

*Barbara Batóg**, *Iwona Foryś***

THE ANALYSIS OF THE SPATIAL STABILITY OF PRICES ON THE SECONDARY HOUSING MARKET

1. INTRODUCTION

The housing market is the best acknowledged segment of the Polish property market due to the role and importance an apartment plays in the life of every household. Since the purchase of an apartment is the long-lasting investment which significantly burdens the household budget, its price and, consequently, its area is a crucial factor affecting a potential buyers' decision. Still, these are not the only criteria determining the purchasing decision, which is clear when we observe considerable differences in prices of apartments of similar area. Such decisions are also based on an individual buyer's preferences, including location.

Choice of specific location as a place of residence is sometimes the result of "fashion". It is more often effect of marketing on primary market, while additional attributes (easy access to shops and municipal transport services) play a role on the secondary market.

In former studies, however, the researchers rarely refer to 'fashionable' locations where apartments are sold faster and with higher prices than in other parts of a city (Bryx 2006, DiPasquale and Wheaton 1992, Foryś 2011, Muelbauer and Marthy 1997, Wood 2005). That aspect of the property market in Warsaw was discussed by Batóg and Foryś (Batóg and Foryś 2011).

Present study concerns the impact of the economic crisis on the decisions of the apartment buyers, in particular the assessment whether the locational preferences of buyers have changed, if there exist residential areas that are chosen more often than others, if transaction prices have changed and if smaller apartments are being sold faster.

The analyses of housing markets usually concern the main cities in Poland. Therefore the local housing market was taken into consideration in the present study. The data come from the Cooperative Housing in Stargard Szczeciński (capital of the powiat). Housing stock of this Cooperative is 38,9% of the housing resources in the town. So it is possible to determine whether smaller apartments in cheaper locations are more often bought during crisis. The aim of the study is a spatial analysis of transaction prices on the local secondary housing market. The analysis was based on information about all transactions

* PhD, University of Szczecin.

** PhD, University of Szczecin.

of resources of the Cooperative Housing in Stargard Szczeciński in years 2007 (market boom), 2009 (beginning of the crisis) and 2011 (deepening of the crisis).

In the paper the hypothesis that prices on the secondary housing market are stable in time in given location was also verified. On the given local market there was no growth or loss of housing resources in the analysed periods. Also, apart from thermal efficiency improvement, there were no other significant upgrades, reconstructions or conversions that could have influenced the buyers' decisions. In order to verify above hypotheses two kinds of econometric models were applied: linear and logit ones. The transaction price was the endogenous variable and apartment attributes were the explanatory variables. In case of logit regression it was necessary to transform the dependent variable into a dichotomous one. The second part of the paper presents the applied models, the third one – characteristics of data, the fourth one – results of estimation and the last one – conclusions. The study points out that the buyers behaviour on small local markets is different from buyers behaviour on housing markets in the big cities.

2. APPLIED MODELS

In the literature about the property market we can find several theoretical proposals how to model apartment transaction prices. Yet, on the local market these models can be applied to a limited extent because of the lack of sufficient information concerning potential explanatory variables or due to the fact that the estimated models have small coefficient of determination.

In the article two approaches to the modelling of transaction prices obtained on the secondary housing market were applied. In the first approach linear econometric models with a transaction price as an explained variable and apartment attributes as explanatory variables were used. In the second approach the explained variable was an apartment unit price transformed into a dichotomous variable with the average unit price in a given year as a split point. In this case logit models were applied.

In both types of approach the explanatory variables included both quantitative continuous variables and qualitative variables. The latter were represented by dummy variables, each of which took the value 1 to indicate the presence of a given category of the qualitative variable and the value 0 to indicate the presence of other categories. Thus in the estimated models the location of apartments in specific housing estates was taken in consideration.

