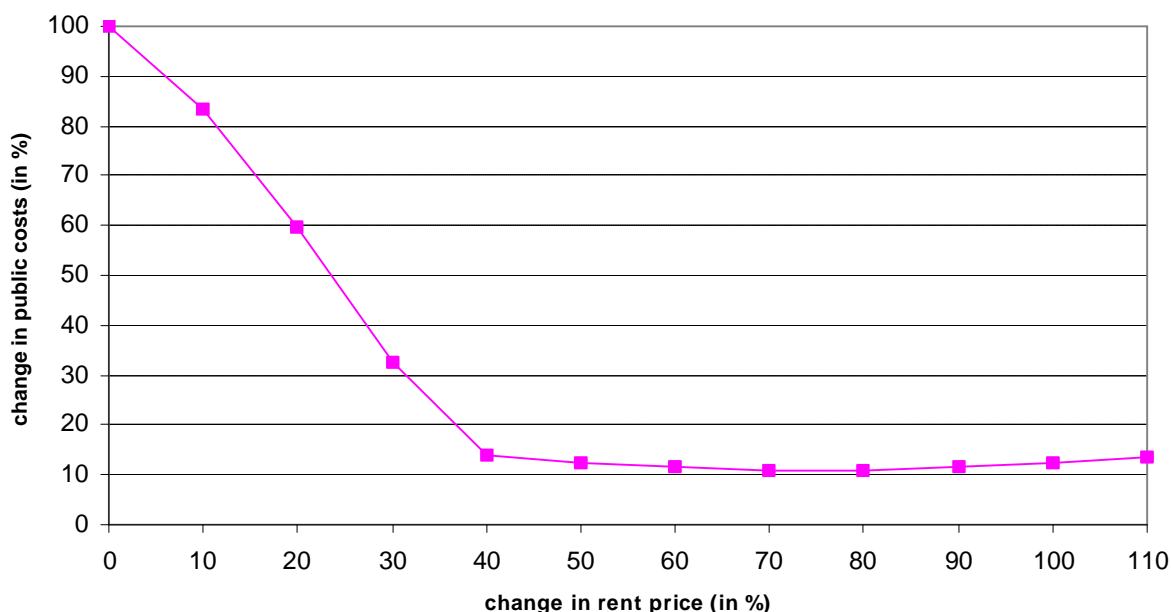
When simulating the change in housing benefit taper, we can assume that a more generous benefit model would shift the relative public cost curve more to the left. A higher share of people on housing benefit and lower turnover would lead to higher public costs in case of rent increase than it was the case for basic model. The more generous the benefit system is then the higher the absolute public costs are and the smaller the space is for rent increase in social housing. This relationship has been discussed already in the introduction and is confirmed by our analysis (see Figure 10). However, when taper is significantly decreased it should have clear consequences on labour market incentives because the danger of poverty trap due to less regressive benefit model is much less acute. Therefore, we made alternative simulations when the reservation income of unemployed was decreased by value of net housing costs and was thus equal only to the income support. Though more people would move to employment in such cases, this change did not affect neither the main conclusions nor the shape of relative public cost curve. The optimum for all simulations remain at the zero stage, i.e. for 1996 actual rents.

Figure 10: Relative Public Cost Curve for Alternative Rent Settings in Scottish Social Housing, 1996 (after change in housing benefit taper)



Source: own calculations

Figure 11: Relative Public Cost Curve for Alternative Rent Settings in Czech Municipal Rent-Controlled Housing, 2001



