Barbara Batóg iD

University of Szczecin, Faculty of Economics and Management
Institute of Econometrics and Statistics, barbara.batog@usz.edu.pl

Iwona Foryś iD

University of Szczecin, Faculty of Economics and Management
Institute of Econometrics and Statistics, iwona.forys@usz.edu.pl

The Temporal Stability of Buyers' Preferences for Property Localization on the Housing Market in Szczecin

Abstract: The housing market investors' decisions are caused by their subjective expectations. These decisions are to do with financial resources, activity of local developers and buyers' individual needs connected to the size of their household or their specific habits, as well as a sense of security and prestige of the neighborhood. The localization of a property is one of the most significant determinants of its price because of its spatial constancy. The attributes of a given residential area influence the value of properties and this phenomenon can be observed through intensity of transactions and transaction prices. On the other hand, the neighborhood's influence changes over time. These changes are sometimes slow but could be very substantial. That is why buyers' preferences can also change over time. The aim of this research is the analysis of the temporal stability of buyers' localization preferences on the housing market in Szczecin. The fixed effects model, which allows for the comparison of changes in apartments' prices in residential areas, has been applied. The data came from notarial deeds, from registers of real estate prices and values concerning transactions on the housing market in Szczecin.

Keywords: housing market, temporal stability, fixed effects model

JEL: C21, R31

1. Introduction

The real estate market is a local market (Kucharska-Stasiak, 2016). Shiller suggested that the real estate prices are influenced by the local situation, and by changes in the incomes of households, employment and national interest rates (Shiller, 2006). In Poland, while analyzing the market for long periods of time, it is also necessary to take into account political and economic changes. Since 1990, the Polish residential market has gone through several stages of development, which have been described as follows (Foryś, 2011):

1) the period of legal and organizational adjustment to the market economy (1990–1997);
2) the period of adopted solutions verification and pre-accession activities (1998–2004);
3) the period of convergence with the European market and international markets (2005–2008);
4) the period of deep crisis on the real estate market (2008–2012);
5) improvement of the economic situation and increase of investors' activity on the housing market, supported by governmental housing programs (after 2013).

During this time, households' abilities to purchase property, as well as their lifestyle expectations changed dramatically.

On the other hand, the investors' decisions on the housing markets are caused by their subjective expectations. These decisions are to do with financial resources, activity of local developers and buyers' individual needs connected to the size of their household or their specific habits, as well as a sense of security and prestige of the neighborhood. The localization of a property is one of the most significant determinants of its price because of its spatial constancy. However, buyers' preferences with regard to apartments' location are not constant over time.

A problem of localization preferences was examined by means of spatial methods in the works of Foryś, Batóg (2013) and Foryś (2011). The analyses provided were conducted for a shorter period of time and did not incorporate localization and time within the same model.

The aim of this research is to examine the temporal stability of the buyers' localization preferences on the housing market in Szczecin. The fixed effects model, which allows for the comparison of changes in apartments' prices in consecutive years and in the whole period, has been applied.

2. Methods

In the spatial analysis the models for panel data are widely used. The detailed description of these kinds of models can be found in many publications. Judge et al. (1985) distinguish five kinds of models that combine time series and cross-sectional data:

1) all coefficients are constant and the disturbance is assumed to capture differences over time and individuals,
2) slope coefficients are constant and the intercept varies over individuals,
3) slope coefficients are constant and the intercept varies over individuals and time,
4) all coefficients vary over individuals,
5) all coefficients vary over individuals and time.

The variable coefficient can be fixed or random. Anselin (1998) presents the case of error components models in which individual and time effects are considered as part of the unobservable random error and how spatial dependence can be incorporated into them. Matyas and Sevestre (2008) explain how to deal with the estimation of that kind of models and when ordinary least squares method could be applied. Maddala (2006) indicates conditions when models with random coefficient can be replaced by models with fixed coefficients. Johnston (1991) demonstrates the way of estimation of panel models with the use of replacing the original observations by the deviations from their unit sample means. Draper and Smith (1998) explain how to deal with dummy variables, i.e. to solve the problem of collinearity in panel models. Cameron and Trivedi (2005) describe nonlinear panel models, especially in the case of binary and count data.

Dańska-Borsiak (2011) presents problems and solutions to them when dealing with dynamic panel data models. These kinds of models should be estimated by means of generalized method of moments. The book contains many examples of applications of panel models but the data do not come from the real estate market.