The linear econometric models estimated in the first approach took the form:

$$Y_i = \alpha_0 + \alpha_1 X_{1i} + \dots + \alpha_k X_{ki} + \sum_{l=1}^L \beta_l z_{li} + U_i, \quad (1)$$

where: Y_i – explained variable, X_1, \dots, X_k , – explanatory variables, z_l – dummy variables, $l = 1, \dots, L$, L – number of categories of a given qualitative variable, $\alpha_0, \alpha_1, \dots, \alpha_k, \beta_l$ – structural parameters, U_i – random error. The estimation and verification of the linear econometric models have been thoroughly discussed in the literature (Cameron and Trivedi 2005, Draper and Smith 1998, Johnston 1999, Maddala 2006). In the second approach the logit models were used:

$$\ln \frac{p_i}{1 - p_i} = \alpha_0 + \alpha_1 X_{1i} + \dots + \alpha_k X_{ki} + \sum_{l=1}^L \beta_l z_{li} + U_i, \quad (2)$$

where: p_i – the probability that the dichotomous explained variable will be characterised with a singled out category, i.e. the probability that a unit apartment price will be higher than average price in a given year; X_1, \dots, X_k , – explanatory variables; z_l – dummy variables, $l = 1, \dots, L$; L – number of categories of a given qualitative variable; $\alpha_0, \alpha_1, \dots, \alpha_k, \beta_l$ – structural parameters; U_i – a random error. The estimation and verification of the logit models has also been discussed in the literature (Cramer 2003, Gruszczyński 2010, Maddala 2006). In the both types of approach we cannot directly estimate the models (1) and (2) because the sum of the dummy variables is equal to the variable consisting of ones (representing intercept term). This is why when we need to estimate these models we perform reparameterization by eliminating one of the dummy variables. After the estimation of the reparameterized models we can transform the obtained results so that they can take form (1) and (2).

3. CHARACTERISTICS OF DATA

The empirical research concentrated on the secondary housing market resources of the Cooperative Housing in Stargard Szczeciński. These resources represent almost 40% of the housing stock in the town and the dominant part of the multi-family construction, hence the conclusions from the analysis of the sales contracts of these dwellings are relevant to the evaluation of the changes on the local housing market. The comprehensive study was conducted basing on information found in notary deeds and obtained from property owners. Each transaction is described by a set of variables:

- the date of sale (*dd-mm-yyyy*),
- transaction price (*zł*),
- apartment area (m^2),
- the number of rooms (*1,2,3,4*),
- the level the apartment is located on (*0,1,2,...,12* and *pp*– an attic),
- specific location within the housing estate in Stargard Szczeciński (*Chopina, Kluczewo, Letnie, Pyrzyckie, Stare Miasto, Zachód*),
- legal form of ownership (collective ownership, separate ownership).

The data concerned all transactions in 2007, 2009 and 2011. The choice of years was determined by the situation on the housing market: 2007 – the boom on the market, 2009 – the first year of the slump on the Polish property market, 2011 – the deep crisis on the property market and the last year when a full analysis could be made. What illustrates the condition of the examined market is the number of contracts concluded in the years in question. In 2007 there were 502 market transactions, which made from 3.2% to 12.7% of the market offer depending on the housing estate (Table 1). In 2009 the market offered over four times fewer apartments than two years before (1.5% of the total resource of the Co-operative). 134 sale contracts were concluded, which made from 0.5% to 3.4% of the housing resources in individual housing estates. The crisis deepened further in the following two years. In 2011 there were 116 apartments for sale, which constituted a mere 1.3% of the housing resources of the Co-operative.

Table 1. Apartments on offer in proportion to the total resource by location in 2007, 2009, 2011 (%)

Housing estate	2007	2009	2011
Total	5.6	1.5	1.3
Chopina	3.2	1.1	1.0
Kluczewo	12.7	3.4	3.2
Letnie	3.5	0.5	1.0
Pyrzyckie	6.2	1.5	1.2
Stare Miasto	5.5	1.2	1.2
Zachód	5.6	1.8	1.3

Source: own study.

