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LONG-TERM DEPENDENCE OF HOUSING PRICES AND CONSTRUCTION COSTS IN EASTERN POLAND

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Abstract: The main purpose of the study is to verify the hypothesis on the occurrence of a long-term relationship between the average prices of 1m^2 UFA (i.e. Usable Floor Area) and the construction costs of residential real estate per 1m^2 for selected 5 cities of Eastern Poland (Białystok, Kielce, Lublin, Olsztyn & Rzeszów). The panel model for cointegrated variables and panel cointegration tests are the tools of the analysis. On the basis of the econometric model constructed, the long-term elasticity coefficient, which shows how average prices of flats change (i.e. the price of 1m^2 UFA) in selected cities of Eastern Poland as a result of changes in their production costs, was estimated.

Keywords: Panel cointegration, housing prices, cost of housing construction, long-term relationship, Eastern Poland

JEL classification: C23, R31

INTRODUCTION

According to the "Social and economic development strategy for Eastern Poland until 2020" adopted by the Council of Ministers on 30 December 2008, Eastern Poland covers the following voivodeships: Lubelskie, Podlaskie, Podkarpackie, Świętokrzyskie and Warmińsko-Mazurskie. The criterion for defining the macroregion is related not only to its geographical location, but also to the economic situation. The above-listed voivodeships in 2005 had the lowest GDP per capita in the extended European Union and for this reason they were covered by the special aid from the European Union Funds ("Development of Eastern Poland 2007-2013" programme). Thus, the whole region of Eastern Poland is the area that has common economic features, although particular voivodeships have

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their distinctive features. The aim of this article is to examine the hypothesis on the impact of the construction costs on pricing of residential real estate in the area with a relatively low indicator of economic growth per inhabitant. The reports of the National Bank of Poland [2016] show that there is a significant difference between the construction costs and prices of residential real estate for the largest cities in Poland. This study is an attempt to narrow down the analysed area only to 5 selected cities particularly relevant to the areas which were provided with the special support of the European Union funds. General conclusions of the study will be drawn not only on the basis of quantitative data, but also on the basis of the econometric model for panel data.

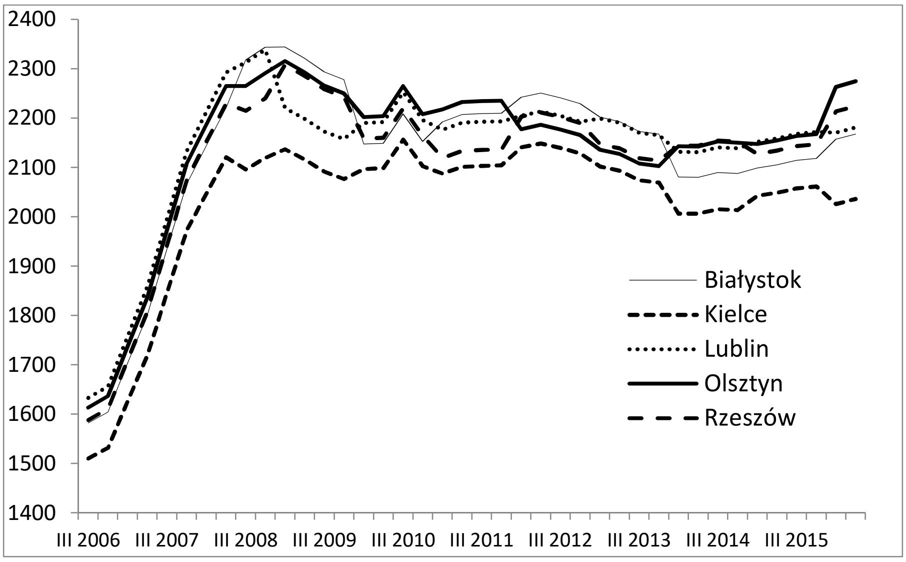
The literature review in the area of quantitative research on the real estate market leads to the conclusion that modeling in this case is not an easy task. This is mainly due to irregular economy cycles and the huge scale of the impact of local or qualitative factors. Reports on the housing market are regularly published by the National Bank of Poland [Łaszek 2016]. Usually econometric analyzes of long-term relationships may be found for banking, finance and macroeconomy [Majsterek 2014, Syczewska 1999]. On the other hand the long-term econometric analyzes are quite rare in the housing market [Zbyrowski 2017]. Incidentally in the area of operational applications, the regression models or core regression algorithms may be found for the initial or approximate valuation of residential real estate [Harney 2007]. In this context, the study of the cointegration relationship for panel data should be considered a completely new approach to analyze the real estate market.

