

Rent imputing for dwelling services: different methods

Metodi per il calcolo dell'affitto figurativo

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Riassunto: In questo lavoro vengono analizzati alcuni differenti metodi di calcolo per l'affitto figurativo delle famiglie che vivono in case di proprietà. Eurostat richiede che questo valore sia considerato come posta figurativa del reddito netto familiare. I risultati, dall'indagine EUSILC dell'Istat, indicano che il metodo dell'autovalutazione da parte delle famiglie intervistate tende a sovrastimare questo valore. Utilizzando invece un approccio econometrico, occorre considerare un problema di sample selection, poiché il modello può essere stimato, per poi applicarne i parametri ai proprietari di case, solo tra quanti vivono in una casa in affitto ai reali prezzi di mercato.

Keywords: Imputed rent, sample selection bias.

1. Introduction

In ESA95, the European System of Accounts, the ownership of the dwelling is considered to produce a service which is actually consumed over the time by the households. Even if no monetary transaction is implicated, ESA requires the estimation of the price of the service, by imputation of a rent, to be included in the household disposable income. Eurostat (2005) claimed that it allows for a better comparison of living conditions between households that have the same level of monetary income but different housing behaviour patterns. The imputed rent must be estimated for the owned dwellings used as households' main residence and for all households that did not report paying full rent, either because they are owner-occupiers or they live in accommodation rented at a lower price (or provided rent free) than the market one. The value to impute must be the equivalent market rent that should be paid for a similar dwelling as the one occupied.

2. Different methods for imputing rents

In this work we present three of the several approaches that can be followed to calculate the imputed rent. The self-assessment method consists in an estimate of the potential market rent of their own dwelling asked to the owner-occupiers. Its main disadvantage is the subjective nature of the estimates: self-assessed estimates may be subject to large degrees of both over and under estimation, depending on the circumstances under which the estimation is made. Such bias, difficult to measure, leaves uncertainty about the reliability of the resulting estimates (Arèvalo, 2001). In addition, referring to the market circumstances of the interview date implies that respondents do not take account of the time for which a household has been living in the same residence: often, tenants living

in the same dwelling for a long time pay less than tenants who have moved in recent times, even if the dwelling characteristics are the same. “Tenure discount” (Miron, 1990) must be taken in account in imputing rents because it is a precise household condition which may modify the price of dwelling services received. Eurostat recommends to take account of this aspect.

In the logarithmic regression, the rent can be interpreted as the price of an indivisible asset under perfect competition (Rosen, 1974), so that it is the result of the intersection between offer and demand for all the dwelling characteristics. In this contest, OLS regression can be used to explain the rent for the tenants as a function of independent variables, such as location variables, characteristics of the dwelling, tenure. The model can be written as:

$$\ln Y_i = \beta_0 + \beta_{1k} X_{ki} + u_i \quad i=1 \text{ to number of households paying a full rent} \quad (1)$$

where Y is the variable “current rent” and X is a vector of independent variables which determine the rent and u is the error term. The coefficient β , derived from sample rents, are then multiplied by the values of the explanatory variables of the owners sample in order to obtain their corresponding value of imputed rent¹. Such a model can suffer from a problem of sample selection, because the rent is observed only for tenants paying market rents, and this sample could differ from the rest of the population in a systematic way; thus, it would be unable to eliminate the selection bias resulting from unobservable factors explaining tenant or owner status.

The Heckman two steps procedure (1979) incorporates the possibility of selection bias in the estimation process. In this contest, this procedure involves the resolution of a probit model with tenant status as dependent variable and conventional explanatory variables. The coefficient found for the inverse Mill’s ratio are then injected into the regression model for rents.

Let R^*_i be the latent variable indicating the indirect utility of staying in rental condition for household i .

$$R^*_i = \alpha_0 + \alpha_{1k} Z_{ki} + e_i \quad (2)$$

where Z_i is a vector of explanatory variables and α is a vector of parameters to be estimated and e_i is a random term. Since R^* is not observable, the dependent variable R takes value 1 (tenant condition) if $R^* \geq 0$ and takes value 0 (owner-occupier condition) if $R^* < 0$. The value of Y is observable only for those households for which $R^* \geq 0$. The expected value of Y is the expectation of Y conditioned on it being observed ($R=1$). The Inverse Mill’s Ratio (λ) estimated from the probit, once injected in the OLS regression, allows for taking account of the selection bias. The regression model becomes:

$$\ln y_i = \beta_0 + \beta_{1k} X_{ki} + \beta_2 \lambda + u_i \quad (3)$$

The Heckman procedure requires that Z_i should include instrumental variables that can be excluded from X_i in equation (1). In the contest of perfect competition, the rent of the

¹ Regarding the tenure discount coefficient, the Canberra Manual (2001) states “Hence, the value to the consumer is close to the market value of the service flow, since the owner could presumably sell the housing unit and rent it back from the new owner were it more profitable to do so”. In this way, we better “sterilize” the tenure discount for the dwelling owners by putting equal to 0 the seniority for the owners, as they were entering in the dwelling in the new condition of tenant at the moment of the interview.

dwelling is determined just by the characteristic of the dwelling. In this way, we can use some characteristics of the household which may help to explain the rental condition². Once estimated the λ parameter, we can estimate the OLS model for tenants both controlling (Table1, 3rd column) and not controlling (Table1, 2nd column) for sample selection bias. The data for this study are taken from EUSILC, a survey carried out by ISTAT. It includes information on income and living conditions for 24,204 households³.