In the research, two kinds of fixed effects models are applied. First one is given by formula (1). In this model the parameters for dummy variables change only over objects and data come from one period at a time.

$$Y_i = \alpha_0 + \alpha_1 X_{1i} + \ldots + \alpha_k X_{ki} + \sum_{l=1}^{L} \beta_l z_{li} + U_i, \tag{1}$$

where:
Y – endogenous variable,
$X_1, \ldots, X_k$, – exogenous variables,
z_l – dummy variables, $l = 1, \ldots, L$,
L – number of objects,
$\alpha_0, \alpha_1, \ldots, \alpha_k$, β_l – parameters,
U_i – random error.

It is assumed that the means of random errors U_i for each object are zero, their variances are constant and they are not correlated over the objects. The model form (1) shows that the parameter β_l for a given object is a parameter for a dummy variable which adopts the value of 1 in the case of the object l and the value of 0 in the case of other objects. A model with the full set of dummy variables cannot be estimated because of the collinearity. The solution is the following re-parametrization of the original model: delete one of the dummy variables (for example z_L) and change the values of remaining dummy variables in rows corresponding to the deleted variables from 0 to –1. Then the model could be estimated, even though one parameter (β_L) is missing. Because of the way of re-parametrization, the missing parameter could be calculated on the base of formula (2).

$$\beta_L = -\sum_{l=1}^{L-1}\beta_l \,. \tag{2}$$

The second model (3) differs from model (1) in the part concerning dummy variables. It contains two kinds of dummy variables: one set for objects and one set for years. The data concerns not only objects but also years.

$$Y_{it} = \alpha_0 + \alpha_1 X_{1it} + \ldots + \alpha_k X_{kit} + \sum_{l=1}^{L}\beta_l z_{li} + \sum_{r=1}^{T}\gamma_r z_{rt} + U_{it} \,, \tag{3}$$

where:
Y – endogenous variable,
$X_1, \ldots, X_k$ – exogenous variables,
z_l – dummy variables, $l = 1, \ldots, L$,
L – number of objects,
z_r – dummy variables, $r = 1, \ldots, T$,
T – number of years,
$\alpha_0, \alpha_1, \ldots, \alpha_k, \beta_l, \gamma_r$ – parameters,
U_{it} – random error.

It is assumed that the means of random errors U_{it} for each object and period are zero, their variances are constant and they are not correlated over the objects and years. The model form (3) shows that the parameter β_l for a given object is a parameter for a dummy variable that adopts the value of 1 in the case of the object l and the value of 0 in the case of other objects. The parameter γ_r for a given year is a parameter for a dummy variable that adopts the value of 1 in the case of the year r and the value of 0 in the case of other years. A model with the two full sets of dummy variables cannot be estimated because of the collinearity. The solution is the following double re-parametrization of the original model: 1) delete one of the dummy variables representing an object (for example z_L) and change the values of remaining dummy variables representing objects in rows corresponding to the deleted variables from 0

to –1, 2) delete one of the dummy variables representing a year (for example z_T) and change the values of remaining dummy variables representing years in rows corresponding to the deleted variables from 0 to –1. Then the model could be estimated, even though two parameters (β_L and γ_T) are missing. Because of the way of re-parametrization, the missing parameters could be calculated on the base of formula (4).

$$\beta_L = -\sum_{l=1}^{L-1}\beta_l, \; \gamma_T = -\sum_{r=1}^{T-1}\gamma_r. \tag{4}$$

3. Research results

The study used information about all transactions on the secondary housing market in Szczecin in 2006–2017. Every transaction from the notarial deeds was described by a set of main variables:
1) date of sale,
2) transaction price,
3) area,
4) localization (district).

It is difficult to measure the apartments' prices in Poland because of market imperfections and lack of qualitative data on transaction prices. This particularly applies to data for long series and collections of all observations (purchase transactions concluded on local markets).

Due to the long period of research, the analysis of prices only took place in four districts of the city, instead of in housing estates, as before (Batóg, Foryś, 2013). The north-south axis is the natural direction of the city's development, along the Odra River, as stated in the local spatial development plans.

However, some ownership changes after 1990 caused the city to spread also towards the north-west (the border with Germany) and towards the east (the city of Stargard). The second direction is associated with the modernization of the highway number 10 and facilities for investors in adjacent communities.

Neoclassical buildings dominate in the Śródmieście district. There are a number of over a century-old tenement houses, complemented by post-war buildings – mostly municipal buildings which are underinvested. Other districts are mainly filled with industrial buildings and new housing estates built by housing cooperatives or developers.