The article contains the characteristics of the numerical data used and the analysis of data panel stationarity. Then a panel cointegration test was carried out and a long-term relationship model was built. Then the study contains conclusions regarding the long-term connections of prices with construction costs on the residential real estate market. Conclusions were formulated on the basis of the estimated panel cointegration model.

FIGURES USED IN THE STUDY

The empirical study was carried out on the basis of information made available by the National Bank of Poland (NBP) and the company Sekocenbud. Time series represent average transaction prices on the primary market of flats and construction costs of 1 square metre of UFA (i.e. Usable Floor Area). The abovementioned costs consist of the costs of building materials, work and the involvement of equipment for a building considered typical when estimating costs of the project. Time series cover the period from 3rd quarter 2006 to 2nd quarter 2016 for five selected cities of Eastern Poland (i.e. Białystok, Kielce, Lublin, Olsztyn and Rzeszów).

Figure 1. Construction costs of 1m^2 UFA for 5 selected cities of Eastern Poland

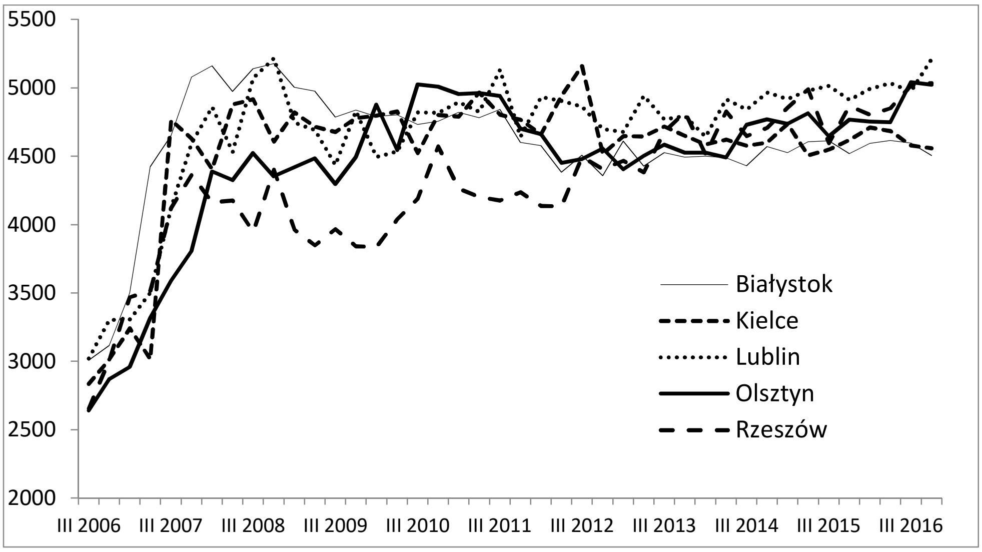


Source: own study on the basis of the NBP data and Sekocenbud report

On the basis of Figure 1 it can be observed that the 1m^2 UFA construction costs had a similar course in the analysed period for all five cities in Eastern Poland. In the first years of the sample, the costs of construction grew dynamically, especially in 2007 and 2008. After 2008, the production cost of 1m^2 UFA was over PLN 2,000, excluding expenses related to the purchase of a plot, paying taxes, preparing designs, land development, making connections and other expenses related to management and marketing. The construction cost covered in the study mainly includes the costs of building materials, equipment and work. The purchase of a plot by a developer actually increases costs by several hundred to over one thousand zlotys per 1 square metre. Thus, the land value is an important additional component of the price of each flat. However, development companies invest in land for development even several years before the construction starts, and the price of the plot depends, of course, on the specifics of the investment and location. In particularly attractive locations the prices of plots are extremely high, but in this case it is to be expected that the price per 1m^2 UFA will be at least commensurate.