In every analyzed year the best sales were recorded in Kluczewo. It is an estate consisting of low, two-storey buildings with apartments in the attics, which was converted from the former Soviet military base quarters. The apartments are small, inhabited mostly by young families who treat them as temporary dwellings, especially as they are far away from the town center. In the analyzed years the area of the apartments on offer ranged from 43.1 to 48.3 m² (Table 3), and their transaction price was from 140 to 150 thousand zloty (Table 2). The apartments sold in the housing estate of Stare Miasto were smaller, which was typical for that type of housing: the buildings were constructed in the 1960s and 1970s in traditional and semi-traditional ways and according to the contemporary standards of the minimum floor area (Foryś 2011, p. 114). They are also the oldest housing resources in the Co-operative. Due to their location the average transaction price, despite their mean floor area being smaller than in Kluczewo, was higher and ranged from 146 to 149 thousand zloty (Table 2).

Table 2. Average transaction price (zloty)

Housing estate	2007	2009	2011
Total	168 439.2	168 803.4	171 659.6
Chopina	187 958.3	165 666.7	194 000.0
Kluczewo	151 916.6	154 444.4	140 588.2
Letnie	215 851.4	238 000.0	213 000.0
Pyrzyckie	198 461.0	204 035.7	209 909.1
Stare Miasto	146 983.0	152 885.8	148 391.9
Zachód	176 469.1	172 887.8	185 618.2

Source: own study.

The apartments with the largest mean floor area on the housing market were offered in Pyrzyckie and Letnie housing estates, the location of which is regarded as attractive to the town residents. These estates are located around the town center, with convenient public transport network, low industrial buildings and larger apartments built in the 1980s by means of the large-scale technology. In the analyzed periods the average apartment in Pyrzyckie cost 198–210 thousand zloty, while in Letnie 213–238 thousand zloty. The apartments on offer in Chopina and the neighbouring Zachód housing estates with numerous high apartment blocks constructed in the large-scale technology were sold for the prices ranging from 165–194 thousand zloty (Table 2), and their average area was 49–55 m² (Table 3).

Table 3. Average floor area (m²)

Housing estate	2007	2009	2011
Total	49.4	48.9	49.7
Chopina	54.6	50.5	53.5
Kluczewo	46.3	48.3	43.1
Letnie	61.6	70.6	55.5
Pyrzyckie	61.2	60.4	63.8
Stare Miasto	42.2	42.3	42.8
Zachód	51.0	49.1	53.9

Source: own study.

In the period of study no tendency to decrease was observed for the average floor area on offer in the individual housing estates, with the exception of Kluczewo. There was also no steady downward tendency in case of the average transaction price although in 2011 the average price was lower than in 2009 in three estates: Kluczewo, Letnie and Stare Miasto.

The figures show the breakdown of the apartment unit prices in 2007, 2009 and 2011 (zloty/m²). In order to keep the data easily comparable the endpoints of the price distribution intervals and values of relative frequencies on the vertical axes were the same on all figures (Figures 1–3).

When looking closely at Figures 1–3 we can see that the distributions in 2007 and 2011 are similar and that they are slightly negatively skewed. Additionally, in those years the same price range could be observed

(3500–4000 zloty/m²) with the highest percentage of concluded transactions (about 40%). In 2009 the distribution of transaction prices was close to the symmetric distribution and the price range with the highest percentage of concluded transactions got wider (3000–4000 zloty/m²).

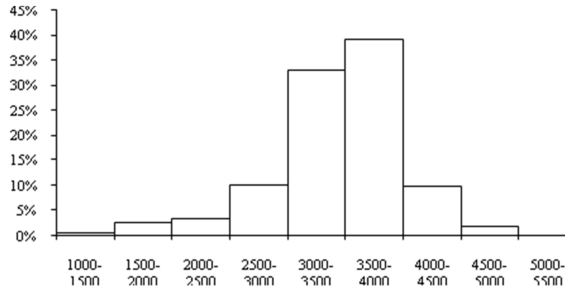


Figure 1. Distribution of the apartment unit price in 2007 (zloty/m²)

Source: own study.