Some parts of the Zachód and Północ districts, which are in the neighbourhood of the Śródmieście district, still contain old tenement houses or pre-war villas. The Prawobrzeże district primarily comprises of large housing estates built by housing cooperatives, or individual single-family housing. The natural spatial division of Szczecin is created by the Odra River and Lake Dąbie, marked blue on the map (Figure 1).
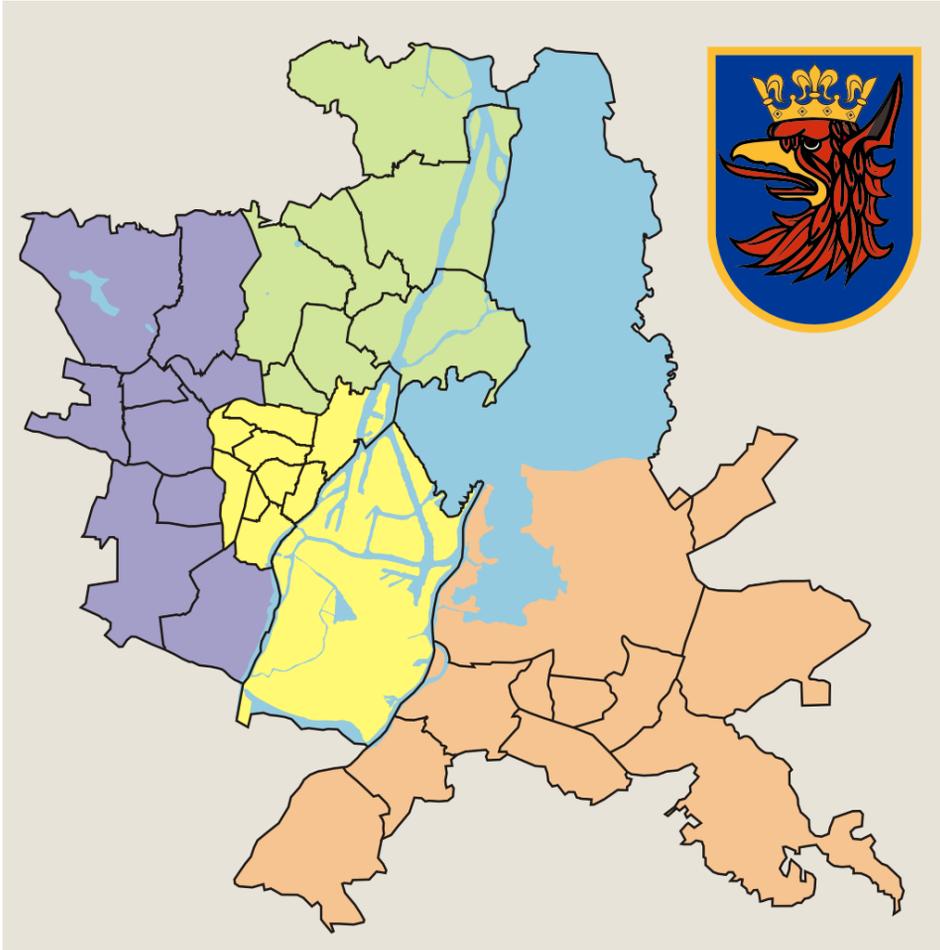
Figure 1. Districts in Szczecin: Prawobrzeże (orange), Śródmieście (yellow), Północ (green),
Zachód (violet)

Source: www.szczecin.pl

The numbers of transactions on housing market in Szczecin, by district, in 2005–2017 are presented in Table 1. The number of transactions in 2005 was much lower than in the following years. This might be the consequence of the economic slowdown in 2001–2002. The numbers of transactions in 2006–2016 were on a similar level. There was a big increase of the number of transactions in the last year of research. It could be due to the period of prosperity in Poland in 2017.

Average unit prices of apartments in Szczecin in 2005–2017 are presented in Figure 2. It can be observed that there was quite a big increase in average unit price in Szczecin in 2005–2008. In the following period (2009–2013) the tendency

has changed and average unit prices were characterized by slow decrease. In 2014 the situation changed again and the average unit price was increasing although very slowly.