A graph of empirical data over time suggests that the lowest construction costs are in Kielce. In other analysed cities the 1m^2 UFA production costs are very similar (Figure 1).

Figure 2. Prices of 1m² UFA for 5 selected cities of Eastern Poland



Source: own study on the basis of the NBP data and Sekocenbud report

Prices of 1m² UFA during the first few years of the analysed period grew rapidly, as did their production costs (Figures 1 and 2). In the short term, significant price fluctuations are visible, and in fact only Rzeszów had slightly lower prices in the period from the beginning of 2008 to the end of 2012. From the beginning of 2013, the average prices per 1m² UFA for all examined cities fluctuated from PLN 4,500 to around PLN 5,000. Since the beginning of 2011, Lublin is the only city that had slightly more expensive flats per square metre (Figure 2).

Testing the stationarity of data-generating processes:

Levin and Lin developed a whole group of panel stationary tests based on the Dickey-Fuller test [Dickey & Fuller 1979]. Panel data-generating process can be written in the following form [Strzała 2008]:

$$y_{it} = \propto_i + \delta_i t + \varphi_i y_{i,t-1} + \theta_t + \varepsilon_{it}\,, \quad i = 1, 2, \dots, N; \; t = 1, 2, \dots, T \tag{1}$$

where: $\varepsilon_{it} \sim \text{i. i. d.}\,(0, \sigma_\varepsilon^2)$ (2)

The model of form (1) and (2) contains varied individual effects ($\propto_i$), differentiated linear trend (δ_i), heterogeneous autoregressive parameter (φ_i), and time effects (θ_t). The study of stationarity is related to the hypotheses concerning parameter (φ_i). Hypotheses of the stationarity test for panel data are generally written as follows [Levin & Lin 1992]:

$$H_0\colon \;(\varphi_i - 1) = \rho_i = 0;\; y_{it} \sim I(1) \tag{3}$$

$$H_A\colon \;(\varphi_i - 1) = \rho_i < 0;\; y_{it} \sim I(0) \tag{4}$$

Both variables subject to modeling in the further part of the article are integrated of order two. The non-stationarity of the series on the levels and the stationarity of their first differences are confirmed by the test results in Tables 1 to 4. Panel stationarity tests were performed for logarised data.

Table 1. Stationarity test of quarterly natural logarithm series of $1m^2$ UFA transaction prices

Variable: ln (Price $1m^2$ UFA)				
Testing method	Test statistic	p-value	number of cross-sectional units	number of observations
Levin, Lin & Chu t	1.798	0.964	5	182
Null hypothesis: Widespread occurrence of the unit root (for panel data)				
Testing method	Test statistic	p-value	number of cross-sectional units	number of observations
ADF - Fisher Chi2	1.472	0.999	5	182
PP - Fisher Chi2	0.611	1.000	5	195
Null hypothesis: Occurrence of the unit root for individual processes				

Source: own study in the Eviews programme

Testing of logarised time series of $1m^2$ UFA transaction prices results in obtaining relatively low test values of the Levin, Lin & Chu and ADF (Augmented Dickey-Fuller) and PP (Phillips Perron) tests. All tests carried out verify the null hypothesis predicting the occurrence of a unit root in the data-generating process (Table 1).

Table 2. Stationarity test of quarterly increments of natural logarithm series of $1m^2$ UFA transaction prices

Variable: D [ln (Price 1m2 UFA)]				
Testing method	Test statistic	p-value	number of cross-sectional units	number of observations
Levin, Lin & Chu t	-12.048	0.000	5	181
Null hypothesis: Widespread occurrence of the unit root (for panel data)				
Testing method	Test statistic	p-value	number of cross-sectional units	number of observations
ADF - Fisher Chi2	150.949	0.000	5	181
PP - Fisher Chi2	185.617	0.000	5	190
Null hypothesis: Occurrence of the unit root for individual processes				

Source: own study in the Eviews programme

Table 2 contains the results of Levin, Lin & Chu and ADF (Augmented Dickey-Fuller) and PP (Phillips Perron) tests estimated for the first logarithm differences of the natural series of $1m^2$ UFA transaction prices. This time, tests checks take high absolute values, on the basis of which the null hypotheses should be rejected with a low probability of making the first type error (where "p-value" means "empirical level of significance" [Gajda 2004]).

