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Item 1(c) of the provisional agenda

**MEASURING THE NON-OBSERVED ECONOMY IN NATIONAL ACCOUNTS**

**ESTIMATING OWNER-OCCUPIED DWELLING SERVICES:  
USER COST APPROACH**

**User cost estimates of dwelling services for Croatia<sup>1</sup>**

Note by the Central Bureau of Statistics of the Republic of Croatia

*Summary*

The paper presents two methods of calculating imputed rent; the official one and preliminary method which was considerably improved during the Eurostat-EFTA-OECD project on measuring the non-observed economy in the Western Balkan Region. The main aim of the paper is to describe how all relevant flows and stocks values on dwellings were derived and to show which problems remain to be solved in near future.

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<sup>1</sup> CBS would like to thank to Mr. Nadim Ahmad from OECD on his valuable advices.

## **I. INTRODUCTION**

1. In Croatia, according to the Census of Population in 2001, 96% of inhabited dwellings are privately owned (natural persons), while legal entities own just 4% of dwellings.
2. Analysing the 2001 Census of Population, the proportion of households renting their homes amount to only 3,8%. Due to this fact and the high percentage of private ownership, as well as the non-existence of a statistically relevant dwelling rentals market survey, in the present calculation of dwelling services for Croatia we used the indirect calculation method – simplified user cost method. This method of was adopted in 1990. But we were aware that it contained weaknesses. In the calculation of gross rent for example we include dwellings for permanent residences, but not temporary residences such as holiday homes. Moreover current calculations make no estimate for a notional net operating surplus.
3. Based on this approach current estimates of imputed rent amount to no more than 6,2% of GDP in 2005; a figure that is significantly lower than might be expected, compared to other countries, even more so after making corrections for the NOE that raise the denominator in this percentage (GDP).
4. The following sections provide an overview of the improvement we envisage in the estimates reflecting the user-cost guidelines, in line with Eurostat recommendation, provided by the OECD.

## **II. CALCULATION OF DWELLING SERVICES OUTPUT FOR OWNER-OCCUPIED DWELLINGS**

5. Calculations were carried out on the basis of template tables, provided by the OECD which described the detailed methodology, for the 1999-2005 period. In the following chapters, estimation of each item of the template table is described.

### **A. Intermediate consumption**

6. Item UC01 'Expenditure on maintenance and repair of owner-occupied dwellings' was estimated on the basis of the Household Budget Survey. These estimates demonstrated considerable and implausible volatility, however, and the advice of the OECD was that we calculate this component by taking the average expenditure to imputed rent ratios (10.7%) over the whole period (1999-2005) as the basis for smoothing.
7. Data for items UC02' Gross insurance premiums paid on owner-occupied dwellings' and UC03' Insurance claims paid to owners' are collected from the database of Supervisory Agency for Insurance Companies.

### **B. Other taxes on production**

8. In item UC08 'Total taxes paid by owners' we include taxes on holiday homes where the taxpayer is a natural person or a legal entity who is the owner of a holiday home. Data source is the Tax authority database.

### C. Consumption of fixed capital

9. Central Bureau of Statistics (CBS) calculates data on dwelling stock with a quantity-price method for one benchmark value (2001) and the perpetual inventory model (PIM) for years 1996 to 2005. Unfortunately we do not use the alternative PIM using; age-efficiency and age-price profiles but the standard PIM. Consumption of fixed capital (CFC) of dwellings is derived from net capital stock (NCS).

#### Benchmark value of dwellings – Census 2001

10. Most statistical offices have a very good database from the last census (or good administrative data sources) which makes this type of source ideal to measure dwelling stock.

11. The Census is a good source not just because of exhaustiveness but also because it is compiled according to international standards, the “Recommendations for the 2000 Censuses of Population and Housing in the ECE Region”. Besides being the source for quantity data, Census data are also the source of information on vintages and quality data (different types of dwellings depending on the facilities and other characteristics of dwelling). This information can be used for calculating gross and net benchmark value of dwelling stock.

12. Benchmark value of dwellings is calculated using data from the last Census on population, households and dwellings. Data from the Census are corrected with the net rate of undercoverage from the Post Enumeration Survey<sup>2</sup>.

13. Not all dwellings enumerated in the Census were included. Those that were are occupied dwellings, temporarily inhabited dwellings, dwellings used for vacation, collective dwellings, other inhabited premises that are not dwellings and garages.