Table 1. Numbers of transactions on housing market in Szczecin, by district, in 2005–2017

| Year	Północ	Prawobrzeże	Śródmieście	Zachód	Total
2005	101	100	336	271	808
2006	498	258	888	709	2353
2007	591	320	869	719	2499
2008	603	381	839	791	2614
2009	444	404	726	765	2339
2010	540	508	810	948	2806
2011	574	487	847	828	2736
2012	527	428	865	900	2720
2013	569	344	777	1010	2700
2014	552	447	1015	938	2952
2015	519	467	998	826	2810
2016	535	432	1069	891	2927
2017	664	658	1240	977	3539

Source: own calculations
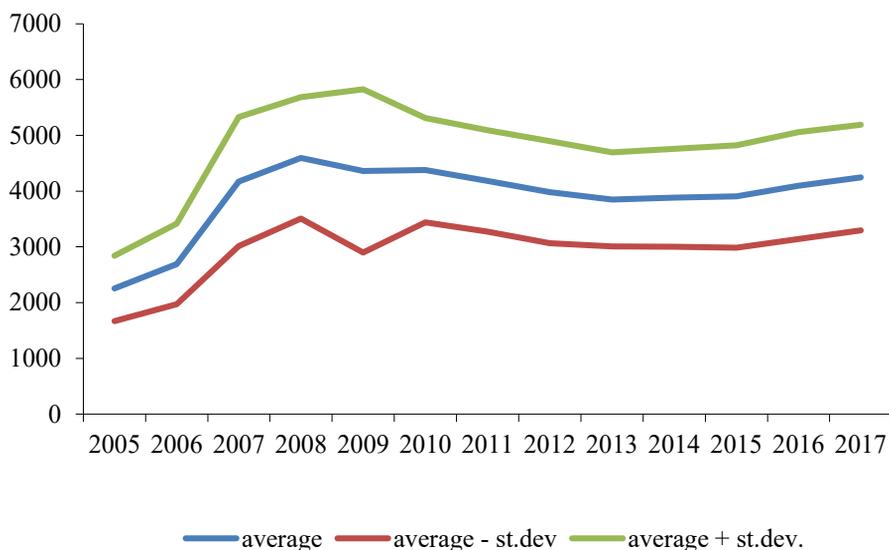
Figure 2. Average unit prices of apartments in Szczecin in 2005–2017

Source: own calculations

Median and quartiles of unit prices of apartments in Szczecin in 2005–2017 are presented in Figure 3. These results confirm conclusions form Figure 2. Also

it is visible that all lines in Figure 3 are almost parallel. This means that diversification of unit prices in Szczecin is stable over time.
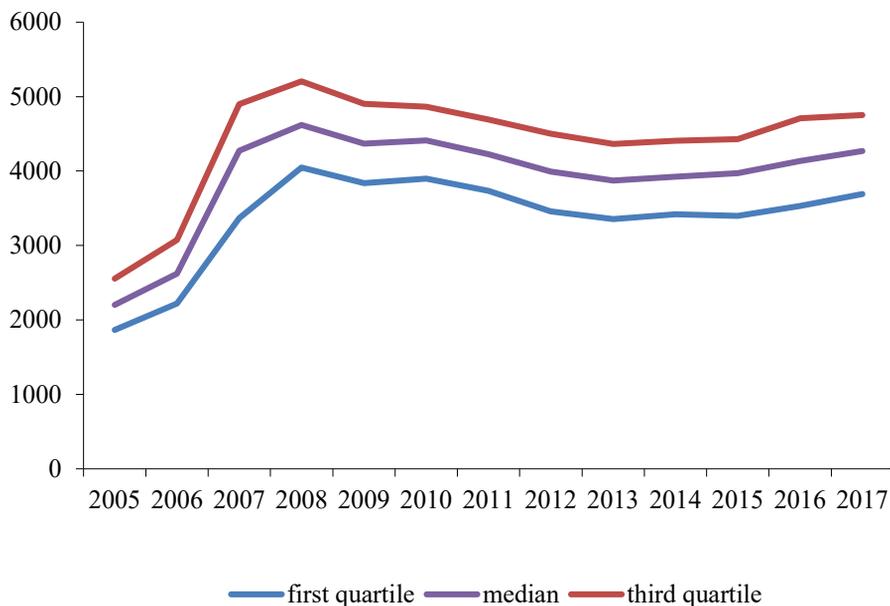

Figure 3. Median and quartiles of unit prices of apartments in Szczecin in 2005–2017
Source: own calculations

Average unit prices of apartments in Szczecin, by district, in 2005–2017 are presented in Figure 4. Analysis of average prices in individual districts shows the same tendency, consistent with the general trend prevailing in the graphs above.