Table 3. Stationarity test of quarterly natural logarithm series of 1m^2 UFA construction costs

Variable: ln (Cost 1m^2 UFA)				
Testing method	Test statistic	p-value	number of cross-sectional units	number of observations
Levin, Lin & Chu t	2.133	0.983	5	184
Null hypothesis: Widespread occurrence of the unit root (for panel data)				
Testing method	Test statistic	p-value	number of cross-sectional units	number of observations
ADF - Fisher Chi2	1.478	0.999	5	184
PP - Fisher Chi2	0.722	1.000	5	195
Null hypothesis: Occurrence of the unit root for individual processes				

Source: own study in the Eviews programme

Table 3 confirms the non-stationarity on the levels of natural logarithm time series of 1m^2 UFA construction costs. The null hypothesis on the occurrence of a unit root cannot be rejected due to the low values of the Levin, Lin & Chu and ADF and PP tests (Table 3).

Table 4. Stationarity test of quarterly increments of natural logarithm series of 1m^2 UFA construction costs

Variable: D [ln(Cost 1m^2 UFA)]				
Testing method	Test statistic	p-value	number of cross-sectional units	number of observations
Levin, Lin & Chu t	-6.752	0.000	5	187
Null hypothesis: Widespread occurrence of the unit root (for panel data)				
Testing method	Test statistic	p-value	number of cross-sectional units	number of observations
ADF - Fisher Chi2	57.303	0.000	5	187
PP - Fisher Chi2	47.451	0.000	5	190
Null hypothesis: Occurrence of the unit root for individual processes				

Source: own study in the Eviews programme

Table 4 confirms the stationarity of the increments of natural logarithm time series of 1m^2 UFA construction costs. The null hypotheses about the occurrence of the unit root should be rejected due to the very high values obtained in the Levin, Lin & Chu, ADF and PP tests.

The tests carried out in a panel and individual approach confirm the integration of natural logarithms of the first order time series analysed.

Testing the long-term dependence of 1m^2 UFA prices and construction costs.

In order to verify the hypothesis about the occurrence of a long-term dependence between the studied variables, the Pedroni panel cointegration tests were used [Strzała 2012]. These tests are modeled on the Engle-Granger procedure and have different variants (Pedroni developed 11 tests of the cointegrated panel test). The null hypothesis for Pedroni tests provides for a lack of cointegration between variables. Whereas the alternative hypothesis of panel cointegration tests predicts the existence of cointegration at the group level (between-dimension, group statistics test) or for the whole panel (within-dimension, panel statistics test).

The procedure of applying Pedroni cointegration tests is divided into two stages [Strzała 2012]:

1. In the first stage, the parameters of the general panel model are estimated in the following form:

$$y_{it} = \propto_i + \partial_i t + \beta_{1i}x_{1i,t} + \beta_{2i}x_{2i,t} + \cdots + \beta_{Ki}x_{Ki,t} + e_{it} \tag{5}$$

   for $t = 1, 2, \dots, N; t = 1, 2, \dots, T; k = 1, 2, \dots, K$ and $(y_{it}, x_{it}) \sim I$

   The above equation (5) contains varied individual effects $\propto_i$, individual values of trend slope factors $\partial_i t$ and parameters β_{1i}.

2. In the second stage, the stationarity of the residuals should be investigated using auxiliary regressions for individual panel units. The auxiliary equations should be estimated as joint regressions in the following form:

$$\hat{e}_{it} = \rho_i \hat{e}_{it-1} + v_{it} \tag{6}$$

   or in the extended form:

$$\hat{e}_{it} = \tilde{\rho}_i \hat{e}_{it-1} + \sum_{j=1}^{p_i} \varphi_{ij}\, \Delta\hat{e}_{it-j} + v_{it} \tag{7}$$

   where: $\hat{e}_{it}$ – is a series of model residuals (5); $v_{it} \sim i.i.d.(0, \sigma_v^2)$ – is a random component of the auxiliary equation (joint regression) of the form (6) or (7).