14. Some doubts appeared about dwellings which are used for performing activities (share of this type of dwellings in total is 1,36%), dwellings used in the season of agricultural works (0,45%) and abandoned dwellings (2,26%). In the Eurostat-EFTA-OECD project on measuring the non-observed economy in the Western Balkan Region it was explained how the first two types of dwellings should be included in non residential buildings in the corresponding activity. But, except in exceptional cases, not the third.

15. In the 2001 Census, abandoned dwellings were enumerated if they were in order in construction sense, even partly, or if they could be prepared for habitation after minor repairs. Dwellings in old and dilapidated buildings were not enumerated as well as those situated in houses severely damaged in the war, by landslides or earthquakes that were not renewed, and houses that were intended for demolition<sup>3</sup>.

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<sup>2</sup> Department for International Development (DFID) from UK gave support to CBS in this Project. Main consultant was Mr. Basil Mahon.

<sup>3</sup> See methodological guidelines for Census 2001 on [www.dzs.hr](http://www.dzs.hr)

16. The fields from the Census data and used in our calculations are shown in the table below. The same fields are used for all types of dwellings which are included in CBS dwelling stock (AN.1111). All tables are produced at the level of town/municipality and have 8 parts for 1 room dwellings, 2 room dwellings etc. up to 8 and more room dwellings.

17. The method for calculating benchmark values can be explained in its simplest form by looking at Table 1 and picturing how these huge tables are multiplied with matrices of gross/net coefficients.

18. Two matrixes are constructed; one for gross and one for net value. They contain coefficients, and relationships between gross/net values by type of dwelling in relation to average dwellings.

19. Data in one cell; for example occupied dwelling with central heating, kitchen, toilet and bathroom from 1952 is multiplied with the corresponding cell from the gross/net matrix.

20. When CBS presented this (still unofficial) method at the last IARIW General Conference<sup>4</sup> one major comment from Mr. Marcel Timmer from University of Groningen was to introduce cross-classified data. This has now been introduced. Instead of 17 coefficients multiplied several times, we now have 26 variables (characteristics of housing unit) for gross capital stock (GCS) and 79 for NCS. Multiplying these variables for all possible combinations (cells in the table above) thousands of different coefficients are calculated.

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<sup>4</sup> Markku Suur-Kujala, Jukka Jalava, Marija Gojević; "Flows and Stocks of Fixed Residential Capital: the Croatian Experience".

**Table 1. Dwellings from database Census 2001**

1 room dwelling	Amenities of dwelling				
	Kitchen, toilet and bathroom	Kitchen and toilet	Kitchen only	Other combinations of auxiliary facilities	Without kitchen, bathroom and toilet
<b>Inhabited</b>					
<i>With central heating</i>					
Dwelling in cellar or basement					
Inhabited with central heating built in the period:					
1900 and before					
1901-1905					
...					
1946 -1950					
1951					
1952					
...					
2001					
Unknown					
Uncompleted dwelling					
<i>Without central heating</i>					
Dwelling in cellar or basement					
Inhabited without central heating built in the period:					
1900 and before					
1901-1905					
...					
1946 -1950					
1951					
1952					
...					
2001					
Unknown					
Uncompleted dwelling					
Etc. other types of dwellings from AN.1111					