Table 1: *Rent equation, not correcting and correcting for sample selection bias*

Variable	OLS		OLS correcting for sample selection bias	
	Parameter	S.E	Parameter	S.E.
Intercept	4.9227*	0.1116	4.88524*	0.11381
Tenure	-0.02115*	0.00199	-0.02227*	0.0021
Tenure squared	0.00018571*	0.00004046	0.00019699*	0.00004101
Type of dwelling (Ref=flat in building with more than 10 flats)				
<i>Detached house</i>	-0.05706	0.03671	-0.0578	0.0367
<i>Semi-detached</i>	-0.10839*	0.03313	-0.10577*	0.03316
<i>Flat in building with less than 10 flats</i>	-0.0481**	0.02538	-0.04774**	0.02537
<i>Other type</i>	-0.07804	0.06571	-0.07966	0.0657
Surface (squared meters)	0.00781*	0.00075743	0.00759*	0.00076805
Surface squared	-0.00000694*	0.00000283	-0.00000648*	0.00000284
Bathroom inside	0.32461*	0.09937	0.31973*	0.09938
Terrace, garden	0.08166*	0.02652	0.07755*	0.02663
Leaking roof, dump walls	0.09589*	0.0235	0.09261*	0.02358
Scarce lightness	-0.07656*	0.02957	-0.07709*	0.02956
Area of residence (Ref=North East)				
<i>North West</i>	-0.12846*	0.02981	-0.12483*	0.02988
<i>Centre</i>	-0.16864*	0.03484	-0.17201*	0.03489
<i>South</i>	-0.46275*	0.03251	-0.461*	0.03251
<i>Islands</i>	-0.73168*	0.04043	-0.7324*	0.04042
Demographic size (Ref=less than 10,000 inhabitants)				
<i>More than 250,000</i>	0.45662*	0.03436	0.47395*	0.03589
<i>50,000<inhabitants≤250,000</i>	0.29261*	0.03026	0.30499*	0.03115
<i>10,000<inhabitants≤50,000</i>	0.24119*	0.0277	0.24647*	0.02788
Noise, pollution in area	0.01148	0.02173	0.0111	0.02172
Crime in area	-0.06061*	0.02787	-0.05777*	0.02791
Λ			0.04286**	0.02569
Adjusted R ²	0.3331		0.3335	

*Significance at 5%. **Significance at 10%.

The variable measuring the possible sample selection bias (λ) is found to be statistically significant, implying that there is evidence of such a bias and failing to control for this

² The variables chosen as explicative for the probit estimates are the age, the professional condition, the civil status, the nationality and the education of the household head; the number of household members and of income earners; the demographic size of the municipality and the geographic repartition. Unfortunately we do not have survey information on dwelling taxes and loan rates in the different areas of the Country.

³ In the model are considered the 2,940 households paying a full rent. The variables chosen as explicative variables regard the location and the characteristics of the dwelling and the tenure, and are the ones presented in table 1. To consider the non-linear effects of the dwelling size and of the tenure on the rents, these variables are also presented in squared form. Data refers to the 2004 survey.

could lead to biased estimates. We turn now our attention to the coefficients of the explanatory variables. As expected, the useable surface is an important determinant, with a positive effect, of the imputed rent, even considering its non-linear effect. Also tenure has a large, and negative, impact on the rent. Households living in the North are found to have greater value than in the South. Households living in municipalities with an high level of urbanisation (proxied by demographic size) pay higher rents⁴. The coefficient on the security problem is negative. Bad housing conditions imply a lower value of rent whilst amenities, such as terraces or gardens, increase the value.

In table 2 the average values for the imputed rent obtained by the three methods are presented. Both the econometric methods present lower average values than the self-assessment approach. The Heckman's procedure underestimates the value of the impute rent with respect to the OLS approach. However, the analysis showed that exists a selection process that affects the imputed rents and that must be taken in account.

Table 2: Average imputed *rent by area of residence*

	North West	North East	Centre	South	Islands	Italy
Self-assessment	595	627	633	365	323	530
OLS	448	533	460	322	253	419
Heckman	420	499	431	301	237	393

3. Conclusions

The present paper is a preliminary analysis of different computational methods for service dwelling for owner-occupied dwellings. The results show that with the self-assessment method the households overestimate the rent market for their dwellings with respect to OLS method. Utilizing an OLS approach, we have to face a sample selection problem. Once corrected for sample selection bias, we find lower values of the imputed rent in respect of the OLS estimates. Moreover, we do not think that the tenure discount, existing for the rental stock of households, must be considered in estimation the imputed rent, as suggested by Eurostat.

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⁴ It also emerges from the coefficients of the type of dwelling.