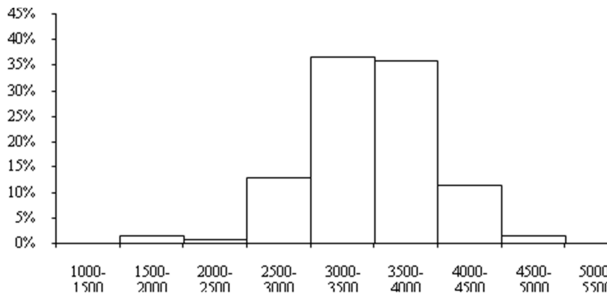


Figure 2. Distribution of the apartment unit price in 2009 (zloty/m²)

Source: own study.

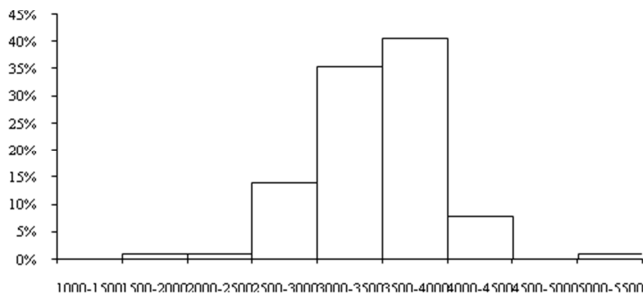


Figure 3. Distribution of the apartment unit price in 2011 (zloty/m²)

Source: own study.

In all the analyzed years over 90% of the transactions were concluded with the unit price ranging from 2500 to 4500 zloty. This percentage grew gradually in the subsequent years: in 2007 – 91.9% of the transactions, in 2009 – 96.3%, in 2011 – 97.4%. Additionally, in 2009 some apartments were sold for the price higher than 5 thousand zloty/m². No price was lower than 1.5 thousand zloty/m² (Figure 3).

4. RESULTS OF MODEL ESTIMATIONS

In all the examined years the floor area of an apartment on offer had a significant effect on its price. Out of the remaining potential explanatory variables (all of them were of the qualitative character) only the location proved important. The estimations of models in the first approach are shown in Table 4 and 5. In this approach the explained variable was the transaction price of an apartment (in zloty). Also, in case of each model elementary statistics describing the quality of the estimation, i.e. R^2 and the standard error of estimation were presented. The second columns of the Tables contain estimates of the parameters of the models after reparameterization. The last columns present the transformed estimates of parameters, i.e. the parameters of the model (1). All the estimated models were characterized by high values of R^2 , which means that they fitted the data well; by explained part of variance of the explained variable significantly greater than unexplained one; and by low values of the standard errors of estimation.

Table 4 and 5 present the results of estimation of linear models. In Table 4 dummy variables for all housing estates are presented whereas Table 5 presents only dummy variables with statistically significant parameters.

In 2007 a statistically significant parameter was obtained in Kluczewo and Pyrzyckie housing estates. The parameter estimates for both the estates were negative, which means that in these locations the obtained prices were significantly much lower than the average of all the transactions concluded in the Co-operative (Table 4). The example of Kluczewo clearly shows that buyers tend to pay less for an apartment in the location perceived by the local market as less attractive.

In 2009 a statistically significant parameter was obtained only in Kluczewo, so in the first year of the crisis the buyers' willingness did poorly depend on the apartment location and the transaction price was strongly correlated to the floor area. Worsening economic situation of households as well as the general uncertainty of how long and vast the crisis will be discourage people from apartment purchasing decisions, which can eventually make all the locations equally attractive.