21. Principle 3 from the EU recommendation Commission Regulation No. 1772/2005 describes how stratification of the housing stock should be done using a minimum of 30 cells. CBS can fulfil this only for quantity/quality but not for rents. We are lacking an unbiased database with transaction values, since we do not have an active real estate market.
22. For the reasons explained above, CBS had to use some assumptions to adjust average price to reflect the value of each type of dwelling depending on its quality, which were made using expert estimations.
23. For this benchmark (2001) the main source for gross/net coefficients is Purchasing Power Parities (PPP). In the PPP, the price of family house/dwelling is broken down into components of total price, cost of labour and material, tax (VAT), architect's and engineer's fees. Then shares for each variable (amenities of dwelling, central heating) are calculated as a percentage of the total price. These coefficients are used for matrices, for example central heating and ventilation in house represents 7,2% of total price. Dwellings without central heating are decreased by percentage of installations (1-7,2%), to show how this dwelling is less valuable than average dwelling. Beside PPP for size/number of rooms the source was International Comparisons of Housing (experience from the last ECP rounds), S. Sergueev.
24. Gross value represents the value of a given asset as if it were new. When, for example, dwellings of 40 years old, and one built today (with same facilities), are evaluated for gross capital stock it is probable that they will not have the same price (newly built m<sup>2</sup>) because these dwellings are built with different construction procedures, different materials etc. They have different qualities and therefore different values despite 'looking' the same on the surface. We came up with this idea when Mary O'Mahony from the UK National Institute of Economic Studies suggested using different age-price profiles depending on the different quality of houses in the same vintage (depending on the construction material and process of construction).
25. Questions on construction procedures and materials do not belong to the core topics in the UN's Census Recommendations, so we used information from a Croatian study that describes coefficients assigned by construction engineers to different types of dwellings. It is assumed that older dwellings, although obviously built from solid material, have a lower quality and that they are probably built under less stringent construction procedures. Houses built today have, for example, often incorporated solar cells in their roofs and different insulation systems. All of this provides information to estimate quality changes.
26. The net capital stock matrix has the same coefficients as those coefficients in gross capital stock for all elements except for year when they were built.
27. The end-year net value of dwellings in a given year (in PIM) is calculated by multiplying net capital and half of the investment value in that year (all at end year prices) by the annual depreciation rate. For benchmark data net values areas calculated by multiplying every vintage with corresponding accumulated depreciation since construction. For a family house from 1952, for example, accumulated depreciation would be: m<sup>2</sup> of dwelling space multiplied by the average price adjusted by  $(1-d)^{49}$  and corresponding coefficients for amenities and other characteristics of the house, relative to an average dwelling.

28. The share of net to gross value of dwellings by different regions can inform us about a combination of different factors affecting the value of dwellings; vintage structure, quality of dwellings, major improvements and input decay. For example, the biggest share of net to gross value in Croatia is in Vukovar, because most of the dwellings were rebuilt after the war.
29. CBS had a problem, identified by the OECD, in the average prices being used. CBS did not use the average price for an average dwelling, and as a result a distortion was introduced between the relative values of different dwellings and the relative quality between the dwellings in question. But now this has been corrected.
30. As it was already mentioned our square meters are multiplied with prices from the PPP. One may feel that this price is too low, especially if you are coming from developed economies where most of the housing stock is built and sold to households by developers.
31. Most of the houses in Croatia (especially before 2005) are built by their owners. So the valuation should be like that for any asset produced on own-account<sup>5</sup>. According to ESA95 the mark-up for net operating surplus or mixed income should be imputed, but also the cost of production too (ESA95 paragraph 3.113). It is difficult for us (we had few attempts<sup>6</sup>) to find a suitable source for this information. Until we do so we will need to continue to use the PPP.
32. It will be demanding/interesting to do the split of developers “margin” on the separate buildings and land components. Our guess for Croatia is that a significant proportion reflects land, typically the main driver for significant property appreciation, reflecting its scarcity. Newly built houses in some regions have considerably higher prices than in some other regions.
33. All 7 models/attempts at estimations produced in CBS are shown in Table 2. One of the versions in the past was calculated with an adjusted price of new dwellings sold. The Construction Department has two prices; the price of dwellings sold for capital and one a price for all other settlements in Croatia. The price for other settlements was multiplied with an index of adjusted disposable income to have data on prices at the level of 21 counties (21 prices). Then these 21 prices were multiplied with different types of dwellings to calculate the gross value of dwellings.
34. The first variable removed from this model was the index of disposable income. It can be used as a top-down distribution key for calculation of rent, but not for dwelling stock. Mr. Nadim Ahmad, our consultant on the Eurostat-EFTA-OECD project on measuring the NOE in the Western Balkan Region, pointed out that, for similarly specified buildings, differences in property values across regions (costal, rural, urban etc) fundamentally reflected mainly the differences in the value of land and not buildings. Location together with supporting infrastructure belongs to land not to buildings. The significance of this observation can be seen in table (2) below by the previous and current estimates.

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<sup>5</sup> Only recently (around 5 years) lots of new firms (with more than 5 employees) were registered in activity of construction and development and sale of residential real state (70.11.11). In the 1999 there was not one firm in activity 70 according to FINA database.

<sup>6</sup> The problem was that CBS does not have a data source for NACE activity at 6 digit levels.