However, in each year under review the highest prices can be observed in the Północ district. It is the area of the city where, within the analysed period, the highest number of apartments were built by developers in the form of modern housing estates and sold for ownership.

An additional advantage of this location is the constantly expanding city bypass leading to the housing estates in the district.

The lowest prices were recorded in the Prawobrzeże district, due to the sale of apartments in older properties and cooperative rights to premises. The observed regularity is constant throughout the analysed period. This means that for years buyers have been attaching the greatest value to the properties in the Północ quarter of the city (Figure 4).

The very dynamic price increase in all analysed districts in 2005–2008 was related to Poland's accession to the European Union and financial resources injected into Polish economy for the development of infrastructure, as well as the general good economic situation in Poland and in Europe at the time.
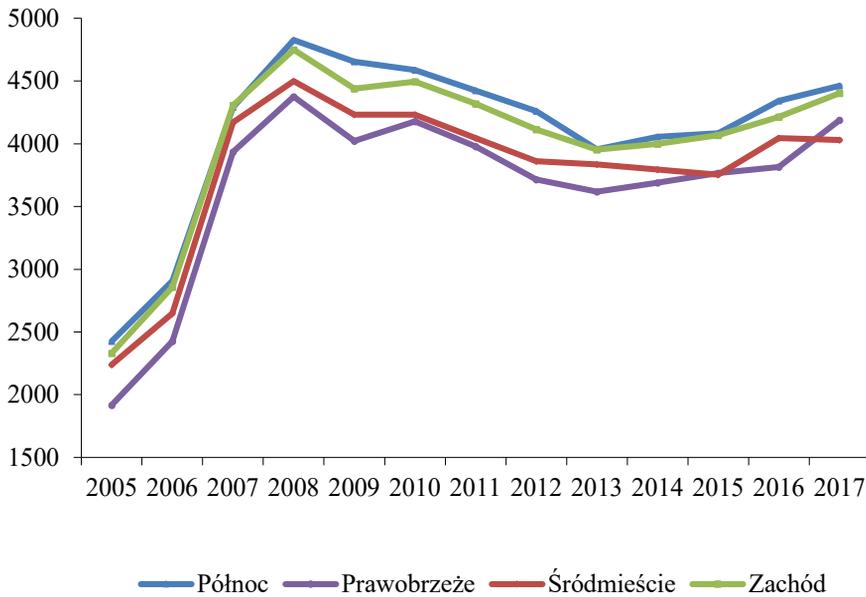
Figure 4. Average unit prices of apartments in Szczecin, by district, in 2005–2017
Source: own calculations

The drop in prices in 2009–2013 is the effect of the global economic crisis and downturn in the real estate market. Local price drops were not always visible immediately in the second half of 2008, often the market reacted with a delay of up to two years.

Starting from 2014, one can speak about the improvement of the economic situation and improvement of the situation on the housing market in Poland. This market has gained additional state support in the form of housing programs dedicated to young people and families. The government programs have stimulated residential investments.

The average areas of the apartments sold in Szczecin, within the four districts, in 2005–2017 are presented in Table 2. The averages are almost on the same level in all examined years. The average areas are only a little bit higher in the Północ district than in the other three districts.

In the next step of the study the fixed effects models were estimated on the base of all transactions on the secondary market in the given year. The endogenous variable was the unit price of apartment and the exogenous variable was the area of the apartment. The dummy variables represented districts of Szczecin (objects). As indicated in the descriptions of fixed effects model (1), one of the dummy variables has to be deleted. The deleted dummy variable was for the Zachód district. The missing parameter was calculated on the base of formula (2). The estimated parameter of models for consecutive years are presented in Table 3.

Table 2. The average areas of the apartments sold in Szczecin, by district, in 2005–2017

Year	Północ	Prawobrzeże	Śródmieście	Zachód
2005	51.84	51.66	54.77	49.70
2006	54.13	55.13	53.37	56.02
2007	53.83	54.42	53.58	57.45
2008	52.35	63.48	57.23	53.43
2009	51.44	54.92	49.50	55.45
2010	52.37	58.74	50.89	55.23
2011	53.97	56.40	49.43	54.71
2012	52.54	55.80	50.21	55.07
2013	52.48	53.92	48.84	53.84
2014	55.29	56.91	50.24	53.64
2015	55.17	57.77	51.50	55.66
2016	54.60	56.23	52.80	52.98
2017	53.53	59.08	52.08	53.41