The null hypothesis of the test assumes that the parameters in the auxiliary equations for individual units are equal to unity:

$$H_0: \rho_1 = \rho_2 = \cdots = \rho_N = 1 \tag{8}$$

In the Pedroni tests, two types of alternative hypotheses are found.

1. For a panel test, i.e. within-dimension, panel statistics test, when we assume parameter homogeneity ρ_i:

$$H_A: \rho_1 = \rho_2 = \cdots = \rho_N < 1 \tag{9}$$

2. For the between-dimension, group statistics test, when we assume the parameter heterogeneity ρ_i:

$$H_A: \rho_i < 1 \text{dla i=1,2,…,N} \tag{10}$$

   with the assumption that $\lim_{N\to\infty} (m/N) = \delta, \quad 0 < \delta \leq 1$

On the basis of the auxiliary regression (6) or (7) residuals, Pedroni panel statistics $Z_{N,T}$ is determined, which in a standardised form is asymptotically convergent to the normal distribution [Pedroni 2004]:

$$\frac{Z_{N,T} - \mu\sqrt{N}}{\sqrt{\omega}} \to N(0.1) \tag{11}$$

The values of μ and ω were determined as a result of the Monte Carlo simulation. The variant of a homogeneous alternative hypothesis requires separate determination of average values of numerators and denominators of DF and ADF statistics for panel cross-sectional units. Then, the quotient of the values thus obtained should be standardised in accordance with the formula (11) on the basis of adjusted coefficients set out in the 1999 Pedroni article. In the case of a heterogeneous alternative hypothesis (Pedroni group-statistics test), DF or ADF statistics for individual panel units are averaged, which should then be standardised in accordance with the formula (11) [Strzała 2012].

Table 5. Cointegration test of quarterly price and cost series of 1m^2 UFA for the region of Eastern Poland

Variables: (Price 1m^2 UFA) and (Cost 1m^2 UFA)		
Null hypothesis: no cointegration		
Alternative hypothesis: Panel cointegration (within-dimension)		
Testing method	Test statistic	p-value
Panel v-Statistic	2.697	0.049
Panel rho-Statistic	-4.792	0.000
Panel PP-Statistic	-4.091	0.000
Panel ADF-Statistic	-2.525	0.002
Alternative hypothesis: Panel cointegration (between-dimension)		
Testing method	Test statistic	p-value
Group rho-Statistic	-3.701	0.000
Group PP-Statistic	-5.428	0.000
Group ADF-Statistic	-3.295	0.001

Source: own study in the Eviews programme

Table 5 contains the high absolute values of the Pedroni cointegration tests. Hence, regardless of the type of test and the type of alternative hypothesis, the null hypothesis that there is no cointegration between the analysed variables should be rejected. Therefore, the long-term dependence between prices and construction costs of 1m^2 UFA is in fact confirmed in the examined cities of Eastern Poland. In the studied region, developers are willing to take into account higher construction costs at transaction prices, transferring production costs to the final purchaser. In the further part of the study, a model of panel cointegration which shows the scale of transmission of construction costs to transaction prices using the long-term elasticity coefficient was estimated. The long-term equilibrium model was estimated using the FMOLS method (Fully Modified Least Squares, Phillips and Moon, 1999). It is characterised by moderate adjustment to empirical data. The adjusted coefficient of determination of 0.66 allows concluding that approximately 66% of the volatility of the 1m^2 UFA price can be explained by the variability of the 1m^2 UFA construction cost for the five cities studied located in the region of Eastern Poland (Enders, 2003). The model's fit coefficient is not high. However, the estimation of long-term elasticity coefficient of 1.315 with an error of 0.126 results in a high value of t-Student statistics of 10.43, which clearly confirms the statistical significance of the estimation.

Naturally, the 1m^2 UFA prices depend in practice on many factors. The purpose of this study is solely to analyse the relationship between the price and the construction costs of 1m^2 UFA. Although the tested relationship does not seem to be controversial in economic terms, the specificity of the real estate market, which is very difficult to model and is often determined by qualitative factors that effectively disrupt its regularity, should be taken into account.