**Table 2. Benchmark values (1.4.2001.) by 7 different models in million kuna**

Model	Land	Variables	Coefficients for GCS / NCS / NCS <sub>2</sub>	The level of	GCS	NCS (d=2,27%)	NCS (d=1,45%)	NCS (d=2,27%) / NCS (d=1,45%)
1	part. included	not CS	old/old	town/municipality.	765 476	464 529	-	-
2	part. excluded	not CS	old/old	county	703 254	451 358	-	-
3	part. excluded	not CS	new/old/new	town/municipality.	580 452	372 145	351 698	1,058
4	excluded	part. CS	new/new/new	county	519 202	249 482	314 863	0,792
5	excluded	part. CS	new/new/new	county	513 054	246 577	311 190	0,792
6	excluded	CS	new/new/new	county	453 735	258 030	325 038	0,794
7	excluded	CS	new/new/new	town/municipality.	453 842	258 109	323 634	0,798

**Legend**

Part. included = some elements still included in price for dwelling (in other costs and profit) that should belong to the land

Part. excluded = adjusted price of new dwellings sold

CS = cross-classified

Part. CS = partially cross-classified; for GCS 11 variables and 48 cells and for NCS one value of GCS to 131 cells

New Coeff. = improved after Mr. Nadim Ahmad (OECD) suggestions

Perpetual inventory method (PIM)

35. Retirement is not needed when geometrical depreciation is used, but we chose still to include an estimate based on empirical data from the Construction Department, who provide data on the number of dwellings excluded from dwelling stock. This number does not represent the true value of retirement because it is based on administrative data sources (local administration) and it covers only demolished dwellings reported.

36. Gross fixed capital formation (and the same goes for price indices) has only one source that in theory would be close to excellent; supply and use (SU) tables. Only balanced data on investment are good enough to make PIM. However the CBS is only able to use a second best source (still do not have SU tables).

37. Although supply and use tables are a powerful tool, problems related to the borderline between investment and maintenance will remain. How statistical offices treat, for example, repairing roofs is likely to differ.



38. Geometric *depreciation* is used currently. The average service life is taken as 80 years, based on empirical data from the Census. CBS calculated two declining balance rates. We calculated two different percentages of g: value by time a dwelling reaches 80 years – average service life compared to value of a new dwelling, from two different sources. For g 0,159 declining balance rate is 1,820 and depreciation rate (declining rate/80 years) is 2,274%. Second declining rate (based on g = 0,311) is 1,159 and result is depreciation rate of 1,448% annually. Our wish is to use linear depreciation and a mortality function in near future.

39. The *prices* are the most challenging part of this evaluation. There are problems of how to make an index for unique products, how to split the value of land and buildings and maybe even measure quality, since dwellings are becoming more and more equipped with higher technical specifications. We are still searching for a better price index than the one used at present. Producers' building material price indices had been used for a while but since this is not an output index we switched to a price index based on prices of 1m<sup>2</sup> new dwelling sold. However, land is a component of this price index which rendered it volatile. Therefore, we tried the consumer price index on maintenance and repair of dwellings but this is not an appropriate index for dwelling stock (it is a B method but only if the share of major improvements in GFCF is representative enough). Now we are using an implicit GDP output index for construction (which is also not perfect; a C method).

40. *Other changes in the volume of dwellings* are calculated by using the same source used for retirement figures. So they are also far from perfect and have to be improved in future by examining many available sources.

#### **D. Net operating surplus**

41. Estimates of operating surplus shown in Table 7 are based on a fixed 15% of value of land and net capital stock.

42. CBS made estimates of land under buildings by calculating differences for every transaction value (sold dwelling) and costs of newly built dwellings (our PPP average price adjusted with the corresponding net capital stock coefficient).

43. Quantity of land is calculated by assuming that households with land less than 0,1 hectares have yards and gardens. The surface of houses is multiplied with 2 (house + garden<sup>7</sup>). To calculate the value of land under apartments we take the surface of ground floor dwellings, increased by 5% to reflect the land under communal areas.

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<sup>7</sup> Land underlying buildings and structures (AN.2111) includes also yards and gardens.

44. The value of the land after multiplying with environmental and socio-economic coefficients (details can be found in the IARIW paper mentioned before) is increased by 20,2%. But after multiplying the value of land with a coefficient for infrastructure (quality of infrastructure) the value of land has decreased by 59%. This huge decrease is mainly because the infrastructure in Croatia is not as productive as in developed countries.

45. Different parameters are used to calculate the quality of infrastructure at the level of the country. Most important among them is the quality of road infrastructure and railway lines and stations, then telecommunication infrastructures (fixed lines, mobile networks, internet subscribers), ratio of number of shops on number of households and among them the most important infrastructure is education; number of persons in employment in kindergartens, ratio of pupils to schools, etc.