Source: own calculations

Table 3. Estimated models for unit prices in Szczecin in consecutive years

Year	Constant	Area	Północ	Prawobrzeże	Śródmieście	Zachód
2005	2304.04	−1.68	209.10	−298.99	15.67	74.22
2006	2994.07	−5.20	199.06	−287.03	−67.17	155.14
2007	4866.77	−12.60	109.32	−252.88	−20.68	164.24
2008	4703.25	−1.60	224.87	−244.13	−112.80	132.06
2009	4728.18	−6.91	305.45	−307.42	−154.84	156.80
2010	4540.39	−3.07	226.90	−200.41	−151.94	125.45
2011	4518.59	−6.09	249.61	−210.82	−172.39	133.59
2012	4227.29	−4.49	284.14	−277.52	−141.08	134.46
2013	4145.97	−5.85	124.23	−219.98	−25.85	121.60
2014	4235.30	−6.49	188.55	−187.11	−114.47	113.04
2015	4345.16	−7.77	187.46	−151.40	−190.31	154.25
2016	4689.53	−10.82	259.60	−284.01	−73.86	98.28
2017	4900.66	−11.54	243.91	−94.96	−268.48	119.53

Source: own calculations

The estimates of parameters for dummy variables (districts) in 2005–2017 are presented in Figure 5. Almost all examined years presented the same order of districts according to their estimated parameters. The highest values were for the Północ district and the lowest ones for the Prawobrzeże district with temporary changes in 2007, 2015 and 2017.

The estimation results for the second kind of the fixed effects model are presented in Table 4. This time only one model was estimated. The endogenous variable was the average unit price calculated for a given district and a given year on the base of all transactions on the secondary market in Szczecin in 2002–2017.

The exogenous variable was the average area of the apartments, calculated similarly as the average unit price. The dummy variables represented not only districts but also years. As indicated in the descriptions of the fixed effects model (3), one of the dummy variables from each set of the dummy variables has to be deleted. The deleted dummy variables were for the Zachód district and the year 2017. The missing parameters were calculated on the base of formula (4). Therefore, the corresponding standard errors, t statistics and p values are not presented.
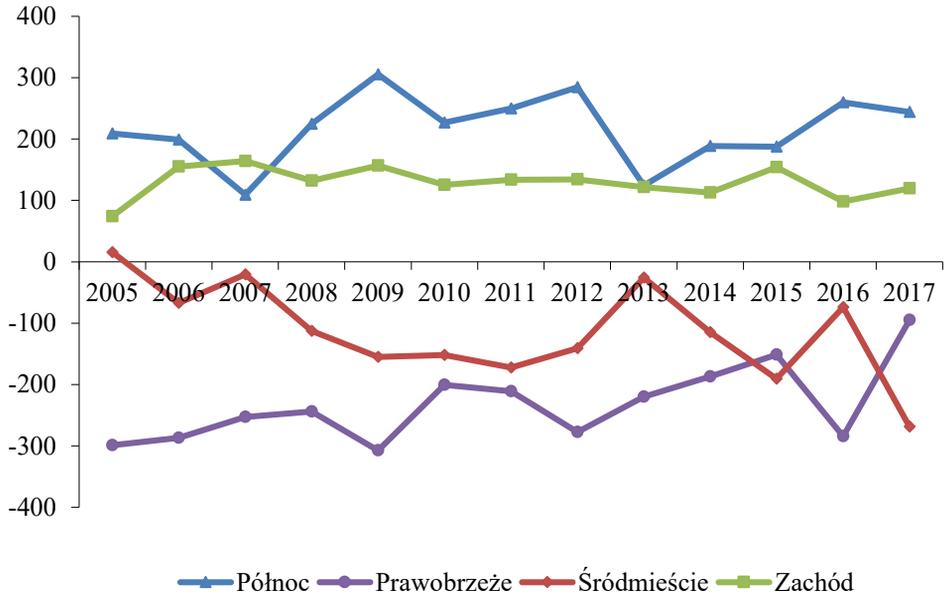

Figure 5. Parameters for districts in Szczecin in 2005–2017
Source: Table 1

Table 4. Estimated fixed effect model for average unit prices in Szczecin

Variable	Parameter	Standard error	t statistic	p
Constant	3443.41	265.76	12.96	0.000
Area	8.43	4.92	1.71	0.095
2005	−1653.04	31.58	−52.35	0.000
2006	−1194.40	30.14	−39.63	0.000
2007	270.10	30.23	8.93	0.000
2008	691.88	32.60	21.23	0.000
2009	482.87	30.58	15.79	0.000
2010	472.42	30.01	15.74	0.000
2011	312.44	30.03	10.40	0.000
2012	94.00	30.12	3.12	0.004
2013	−43.94	31.18	−1.41	0.168