2011 was another year of the deepening of economic crisis and, consequently, of the slump on the housing market. In the estimated models Kluczewo and Letnie had statistically significant parameters. The Kluczewo parameter was

negative, which means that in this particular housing estate the obtained prices were significantly much lower than the average of all the transactions concluded in the Co-operative. On the other hand in Letnie the parameter estimate was positive, which means that in this location the obtained prices were significantly much higher than the average of all the transactions concluded in the Co-operative (Table 4). It proves that in 2011 Letnie was on average more attractive than other housing estates in question.

Table 4. The results of the linear model estimation for the 2007, 2009, 2011 transaction price for all housing estates

Variable	Parameter*	Standard error	Statistics t	p value	Model (1) parameters
2007 rok					
Intercept	18 683.34	5 849.58	2.78	0.01	16 246.99
Floor area	3 091.83	106.37	29.07	–	3 091.83
Chopina	309.32	4 158.91	0.66	0.51	2 745.67
Kluczewo	9 873.04	3 313.00	– 2.24	0.03	– 7 436.69
Letnie	6 592.40	5 346.57	1.69	0.09	9 028.75
Pyrzyckie	– 9 412.15	3 513.69	– 1.99	0.05	– 6 975.81
Stare Miasto	– 2 234.61	2 656.85	0.08	0.94	201.73
Zachód					2 436.35
R ² = 0.694. adjusted R ² = 0.690. standard error of estimation: 28107.1					
2009 rok					
Intercept	7 907.48	9 673.31	0.82	0.42	1 358.46
Floor area	3 361.01	182.73	18.39	–	3 361.01
Chopina	– 12 134.22	8 171.75	– 1.49	0.14	– 5 585.20
Kluczewo	– 15 896.87	6 990.28	– 2.27	0.03	– 9 347.85
Letnie	– 7 340.36	15 587.58	– 0.47	0.64	– 791.35
Pyrzyckie	– 6 747.08	7 955.87	– 0.85	0.40	– 198.06
Stare Miasto	2 824.43	5 619.94	0.50	0.62	9 373.45
Zachód					6 549.02
R ² = 0.874. adjusted R ² = 0.764. standard error of estimation: 25358.5					
2011 rok					
Intercept	30 180.49	12 211.10	2.47	0.02	31 781.64
Floor area	2 882.40	214.62	13.43	–	2 882.40
Chopina	9 744.69	7 876.66	1.24	0.22	8 143.55
Kluczewo	– 13 825.44	6 895.34	– 2.01	0.05	– 15 426.58
Letnie	22 836.64	10 059.96	2.27	0.03	21 235.50
Pyrzyckie	– 4 121.42	8 155.18	– 0.51	0.61	– 5 722.57
Stare Miasto	– 5 027.60	5 902.95	– 0.85	0.40	– 6 628.75
Zachód					– 1 601.15
R ² = 0.749. adjusted R ² = 0.735. standard error of estimation: 22706.5					

* after reparameterization.

Source: own study.

Table 5. The results of the linear model estimation for the 2007, 2009, 2011 transaction price for housing estates with statistically significant parameters

Variable	Parameter*	Standard error	Statistics t	p value	Model (1) parameters
2007 rok					
Intercept	15 675.56	4 920.59	3.19	0.00	9 453.45
Floor area	3 142.04	97.86	32.11	–	3 142.04

Variable	Parameter*	Standard error	Statistics t	p value	Model (1) parameters
Kluczewo	-9 189.39	3 726.69	-2.47	0.01	-2 967.28
Pyrzyckie	-9 476.93	4 135.80	-2.29	0.02	-3 254.82
Others					6 222.11
R ² = 0.693. adjusted R ² = 0.691. standard error of estimation: 28073.6					
2009 rok					
Intercept	11 637.86	8 306.73	1.40	0.16	4 325.34
Floor area	3 257.51	162.82	20.01	-	3 257.51
Kluczewo	-14 625.05	6 418.13	-2.28	0.02	-7 312.53
Others					7 312.53
R ² = 0.756. adjusted R ² = 0.753. standard error of estimation: 25332.1					
2011 rok					
Intercept	25 121.55	9 454.05	2.66	0.01	29 078.67
Floor area	2 956.01	180.94	16.34	-	2 958.79
Kluczewo	-11 938.91	6 012.13	-1.99	0.05	-15 896.03
Letnie	23 810.27	9 635.45	2.47	0.02	19 853.15
Others					-3 957.12
R ² = 0.739. adjusted R ² = 0.732. standard error of estimation: 22871.4					

* after reparameterization.