46. The difference between the transaction value per m<sup>2</sup> and PPP price is not only due to land. Major improvements during the service life of each dwelling are included in this difference too. The share of major improvements in this difference is calculated as the average for all years of percentages of differences between houses older than 80 years and PPP price and land.

47. The above mentioned average share for the period from 1997 to 2005 is 72,73% so for the land we took only 27,27% from the total difference<sup>8</sup>. Calculations are done like this; first from each transaction price per m<sup>2</sup> our average PPP price<sup>9</sup> is subtracted. Then this price was divided with PPP price for dwellings older than average (in Croatia it is 80 years). And average among them for Croatia is 72,73%.

48. CBS used these figures only for calculating land. The numbers were not used for improving the benchmark value because it was currently too difficult to do this in a methodologically correct way.

49. If statistical offices have a long series of investment and perfect price indices they can use PIM and PIM should also include major improvements. For benchmark data it is not easy to decide how many owners in each vintage have invested in a given house.

50. It is also confusing taking into account that according to the ESA95, SNA93 and GFS (from IMF) when a building is fully written off but still used, it should be recorded under economic appearance of a produced asset (K.4) in other changes.

51. When the numbers in Table 3 are added to Table 7, all fits together; imputed rent in NOE GDP is not so volatile; it is 10% for 1999 and 9% for other years.

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<sup>8</sup> Older houses need a lot of maintaining and improvements, one can even say they eat capital but also for some of them age-price profile goes up with years.

<sup>9</sup> Average PPP price adjusted for vintage of the house sold.

### III. CONCLUSIONS AND FUTURE WORK

52. It is evident from the results presented in the tables above that present estimation of dwelling services need to be improved according to the Commission Regulation No. 1772/2005. In the Central Bureau of Statistics we will try to improve valuation of land (which is for now estimated as fixed percentage of the value of dwelling stock -15%).

**Table 3. Value of land underlying buildings; AN.2111 in million kuna**

1999	2000	2001	2002	2003	2004	2005
100 023	93 282	102 959	120 108	130 576	149 756	156 543

**Table 4. Estimating expenditure on owner-occupied dwelling services (thousand HRK)**

		1999	2000	2001	2002	2003	2004	2005
<b>Intermediate consumption</b>								
UC01	Expenditure on maintenance and repair of owner-occupied dwellings	1.533.749	1.588.219	1.647.125	1.737.805	1.847.744	1.929.018	2.010.437
UC02	Gross insurance premiums paid on owner-occupied dwellings		225.614	232.434	256.591	272.263	288.571	319.963
UC03	Insurance claims paid to owners (minus)		85.981	92.872	128.353	110.886	121.223	128.765
UC04	Net insurance premiums paid by owners $(UC02) - (UC03)$		139.632	139.562	128.238	161.377	167.348	191.198
UC05	Total intermediate consumption (UC01)+(UC04)	1.533.749	1.727.852	1.786.687	1.866.043	2.009.121	2.096.366	2.201.635
<b>Other taxes on production</b>								
UC06	Taxes paid by owners on dwelling services							
UC07	Taxes paid by owners on the value of owner-occupied dwellings and their associated land							
UC08	Total taxes paid by owners (UC06)+(UC07)	40.240	42.088	42.408	50.808	55.467	59.758	63.989
<b>Consumption of fixed capital</b>								
UC09	Consumption of fixed capital on owner-occupied dwellings at current prices	5.609.855	5.796.233	6.017.600	6.375.677	6.792.415	7.045.902	7.323.339

**Net operating surplus**

UC10	Current market value of the stock of owner-occupied dwellings at the beginning of the year		287.766.748	296.476.054	309.493.432	328.558.858	346.234.292	362.442.489
UC11	Current market value of the stock of owner-occupied dwellings at the end of the year	287.766.748	296.476.054	309.493.432	328.558.858	346.234.292	362.442.489	376.276.405
UC12	Average current market value of the stock of owner-occupied dwellings at mid-year (UC10)+(UC11)/2	287.766.748	292.121.401	302.984.743	319.026.145	337.396.575	354.338.390	369.359.447
UC13	Rate of return on owner-occupied dwellings in percent per annum	0,025	0,025	0,025	0,025	0,025	0,025	0,025
UC14	Net operating surplus (UC13)*(UC12)	7.194.169	7.303.035	7.574.619	7.975.654	8.434.914	8.858.460	9.233.986