Source: own computations

### *The Case of the Czech Republic*

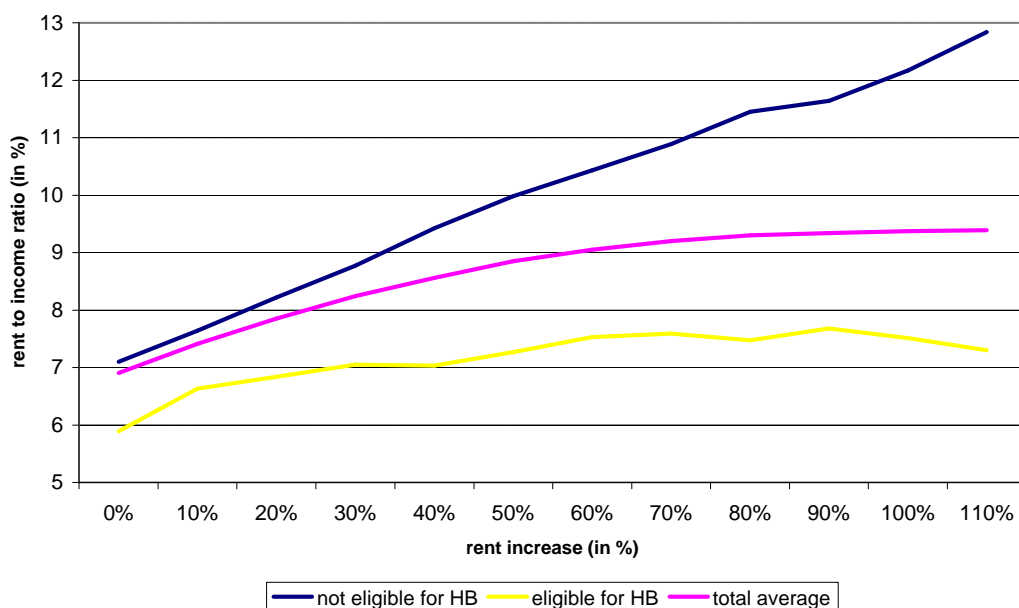
Figure 11 shows the shape of relative public costs' curve in the Czech Republic for ten rent price simulation stages. It is immediately clear that the space for "rational" rent increase in the Czech rent controlled housing is much wider than it was the case in the Scottish social housing in 1996.

If we examine Figure 11, we see that the critical point  $A_1$  (in the sense mentioned in the introduction), at which a potential greater rent increase should be carefully considered (a further rent increase would still contribute to a further reduction of public expenditures but the limit value of the gain starts to fall), is somewhere between a rent increase of 40% and 50%. Moreover, from 70% rent increase simulation stage any further rent increase becomes counterproductive from the point of view of public expenditures because it does not result in public savings. A rent increase beyond this critical point would decrease the amount of public funds saved for housing in absolute terms.

Figure 12 shows the development in average rent to income ratios for different simulation stages: a "quasi-normative" on average rent to income ratio in the whole sector would be, according to the results from relative public costs' analysis setting optimum at rent price equal to 1.7 multiply of current price, slightly more than 9%.



Figure 12: Average Rent to Income Ratio for Alternative Rent Settings in Czech Municipal Rent-Controlled Housing, 2001