Variable	Parameter	Standard error	t statistic	p
2014	−14.20	29.97	−0.47	0.639
2015	10.33	30.38	0.34	0.736
2016	203.46	29.98	6.79	0.000
2017	368.08	–	–	–
Północ	178.11	19.32	9.22	0.000
Prawobrzeże	−223.80	15.36	−14.57	0.000
Śródmieście	−81.83	18.30	−4.47	0.000
Zachód	127.51	–	–	–
$R^2 = 0.994$, $F = 379.945$, $p = 0.000$				

Source: own calculations

The estimates of parameters for dummy variables (years) are presented in Figure 6.
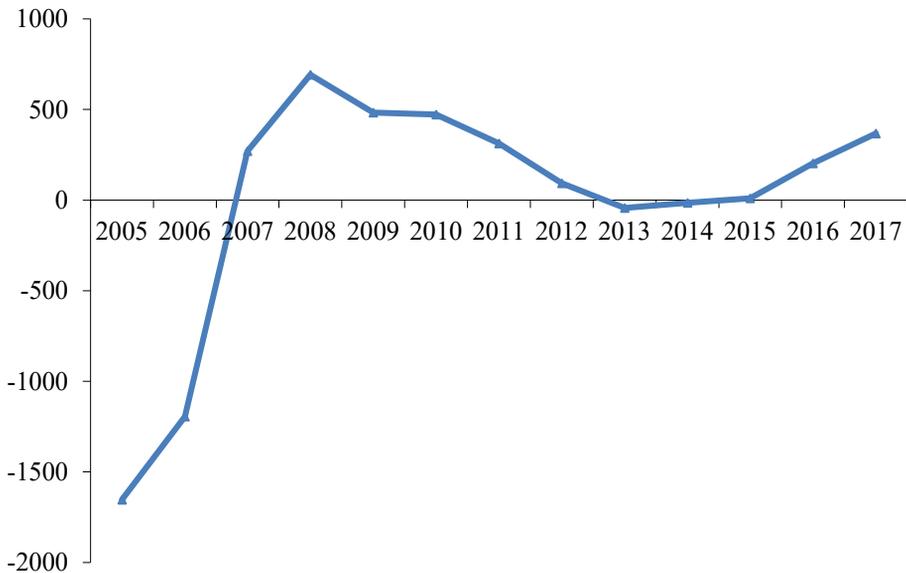
Figure 6. Parameters (fixed effects) for years 2005–2017, in Szczecin

Source: Table 4

From Table 3 it is visible that the estimated model is characterized by almost all parameters being statistically significant and by a very high value of R^2. At the beginning of the examined period the estimates of parameters for years increase until 2008 – the starting point of the global crisis. Then the estimates of year parameters start to diminish until 2012. The parameters for 2013, 2014 and 2015 are statistically insignificant and this could also be observed in Figure 6, where the estimates for these years are very close to zero. The estimates of parameters for

2016 and 2017 increase again. In this joint model, the estimate of parameter for the Północ district is the highest and the estimate of parameter for the Prawobrzeże district is the lowest.

4. Conclusions

The aim of this research was the analysis of temporal stability of buyers' localization preferences on the housing market in Szczecin. In the article authors show that the most important factor in determining property prices is the location of the property. The research showed that developing districts in the city, where a lot of new housing investments are being built, also accompanied by investments such as schools, commercial facilities and, above all, road infrastructure, are the most valued by the buyers. Some authors show that affordable housing sells out quickly regardless of location (Friedman, 2000).

Cities' growth patterns are undergoing qualitative change. Since the beginning of the 1990s, there has been a decentralization process of large cities around the world and a deconcentrating of housing prices (DiPasquale, Wheaton 1996; Anas, Arnott, Small, 1998). Polish cities spread to neighboring municipalities. High housing prices appear in new peripheral neighborhoods, whereas in the neglected city centers, housing prices are lower. However, with low-income households, the most important feature of an apartment is its price, and this is closely related to the apartment's surface area and its location.

The study confirmed spatial diversification of the housing market in Szczecin. For the four examined districts the temporal patterns were similar but the levels were different. Buyers' preferences are stable – the highest and the lowest prices are almost always in the same districts, regardless of the year of the study. The prices were decreasing starting at the time of the global crisis in 2008–2009 until 2015 and then a slow increase of prices was observed.