The standard deviation of model disruptions is low (0.06661), since it represents less than 1% of the arithmetic mean value of the natural logarithm of the dependent variable of 8.413 (Borkowski, Dudek, Szczesny, 2007).

Dependent variable: $Price_{it}$ – transaction price of 1m^2 UFA on the primary market for the city and at the time t;
Independent variable: $Cost_{it}$ – the construction cost of 1m^2 UFA (without the cost of land purchase) for the city and at the time t.

Table 6. Model of 1m^2 UFA price and construction costs dependence for five selected cities of Eastern Poland

Dependent variable: Ln(CENA)				
Method: Panel Fully Modified Least Squares (FMOLS)				
Sample (adjusted): 2006Q4 2016Q2				
Periods included: 39				
Cross-sections included: 5				
Total panel (balanced) observations: 195				
Cointegration equation deterministics: C				
Variable	Coefficient	Std. Error	t-Statistic	p-value
Ln(KOSZT)	1.315132	0.126088	10.43031	0.0000
R-squared	0.668932	Mean dependent var		8.4131
Adjusted R-squared	0.660173	S.D. dependent var		0.1143
S.E. of regression	0.066611	Sum squared resid		0.8286
Long-run variance	0.015290			

Source: own study in the Eviews programme

On the basis of Table 6, the long-term dependence model can be written as follows:

$$\ln(\widehat{\mathrm{CENA}}_{\mathrm{it}}) = 1.315 * \ln(\mathrm{COST}_{\mathrm{it}}) + c_i \quad (12)$$

The model shows that if the construction costs of 1m^2 UFA increase by 1%, the transaction prices of 1m^2 UFA on the primary market will also increase on average by 1.315% over a long period of time with the ceteris paribus assumption [Gajda 2004]. The model (12) contains in the equation a constant value different for the five examined cities c_i (a deterministic element of the cointegration vector) which allows taking into account a fundamental part of the local heterogeneity [Maddala 2006]. The estimation of the parameter of 1.315 suggests that in cities of Eastern Poland there may be a highly flexible reaction of 1m^2 UFA price changes to changes in their production costs. It should be noted that the prices of residential real estate in the cities of Eastern Poland are quite low compared to other agglomerations of the country. On the one hand, it seems justified if GDP per capita of Eastern Poland is also record low. On the other hand, the study shows that in the case of an increase in production costs, transaction prices increase even faster in the east of our country. This may result from the fact that developers want to achieve additional profit as they are aware of higher flat prices on the national market. Another explanation of a high elasticity may be a long investment process. The construction of a complex of many flats takes years – if construction costs increase, it is expected that they will increase further during the investment period, which is reflected in the cost estimates. Developers therefore assume a greater margin of security for their investments so as not to incur losses, and this may stimulate further price increases.

SUMMARY

1. The analysed figures indicate very similar fluctuations in the 1m^2 UFA construction costs in all examined cities, with noticeably lower costs in Kielce compared to the remaining four. The 1m^2 UFA prices are more diversified in the short-run than the construction costs. Rzeszów definitely had the lowest UFA price per 1 square metre in 2008-2012, however, in the long run it joined the average for the entire examined group of cities in Eastern Poland. It can be said that Białystok, Kielce, Lublin, Olsztyn and Rzeszów form a homogeneous group in terms of the analysis of the residential real estate market.
2. On the basis of the panel cointegration tests performed, the existence of a long-term relationship between construction costs and the 1m^2 UFA price in all examined cities is confirmed. As already mentioned, although the dependence of the price on costs does not seem to be controversial in economic terms, in the case of the housing market, the differences between these two categories are counted in thousands of zlotys per square metre. Whereas, the housing market is subject to speculation and disruptions that may in practice hinder the impact of fundamental factors.
3. Estimation of the long-term elasticity coefficient equal to 1.315 suggests that in the cities of the eastern region, 1m^2 UFA prices on the primary market may on average increase faster than construction costs. Therefore, relatively low prices for 1m^2 in this region in comparison to other parts of the country may show a tendency to reduce the undervaluation of residential real estate in cities such as Białystok, Kielce, Lublin, Olsztyn and Rzeszów.

The area of future research will include farther econometric analysis of residential property prices in Poland. In particular, the author plans to carry out studies to estimate the scale of impact on the price level of many other exogenous factors.