Source: own computations, Family Budget Survey 2001

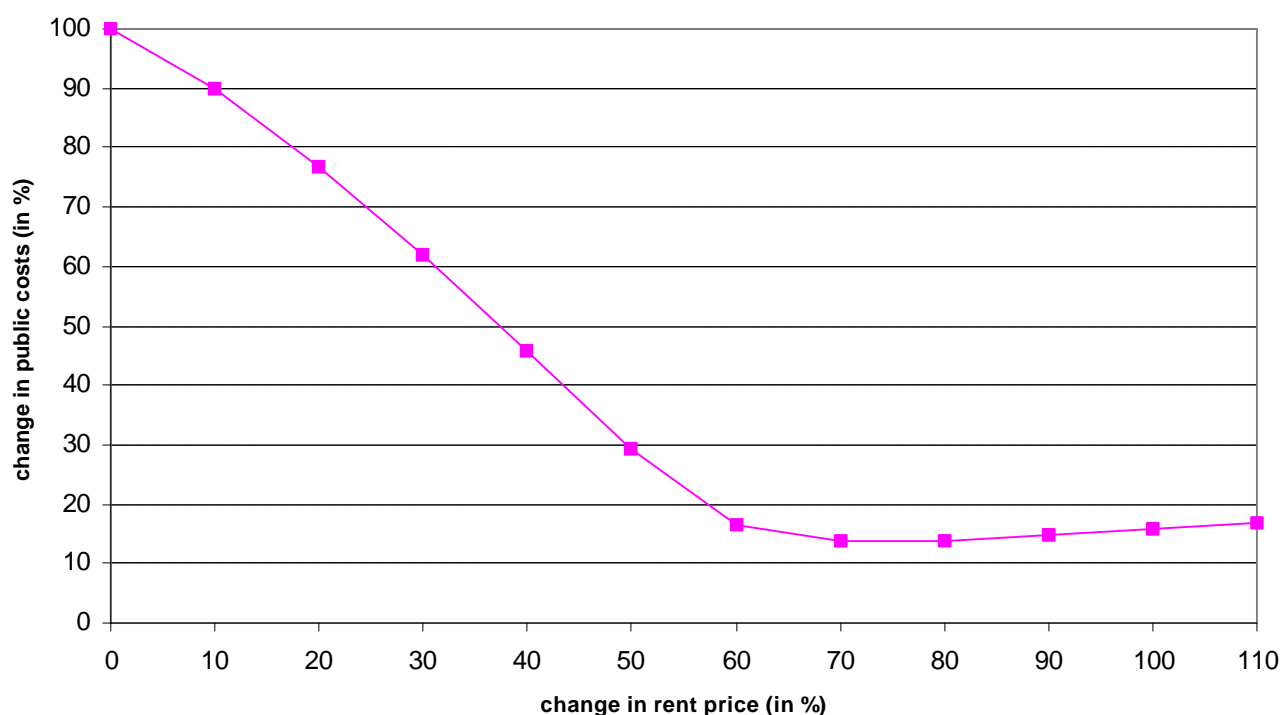
We can see from Figure 12 that the gap between those households eligible for housing benefit and those households who would not receive housing benefit is increasing in the same way, as it was the case in Scotland. However, this is a consequence of accepted eligibility ceilings and subjective welfare judgements and we are not able to evaluate it.

Finally, we changed some of our assumptions on housing construction in the simulations. It may be difficult to justify (although we have tried to do so) why the normative on neediness of new housing should be defined as 10% of the number of households on waiting list and then reduced as the turnover in existing municipal flats increases. Moreover, we have assumed that at least one third of the construction costs will be covered by commercial credits, which has proven to be problematic in the Czech environment. Even the doubling of the existing regulated rents would not eliminate additional revenue subsidies for new municipal housing (rents in new dwellings are counted in relation to rents in existing dwellings). Only if the rents were increased by 110% would the need for additional revenue subsidies be eliminated.

Obviously there are many other ways of setting the normative on neediness of new municipal housing. The aim of this study, however, is not to capture the results of all possible alternate solutions. Rather, it is necessary to select only two changes that may seem to be logic in the context of Czech situation. In the first case, we have defined the normative on neediness of new housing more in relation to the current Czech situation (and less in relation to the situation in Scotland). This time the annual normative has been defined as 10% of the volume of market rental dwellings in a given region. We have assumed that in each phase of rent deregulation the number of municipal flats it would be necessary to construct should equal 10% of the total number of rental flats leased for a market rent, with this number being reduced by the number of liberalised municipal flats in the given phase of simulation. In this respect, we have very carefully observed regional differences.

We have also changed the conditions in order to achieve an optimum combination for the financing of new municipal housing construction, i.e. a combination of commercial credit, qualified credit, grant and (possibly) operating subsidies. The conditions were changed in such a way that the need for co-financing from private capital resources (capital credit) was reduced from one-third to only one-tenth of the acquisition costs. The development in affordability ratios did not change by changing these assumptions but the shape of relative public cost curve is slightly different. Though the critical point  $A_1$  has shifted to the place between 50% and 60% and the public savings are high even after 60% rent increase, the main break point on relative public costs' curve remained at a level of 70%. The quasi-normative on average affordability of rent controlled housing (rent to income ratio in the sector) therefore remained again at a level slightly above 9%.