Source: own study.

In the next stage the logit models were estimated. The results of estimation for years 2007, 2009 and 2011 are presented in Table 6. In this approach the explained variable was a unit transaction price of an apartment transformed in a dichotomous variable with an average unit price as the reference point. Each part of the table contains also the basic statistics presenting the quality of the estimation, i.e. the deviation D and R²_{counted} (Gruszczyński 2010). Analogically to the linear models, the second column of the table contains the estimates of the parameters of reparameterized models, while the fifth column presents the transformed parameter estimates, i.e. the model (2) parameters. All the estimated models are characterized by the high value of R²_{counted}, i.e. empirical classification of the transactions to two groups (above and below the average) is very similar to the classification made on the base of estimated model. Additionally, the values of the deviation D show that we cannot reject the hypothesis about the lack of differences between a given model and a full model (Table 6).

Table 6. The results of the logit model estimation for the 2007, 2009, 2011 unit transaction price

Variable	Parameter*	Standard error	p value	Model (2) parameter	Odds ratio (n)
2007 rok					
Intercept	1.376	0.439	0.002	1.320	
Floor area	-0.022	0.008	0.006	-0.022	
Chopina	0.267	0.306	0.384	0.323	1.381(36)
Kluczewo	-0.832	0.245	0.001	-0.776	0.460 (67)
Letnie	0.661	0.405	0.103	0.717	2.048 (21)
Pyrzyckie	-0.505	0.257	0.050	-0.449	0.638 (59)
Stare Miasto	0.073	0.197	0.709	0.129	1.138 (167)
Zachód				0.056	1.058 (152)
D = 523.78. p = 0.181 . R ² _{counted} = 0.631					

Table 6 (cont.).

2009 rok					
Variable	Parameter*	Standard error	p value	Model (2) parameter	Odds ratio (n)
Intercept	0.796	0.853	0.351	0.683	
Floor area	-0.019	0.015	0.214	-0.019	
Chopina	-0.189	0.555	0.734	-0.076	0.927 (12)
Kluczewo	-1.146	0.544	0.035	-1.033	0.356 (18)
Letnie	-0.166	1.068	0.877	-0.053	0.948 (3)
Pyrzyckie	0.045	0.529	0.932	0.158	1.171 (14)
Stare Miasto	0.780	0.426	0.067	0.893	2.442 (38)
Zachód				0.113	1.120 (49)
D = 139.7. p = 0.208. R ² counted = 0.657					
2011 rok					
Intercept	3.602	1.205	0.003	3.624	
Floor area	-0.064	0.022	0.004	-0.064	
Chopina	1.438	0.709	0.043	1.416	4.121 (11)
Kluczewo	-1.450	0.547	0.008	-1.472	0.229 (17)
Letnie	0.743	0.798	0.352	0.721	2.056 (6)
Pyrzyckie	-0.554	0.660	0.402	-0.576	0.562 (11)
Stare Miasto	-0.044	0.436	0.920	-0.066	0.936 (37)
Zachód				-0.022	0.978 (34)
D = 123.5. p = 0.162. R ² counted = 0.681					

* after reparameterization.

Source: own study.

In all analysed years the parameter accompanying floor area was statistically significant and negative. It means that the increase of the floor area caused the decrease of the probability of obtaining the unit prices higher than the average.