REFERENCES

Borkowski B., Dudek H., Szczesny W. (2007) Ekonometria, wybrane zagadnienia. PWN, Warszawa (in Polish).

Dickey D. A., Fuller W. A. (1979) Distribution of the Estimators for Autoregressive Time Series With a Unit Root. Journal of the American Statistical Association, 74, 427-431.

Enders W. (2003) Applied Econometric Time Series. John Wiley & Sons, New York.

Gajda J. (2004) Ekonometria. C.H. BECK, Warszawa (in Polish).

Harney K. (2007) Reprisals on Appraisals. Washington Post.

Levin A., Lin Ch-F. (1992) Unit Root Test in Panel Data: Asymptotic and Finite Sample Properties. Working Paper, no. 92-23.

Levin A., Lin Ch-F. (1993) Unit Root Tests in Panel Data: New Results. Working Paper, no. 93-56.

Levin A., Lin Ch-F., Chu Ch-Sh. J. (2002) Unit root tests in panel data: asymptotic and finite sample properties. Journal of Econometrics, 108, 1-24.

Łaszek J. (2006) Rynek nieruchomości mieszkaniowych i jego specyfika. [w:] Kucharska-Stasiak E. (red.) Ryzyka banku w zakresie określania wartości nieruchomości dla celów kredytowych w Polsce na tle trendów w Unii Europejskiej, Fundacja na Rzecz Kredytu Hipotecznego, Warszawa (in Polish).

Łaszek J. (2016) Raport AMRON-SARFiN 4/2015. Ogólnopolski raport o kredytach mieszkaniowych i cenach transakcyjnych nieruchomości - komentarz do raportu. Warszawa (in Polish).

Maddala G. S. (2006) Ekonometria. PWN, Warszawa (in Polish).

Majsterek M. (2014) Modelowanie systemów skointegrowanych. Aspekty teoretyczne. Bank i Kredyt, 45(5), 433-466 (in Polish).

Narodowy Bank Polski (2015) Informacja o cenach i sytuacji na rynku nieruchomości mieszkaniowych i komercyjnych w Polsce w III kwartale 2014 roku. Warszawa (in Polish).

Narodowy Bank Polski (2016) Raport o sytuacji na rynkach nieruchomości mieszkaniowych i komercyjnych w Polsce w 2015 roku. Warszawa (in Polish).

Pedroni P. (1999) Critical Values for Cointegration Tests in Heterogeneous Panels with Multiple Regressors. Oxford Bulletin of Economics and Statistics, 61, 653-670.

Pedroni P. (2004) Panel Cointegration: Asymptotic and Finite Sample Properties of Pooled Time Series Tests with an Application to the PPP Hypothesis. Econometric Theory, 20, 597-625.

Phillips P. C. B., Moon H. R. (1999) Linear Regression Limit Theory for Nonstationary Panel Data. Econometrica, 67, 1057–1111.

Strzała K. (2009) Panelowe testy stacjonarności - możliwości i ograniczenia. Przegląd Statystyczny, 56(1), 56-73 (in Polish).

Strzała K. (2012) Panelowe testy kointegracji - teoria i zastosowania. Roczniki Kolegium Analiz Ekonomicznych, 27, 41-54 (in Polish).

Syczewska E. (1999) Analiza relacji długookresowych: estymacja i weryfikacja. Monografie i opracowania, Szkoła Główna Handlowa, Warszawa (in Polish).

Zbyrowski R. (2017) The Long Term Modeling of Residential Property Prices in Poland. Quantitative Methods in Economics, 18(1), 143-156.

Documents

„Strategia rozwoju społeczno-gospodarczego Polski Wschodniej do roku 2020", dokument przyjęty przez Radę Ministrów w dniu 30 grudnia 2008 r., uchwałą nr 278/08 (in Polish).

„Program Operacyjny Rozwój Polski Wschodniej. Narodowe Strategiczne Ramy Odniesienia 2007-2013". Wersja dokumentu po zmianach zaakceptowanych uchwałą nr 94/2011 Rady Ministrów z dnia 6 czerwca 2011 (in Polish).