Figure 13: Relative Public Cost Curve for Alternative Rent Settings in Czech Municipal Rent-Controlled Housing, 2001 (after assumption changes)



Source: own calculations

It is necessary to note that the model can work on disaggregate levels also, although we did not apply more detailed regional or location differentiation. The *Scottish House Condition Survey* data contains a large household sample allowing for the special simulations for regions, sometimes even separately for the biggest cities (see, for example, the Gibb and Mackay 1999 report on the Glasgow social housing need and demand study). The work on the *Czech Family Budget Survey* data is, however, more limited. Such analysis may come up with much more precise and detailed results but it assumes that all estimations (prices, rents, wages, etc.) are made separately for each selected spatial unit. The same applies for more precise work with averages. Instead of using country averages for final cost computation, it would be better to use separate averages for each regional or location unit. This paper, therefore, did not aspire to

finalise the work on estimation of public costs of alternative rent settings either in the Czech Republic or in Scotland but rather to provide a useful benchmark which can be used for further precise research activities in this field.

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## ANNEX A

### Logit Model: Take-Up of Housing Benefit, Scotland

Variable	Beta
<i>Constant</i>	-1.223**
Housing benefit	0.048**
Square of housing benefit	0.000**
Number of dep. children	0.266**
Single parent household	0.972**
Couple or cohabiting	-0.830**
Retired HOH <sup>1</sup>	1.168**
Sick HOH <sup>1</sup>	1.938**
Unemployed HOH <sup>1</sup>	2.033**
Caring for home HOH <sup>1</sup>	1.498**
<i>ERREN</i>	0.467**
<b>Nagelkerke R<sup>2</sup></b>	<b>0.205</b>
<b>Predictions correct</b>	<b>80.6% (cut-off 0.3)</b>
<b>N</b>	<b>4.947</b>

<sup>1</sup> head of household

\*\* significant on 0.01 level of significance

Source: own computation, Scottish House Condition Survey 1996

## ANNEX B

### Heckmen's Model: House Price Estimates, Scotland

Heckman selection model  
(regression model with sample selection)

Number of obs = 10638  
Censored obs = 8400  
Uncensored obs = 2238

Log likelihood = -4340.463

Wald chi2(15) = 2284.96  
Prob > chi2 = 0.0000

	Coef.	Std. Err.	z	P> z	[95% Conf. Interval]	
<b>Ln price 1991-95</b>						
Detached housing	.2705477	.0204257	13.25	0.000	.230514	.3105814
Construction 1919-44	.0855359	.0269223	3.18	0.001	.0327692	.1383026
Construction 1965-82	.087656	.0214405	4.09	0.000	.0456334	.1296786
Construction after 1982	.1927092	.0198707	9.70	0.000	.1537634	.231655
Ln of floor area	.5020454	.0479999	10.46	0.000	.4079673	.5961234
Vacant flats in local.	-.0669619	.0259426	-2.58	0.010	-.1178084	-.0161155
Vandalism in local.	-.1001552	.027753	-3.61	0.000	-.1545501	-.0457603
Affluent owners local.	.1193721	.025105	4.75	0.000	.0701672	.1685769
Prosperous owners local	.1204219	.0214872	5.60	0.000	.0783077	.1625361
Inner city local.	.096396	.0258903	3.72	0.000	.045652	.14714
Worse council housing	-.0917224	.0290067	-3.16	0.002	-.1485745	-.0348702
Ln of number of rooms	.268072	.0302961	8.85	0.000	.2086928	.3274512
Dummy: purchase in 1994	.0397047	.0188565	2.11	0.035	.0027466	.0766628
Dummy: purchase in 1995	.0605986	.0187978	3.22	0.001	.0237557	.0974416
Urban location	.1108265	.0195132	5.68	0.000	.0725814	.1490715
Constant	8.0999	.199179	40.67	0.000	7.709516	8.490284
<b>Tenure choice (own = 1)</b>						
Sick HOH	-.7424632	.0874073	-8.49	0.000	-.9137783	-.571148
SEG professional HOH	.771406	.082564	9.34	0.000	.6095835	.9332285
SEG employers HOH	.6228742	.0536041	11.62	0.000	.517812	.7279363
SEG intermed HOH	.5222266	.0432533	12.07	0.000	.4374518	.6070015
SEG semiskilled HOH	-.2036427	.0508658	-4.00	0.000	-.3033377	-.1039476
SEG unskilled HOH	-.5099884	.0868479	-5.87	0.000	-.6802071	-.3397696
Small adult household	.214354	.0422974	5.07	0.000	.1314527	.2972553
Large family household	-.4277918	.0586099	-7.30	0.000	-.5426652	-.3129185
Single parent household	-.9037835	.0814588	-11.09	0.000	-1.06344	-.7441272
Ln of age of HOH	-.6408172	.0478339	-13.40	0.000	-.7345698	-.5470645
Self-employed HOH	.1300751	.0555986	2.34	0.019	.0211038	.2390465
Ln of household income	1.003231	.0316304	31.72	0.000	.9412367	1.065226
Constant	-7.743512	.3646751	-21.23	0.000	-8.458262	-7.028762
/athrho	-.3984467	.0423182	-9.42	0.000	-.4813889	-.3155045
/lnsigma	-1.013749	.0160493	-63.16	0.000	-1.045205	-.9822931
rho	-.3786191	.0362518			-.4473553	-.3054364
sigma	.362856	.0058236			.3516196	.3744515
lambda	-.1373842	.0141486			-.1651149	-.1096535
LR test of indep. eqns. (rho = 0): chi2(1) = 97.69 Prob > chi2 = 0.0000						