This research could be welcomed by investors, economists and politicians. Also, it is very important for construction industry and real estate companies. These outcomes are also interesting for appraisers, because they provide an overview of location prices.

References

Anas A., Arnott R., Small K. A. (1998), *Urban Spatial Structure*, "Journal of Economic Literature", vol. 36, pp. 1426–1464.

Anselin L. (1998), *Spatial Econometrics: Methods and Models*, Springer   Science+Business Media, Dordrecht.

Cameron A. C., Trivedi P. K. (2005), *Microeconometrics. Methods and Applications*, Cambridge University Press, Cambridge.

Dańska-Borsiak B. (2011), *Dynamiczne modele panelowe w badaniach ekonomicznych*, Wydawnictwo Uniwersytetu Łódzkiego, Łódź

DiPasquale D., Wheaton W. C. (1996), *Urban Economics and Real Estate Markets*, Prentice-Hall Inc., Englewood Cliffs.

Draper N. R., Smith H. (1998), *Applied Regression Analysis*, John Wiley & Sons, New York.

Foryś I. (2011), *Społeczno-gospodarcze determinanty rozwoju rynku mieszkaniowego w Polsce. Ujęcie ilościowe*, "Rozprawy i Studia", vol. 793, Wydawnictwo Uniwersytetu Szczecińskiego, Szczecin.

Foryś I., Batóg B. (2013), *The Analysis of Spatial Stability of Prices on the Secondary Housing Market*, "Acta Universitatis Lodziensis. Folia Oeconomica", no. 292, pp. 77–88.

Freideman A. (2000), *Preferences of First – time Buyers of Affordable Housing Evidence from Grow Homes in Montreal, Canada*, "Canadian Journal of Urban Research", vol. 9, no. 1, pp. 1–22.

Johnston J. (1991), *Econometric Methods*, McGraw-Hill Book Company, New York.

Judge G. G., Griffiths W. E., Hill R. C., Lutkepohl H., Lee T.-C. (1985), *The Theory and Practice of Econometrics*, John Wiley & Sons, New York.

Kucharska-Stasiak E. (2016), *Ekonomiczny wymiar nieruchomości*, Wydawnictwo Naukowe PWN, Warszawa.

Maddala G. S. (2006), *Ekonometria*, Wydawnictwo Naukowe PWN, Warszawa.

Matyas L., Sevestre P. (2008), *The Econometrics of Panel Data*, Springer, Berlin–Heidelberg.

Shiller R. (2006), *Long-Term Perspective on the Current Boom in Home Prices*, "The Economists' Voice", vol. 3(4), pp. 1–11, http://dx.doi.org/10.2202/1553–3832.1145.

Stabilność w czasie preferencji lokalizacyjnych nabywców na rynku mieszkaniowym w Szczecinie

Streszczenie: Decyzje inwestorów na rynku mieszkaniowym są sumą ich subiektywnych oczekiwań. Wiążą się one z możliwościami finansowymi nabywców, modą na daną lokalizację, zakresem i aktywnością działań deweloperskich na danym terenie oraz indywidualnymi potrzebami uwarunkowanymi sytuacją rodzinną czy przyzwyczajeniami. Nie bez znaczenia są również: poczucie bezpieczeństwa, prestiżu mieszkania w danej dzielnicy oraz walory sąsiedztwa pozytywnie oddziałujące na komfort mieszkania w takim otoczeniu. Lokalizacja nieruchomości w przestrzeni jest jedną z najistotniejszych determinant jej wartości. Wzajemne oddziaływanie nieruchomości jest szczególnie widoczne w preferencjach nabywców na rynku, a w efekcie przekłada się na natężenie transakcji w atrakcyjnych lokalizacjach, a także na ich cenę transakcyjną. Z drugiej strony przestrzeń, a zatem i sąsiedztwo zabudowy mieszkaniowej ulega w czasie powolnym, jednak często istotnym przekształceniom. Dotychczasowe priorytety nabywców również ewoluują w czasie. Stąd celem artykułu jest zbadanie stabilności w czasie preferencji nabywców mieszkań w odniesieniu do wyboru lokalizacji w obrębie miasta. Do realizacji postawionego celu zaproponowano modele ze zmiennymi parametrami (*fixed effects models*).

W artykule wykorzystano dane dotyczące sprzedaży mieszkań w Szczecinie zawarte w aktach notarialnych zgromadzonych w Rejestrze Cen i Wartości Urzędu Miasta w Szczecinie.