In 2007 the variables representing Kluczewo and Pyrzyckie housing estates had the statistically significant parameters. In both cases the parameter was negative, which means that in these locations the odds ratio $p/(1-p)$ (0.460 in case of Kluczewo and 0.638 in case of Pyrzyckie), as well as the probability of obtaining the unit prices higher than the average was lower than in all the remaining estates in general. The odd ratios for the rest of housing estates were greater than 1 (although they were not statistically significant) which means that for the Chopina, Letnie, Stare Miasto and Zachód housing estates the probability of obtaining the unit prices higher than the average was greater than in Kluczewo and Pyrzyckie housing estates.

In 2009 only variable representing Kluczewo housing estate had the statistically significant parameter. The parameter was negative which means that in this location the odds ratio $p/(1-p)$ (0.356), as well as the probability of obtaining the unit prices higher than the average was lower than in all the remaining estates in general. The odd ratios for Pyrzyckie, Stare Miasto and Zachód housing estates were greater than 1 (although they were not statistically significant) which means that in this locations the probability of obtaining the unit prices higher than the average was greater than in the remaining housing estates.

In 2011 the variables representing Chopina and Kluczewo housing estates had the statistically significant parameters. In case of Chopina the parameter was positive which means that in this location the odds ratio $p/(1-p)$ (4.121), as well as the probability of obtaining the unit prices higher than the average was greater than in the remaining estates. In case of Kluczewo the parameter was negative which means that in this location the odds ratio $p/(1-p)$ (0.229), as well as the probability of obtaining the unit prices higher than the average was lower than in the remaining estates. In case of the variables representing the remaining housing estates the parameters were not statistically significant, i.e. the odds ratio ($p/(1-p)$) of obtaining the unit price higher than the average was identical as in all the housing estates in general.

5. CONCLUSIONS

The study of the three years selected from various moments of the housing market business cycle did not confirm the evident decrease in the purchased apartment floor area on the local market. Similarly, no discernible downward market tendency was observed in relation to the average transaction price. By means of two types of approach to price modelling on the secondary market the housing estates where the prices were significantly different from the average were indicated. In all the three examined years only Kluczewo remained stable – the statistically significant parameters were negative there. Negative parameters do not mean that buyers are not interested in apartments in this location, because, despite the crisis, in the examined years the turnover in Kluczewo proved the highest in the Cooperative resources. The reason for the fall in prices should be sought in the economic situation of buyers and of the business environment on the property market in Stargard Szczeciński.

Disregarding the year of study, in four housing estates the price was explained solely by the apartment area, while the qualitative attributes did not seem to affect it. In the times of the deepening crisis (2011) the unit prices obtained in Letnie estate for the apartments of similar quality remained above the average in all the Cooperative housing estates in general. Apparently the buyers were then willing to pay the price that was higher than average, which proves that their location preferences changed in time. It seems that similar analyses should be continued in the subsequent turning points of the business cycle of the Polish property market.

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Barbara Batóg, Iwona Foryś

THE ANALYSIS OF THE SPATIAL STABILITY OF PRICES ON THE SECONDARY HOUSING MARKET

The purpose of the paper is the spatial analysis of transaction prices of apartments on the local secondary housing market. In the article the authors verified the research hypothesis that prices on the secondary housing market are stable in time in given location. They proved it in two ways. Firstly, the linear econometric models with the transaction price as an explained variable and the apartment attributes as explanatory variables were estimated. In the second approach a unit transaction price was transformed into a dichotomous variable and logit models were estimated. Both types of approach were applied in the chosen years of the business cycle on the property market.

ANALIZA PRZESTRZENNEJ STABILNOŚCI CEN MIESZKAŃ NA RYNKU WTÓRNYM

Celem badania jest przestrzenna analiza cen transakcyjnych, uzyskiwanych w obrocie wtórnym mieszkaniami na lokalnym rynku oraz analiza rozkładu cech charakteryzujących sprzedawane mieszkania. Przede wszystkim badanie skoncentruje się na przestrzennym zróżnicowaniu cen uzyskiwanych na rynku wtórnym, w tym odchyleniach cen od przeciętnej w każdej z wybranych lokalizacji.