Source: own computation, Scottish House Condition Survey 1996

### OLS Model: Local Authority Rent Estimates, Scotland

Variable	Beta	Standardised Beta
<i>Constant</i>	1.306**	-
Detached housing	0.190**	0.052
Construction 1919-44	0.148**	0.237
Construction 1945-64	0.185**	0.378
Construction 1965-82	0.229**	0.422
Construction after 1982	0.239**	0.169
Vandalism in locality	0.031**	0.057
Prosperous owners locality	-0.130**	-0.113
Inner city locality	-0.128**	-0.078
Better council housing	-0.093**	-0.161
Worse council housing	-0.116**	-0.237
Poor council housing	0.051**	0.082
Ln of total floor area	0.381**	0.314
Ln of annual HI <sup>1</sup>	0.045**	0.088
Skilled manual HOH <sup>2</sup>	-0.027**	-0.051
<b>Adjusted R<sup>2</sup></b>		<b>0.148</b>
<b>N</b>		<b>4.199</b>

<sup>1</sup> net household income

<sup>2</sup> head of household

\*\* significant on 0.01 level of significance

Source: own computation, Scottish House Condition Survey 1996

### OLS Model: Housing Association Rent Estimates, Scotland

Variable	Beta	Standardised Beta
<i>Constant</i>	2.608**	-
Construction pre 1919	-0.259**	-0.371
Construction 1919-44	-0.180**	-0.120
Construction 1945-64	-0.071*	-0.074
Construction 1965-82	0.058*	0.072
Vandalism in locality	-0.073**	-0.099
Ln of annual HI <sup>1</sup>	0.108**	0.159
Single pensioner household	0.076**	0.101
<b>Adjusted R<sup>2</sup></b>		<b>0.209</b>
<b>N</b>		<b>1.058</b>

<sup>1</sup> net household income

\*\* significant on 0.01 level of significance; \* significant on 0.05 level of significance

Source: own computation, Scottish House Condition Survey 1996



# ANNEX C

## Heckmen's Model: Hourly Wage Rate Estimates, Scotland

Heckman selection model	Number of obs	=	7649
(regression model with sample selection)	Censored obs	=	2110
	Uncensored obs	=	5539
Log likelihood = -6899.464	Wald chi2(17)	=	1226.08
	Prob > chi2	=	0.0000