**Expenditure on owner-occupied dwelling services**

UC15	Expenditure on owner-occupied dwelling services (UC05)+(UC08)+(UC09)+(UC14)	14.378.013	14.869.207	15.421.314	16.268.182	17.291.917	18.060.486	18.822.949
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**Table 5. Components of output of owner-occupied dwellings in Croatia,  
in %, UCA estimates**

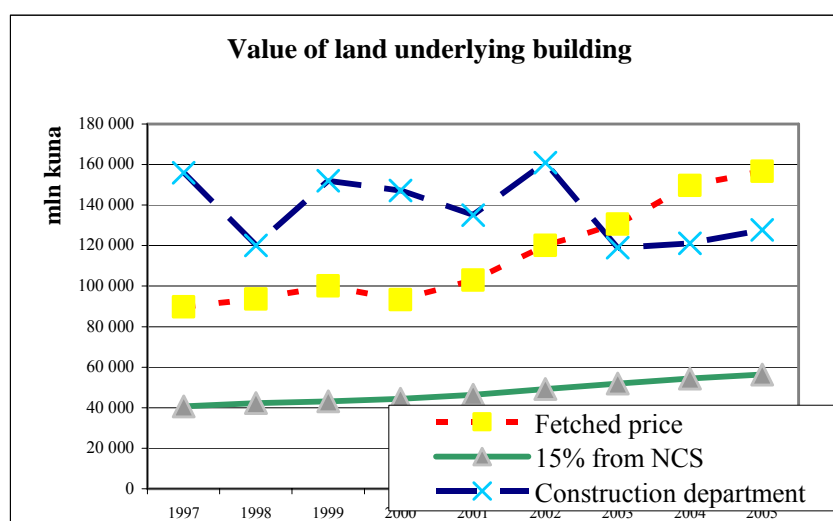
	1999	2000	2001	2002	2003	2004	2005
<b>Output of owner-occupied dwellings</b>	<b>100,0</b>	<b>100,0</b>	<b>100,0</b>	<b>100,0</b>	<b>100,0</b>	<b>100,0</b>	<b>100,0</b>
<b>Intermediate consumption</b>	<b>10,7</b>	<b>11,6</b>	<b>11,6</b>	<b>11,5</b>	<b>11,6</b>	<b>11,6</b>	<b>11,7</b>
Current maintenance and repairs	10,7	10,7	10,7	10,7	10,7	10,7	10,7
Insurance services		0,9	0,9	0,9	0,9	0,9	0,9
<b>Value added</b>	<b>89,3</b>	<b>88,4</b>	<b>88,4</b>	<b>88,5</b>	<b>88,4</b>	<b>88,4</b>	<b>88,3</b>
Consumption of fixed capital	39,0	39,0	39,0	39,2	39,3	39,0	38,9
Other taxes on production	0,3	0,3	0,3	0,3	0,3	0,3	0,3
Net operating surplus	50,0	49,1	49,1	49,0	48,8	49,0	49,1

**Table 6. Comparison of UCA estimates with present estimates of imputed rent  
(000 HRK)**

	1999	2000	2001	2002	2003	2004	2005
<i>UCA estimates</i>							
Output	14.378.013	14.869.207	15.421.314	16.268.182	17.291.917	18.060.486	18.822.949
Intermediate consumption	1.533.749	1.727.852	1.786.687	1.866.043	2.009.121	2.096.366	2.201.635
Value added	12.844.264	13.141.355	13.634.627	14.402.139	15.282.796	15.964.120	16.621.314
<i>Present estimates of imputed rent</i>							
Output	9.804.134	10.653.006	11.311.969	11.773.937	12.558.621	13.349.344	14.237.043
Intermediate consumption	3.431.447	3.819.488	3.959.189	4.120.878	4.395.518	4.672.270	4.982.965
Value added	6.372.687	6.833.518	7.352.780	7.653.059	8.163.103	8.677.074	9.254.078

**Table 7. Share of owner-occupied services in GDP  
(comparison of present calculation and UCA estimates)**

	1999	2000	2001	2002	2003	2004	2005
GDP (000 HRK)	141.579.068	152.518.827	165.639.462	181.230.888	198.421.914	214.983.101	231.348.838
GDP + NOE (000 HRK)	156.907.229	170.469.154	184.438.599	201.282.369	218.436.350	236.379.664	
Imputed rent / GDP - UCA estimates	10,2	9,7	9,3	9,0	8,7	8,4	8,1
Imputed rent/GDP - present estimates	6,9	7,0	6,8	6,5	6,3	6,2	6,2



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