	Coef.	Std. Err.	z	P> z	[95% Conf. Interval]	
<b>Ln gross hour salary HOH</b>						
Full time work	.1765666	.0245378	7.20	0.000	.1284734	.2246597
Age of HOH	.0263424	.0044893	5.87	0.000	.0175435	.0351414
Squared age of HOH	-.0002916	.0000527	-5.53	0.000	-.000395	-.0001883
Couple or cohabiting	-.1183399	.0197704	-5.99	0.000	-.1570893	-.0795905
Urban location	.0567586	.0167224	3.39	0.001	.0239832	.0895339
SEG professional HOH	.5659207	.0289729	19.53	0.000	.509135	.6227065
SEG employers HOH	.3205584	.0223696	14.33	0.000	.2767148	.364402
SEG intermed HOH	.3315131	.018216	18.20	0.000	.2958104	.3672158
SEG skilled manual HOH	.0916502	.0180752	5.07	0.000	.0562235	.1270769
Vandalism in locality	-.0132709	.0196064	-0.68	0.498	-.0516988	.0251569
Affluent owners local.	.1836204	.0222724	8.24	0.000	.1399674	.2272734
Prosperous owners local.	.1212669	.0190691	6.36	0.000	.0838921	.1586417
Inner city locality	.0566731	.0222763	2.54	0.011	.0130124	.1003338
Worse council housing	-.0309051	.0198653	-1.56	0.120	-.0698405	.0080302
Poor council housing	.0597775	.0283742	2.11	0.035	.0041651	.1153898
Male HOH	.1002547	.0211719	4.74	0.000	.0587586	.1417509
Dummy: child 11-15 age	-.0136136	.0171771	-0.79	0.428	-.0472801	.0200529
Constant	.8541878	.0963923	8.86	0.000	.6652624	1.043113
<b>Working (unemployed = 0)</b>						
Age of HOH	.0995145	.0088613	11.23	0.000	.0821467	.1168822
Squared age of HOH	-.0013195	.0000991	-13.31	0.000	-.0015137	-.0011252
Couple or cohabiting	.7968476	.0421647	18.90	0.000	.7142064	.8794888
Urban location	-.0466311	.0461226	-1.01	0.312	-.1370298	.0437676
Single parent household	-.3946045	.0600469	-6.57	0.000	-.5122943	-.2769147
Vandalism in location	-.3067128	.0434086	-7.07	0.000	-.3917921	-.2216334
Affluent owners local.	.6926664	.0682269	10.15	0.000	.5589443	.8263886
Prosperous owners local.	.6589497	.0544382	12.10	0.000	.5522528	.7656465
Inner city location	.5073252	.0576039	8.81	0.000	.3944236	.6202268
Better council housing	.2817157	.0457445	6.16	0.000	.1920583	.3713732
Dummy: child 0-5 age	-.4674476	.0489168	-9.56	0.000	-.5633227	-.3715724
Dummy: child 5-10 age	-.2661245	.0433218	-6.14	0.000	-.3510337	-.1812153
Dummy: child 11-15	-.1138757	.048056	-2.37	0.018	-.2080638	-.0196877
Dummy: child 15-17	-.3137948	.0619599	-5.06	0.000	-.435234	-.1923555
Constant	-1.374703	.1918821	-7.16	0.000	-1.750785	-.998621
/athrho	-.6728556	.063203	-10.65	0.000	-.7967312	-.5489799
/lnsigma	-.7206808	.0142491	-50.58	0.000	-.7486086	-.6927531
rho	-.5868551	.041436			-.6622054	-.4997553
sigma	.486421	.0069311			.4730243	.5001971
lambda	-.2854586	.0233378			-.3312	-.2397173

LR test of indep. eqns. (rho = 0): chi2(1) = 20.84 Prob > chi2 = 0.0000

Source: own computation, Scottish House Condition Survey 1996

## ANNEX D

### OLS Model: Long-Term (Permanent) Household Income, Scotland

Variable	Beta	Standardised Beta
<i>Constant</i>	8.803**	-
Age of HOH <sup>1</sup>	-0.009**	-0.898
Squared age of HOH <sup>1</sup>	0.000**	0.853
Male HOH <sup>1</sup>	0.078**	0.053
Ethnical white HOH <sup>1</sup>	0.156**	0.021
Sick HOH <sup>1</sup>	-0.198**	-0.077
Employee or self-employed HOH <sup>1</sup>	-0.067**	-0.031
SEG Professional HOH <sup>1</sup>	0.827**	0.259
SEG Employers/Managers HOH <sup>1</sup>	0.558**	0.281
SEG Intermed/Junior non-manual HOH <sup>1</sup>	0.412**	0.251
SEG Skilled manual HOH <sup>1</sup>	0.259**	0.172
SEG Semiskilled manual HOH <sup>1</sup>	0.123**	0.068
Couple or cohabiting	0.546**	0.398
Number of dep. children	0.053**	0.076
<b>Adjusted R<sup>2</sup></b>		<b>0.456</b>
<b>N</b>		<b>18.030</b>

<sup>1</sup> head of household

\*\* significant on 0.01 level of significance; \* significant on 0.05 level of significance

Source: own computation, Scottish House Condition Survey 1996

## ANNEX E

### Logit Model: Move/Stay Decision (Home-Owners), Scotland

Variable	Beta
<i>Constant</i>	3.121**
Satisfied with current housing	-0.935**
Age of HOH <sup>1</sup>	-0.065**
Squared age of HOH <sup>1</sup>	0.000**
Number of dependent children	-0.134**
Urban location	0.253**
Detached housing	-0.375**
Semidetached housing	-0.431**
Terraced housing	-0.501**
Construction 1919-44	-0.276**
Inner city locality	0.329**
<b>Nagelkerke R<sup>2</sup></b>	<b>0.249</b>
<b>Predictions correct</b>	<b>60.6% (cut-off 0.23)</b>
<b>N</b>	<b>9.197</b>

<sup>1</sup> head of household

\*\* significant on 0.01 level of significance

Source: own computation, Scottish House Condition Survey 1996

### Logit Model: Move/Stay Decision (Social Renters), Scotland

Variable	Beta
<i>Constant</i>	-3.566**
Satisfied with current housing	-1.198**
Age of HOH <sup>1</sup>	-0.047**
Squared age of HOH <sup>1</sup>	0.000**
Male HOH <sup>1</sup>	-0.361**
Ln of permanent income	0.636**
Tenement housing	0.555**
<b>Nagelkerke R<sup>2</sup></b>	<b>0.288</b>
<b>Predictions correct</b>	<b>60.7% (cut-off 0.15)</b>
<b>N</b>	<b>6.806</b>

<sup>1</sup> head of household

\*\* significant on 0.01 level of significance

Source: own computation, Scottish House Condition Survey 1996

## ANNEX F

### Probabilities of Rational Real Reactions on Working Incentives, Scotland

#### EMPLOYED

##### *Male*

*starting probability 0.5*

- + single (0.1)
- married (0.1)
- having 1–2 children (0.2)
- having 3 and more children (0.3)

##### *Female*

*starting probability 0.5*

- + single (0.1)
- married (0.1)
- + husband not in employment (0.2)
- + having 1–2 children (0.2)
- + having 3 and more children (0.3)

#### UNEMPLOYED

##### *Male*

*starting probability 0.5*

- + single (0.1)
- married (0.1)
- having 1–2 children (0.2)
- having 3 and more children (0.3)
- age higher than 45 (0.1)

##### *Female*

*starting probability 0.5*

- + single (0.1)
- married (0.1)
- + husband not in employment (0.2)
- having 1–2 children (0.2)
- having 3 and more children (0.3)
- age higher than 45 (0.1)

Note: The final probability is computed as starting probability plus/minus additional points if valid. For example, employed lone mother having three children has the probability:

$$P = 0.5 + 0.1 \text{ (single)} + 0.3 \text{ (three children)} = 0.9,$$

i.e. relatively high probability that she will make some rational calculations of potential benefits and will behave according to it.

## ANNEX G

### Logit Model: Move/Stay Decision, Czech Republic

Variable	Beta
<i>Constant</i>	1.510**
Size of residence 1	-0.147
Size of residence 2	-0.449*
Size of residence 3	-0.172
Size of residence 4	-0.505**
Size of residence 5	-0.414**
Size of residence 6	-0.229
Size of residence 7	-0.304
Construction time 1	1.379**
Construction time 2	0.907**
Construction time 3	0.766**
Construction time 4	0.834**
Detached housing	-1.787**
Age of respondent	-0.046**
<b>Nagelkerke R<sup>2</sup></b>	<b>0.278</b>
<b>Predictions correct</b>	<b>63.3% (cut-off 0.23)</b>
<b>N</b>	<b>3.336</b>

\*\* significant on 0.01 level of significance; \* significant on 0.05 level of significance

Note: categories of size of residence are ranked from small villages to big urban centres (Prague forms referential category); categories of construction time are ranked from oldest to youngest constructions (construction after 1990 forms referential category).

Source: own computation, *Housing Attitudes 2001*