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ECONOMETRIC MODELLING OF AVERAGE HOUSING PRICES IN LOCAL MARKETS AND THE PRICE ANCHORING EFFECT

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ABSTRACT

This paper employs the econometric models of relationships over time to evaluate the change in the unit prices of apartments on the local secondary markets in Warsaw and Szczecin, depending on various socioeconomic factors. Indicators reflecting the influence of socio-economic aspects in these cities and the lagged values of housing prices, acting as so-called anchors in this model, were used as the independent variables.

The results obtained from this analysis indicate that it is the lagged prices of housing that have the strongest influence on the formation of price levels in the market. The study confirms the presence of the so-called price anchoring effect, which can be understood as the tendency of market participants to accept prices at levels that can be justified not only by socio-economic factors, but also by the price levels established in their minds.

The main purpose of the research presented here is to show that there is no close relationship between quoted housing prices and their objective factors. The quality of models reflecting these relationships clearly improves when lagged housing prices are introduced as the explanatory variables, which may confirm the price anchoring effect derived from behavioral economics, meaning that the heuristics of anchoring and adjustment can be applied to the analysis of the behavior of a collective of individuals - many market participants.

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1. Introduction

The peculiarities of the real estate market also make it necessary to approach the problem of modelling real estate prices in a specific way. Real estate prices in the market are the result of a complex interaction of many factors. Besides traditional aspects, such as construction costs, the factors relevant in this context are economic and social ones, such as household income and population size, as well as the employment and interest rates (Hwang, Quigley 2006). However, research on the effect of these factors on housing prices has not led to a clear conclusion so far (see e.g. Capozza et al. 2002; Foryś, 2013; Kokot, 2018). Attempts to build econometric models of real estate prices have been repeatedly made in scientific research for different segments of this market, usually encountering certain barriers (Adamczewski, 2006; Parzych, 2007; Zbyrowski, 2010; Drachal, 2014). These barriers are due to the quality and availability of data on real estate prices and their factors, as well as the very nature of the real estate market. As a result, the resulting models explain price levels to an unsatisfactory degree. In addition, classical modelling operates on the assumption of the rationality of buyers' purchase decisions. Such an approach to explaining phenomena is now being increasingly criticized, and theories derived from so-called behavioral economics are finding recognition (Brzezicka & Wisniewski, 2012). Hence, more and more attempts are being made to model prices using tools other than classical econometric models, which are not based on close relationships between real estate prices and their objective factors. Neural networks or various machine learning techniques are used as such tools (Wisniewski, 1998; Jasinski & Bochenek, 2016; Tekin & Sari, 2022; Lee, 2022).

Similar problems are encountered when trying to build econometric models of average prices for local markets. Previous studies indicate that there is a relationship between the level of housing prices and the degree of urban development, though it does not seem clear. In addition, it is difficult to determine the influence of specific factors on prices, as it is more complex than it initially appears. Research in this field has been conducted at various levels - local (e.g. Wolniak, et al., 2020), spatial (e.g. Tomal, 2019) and international (Dąbrowski, et al., 2020). Also, studies have been published that are aimed at explaining the mechanisms that shape the real estate price dynamics (see Bełej & Kulesza, 2015; Żelazowski, 2017).

This article presents research that is part of the research trend on the determinants of housing prices. However, the inability to clearly determine the impact of factors of a socio-economic nature on housing prices has made the researchers look for other sources of impact, including those related to human behavior that arise from both socio-economic and psychological aspects. The prices that are actually paid in the real estate market are the result of decisions made by both sellers and buyers. These decisions are often shaped by subjective judgment, i.e. by emotions and feelings which determine how attractive a property's price is in the context of a particular market situation. Research on human behavior has indicated that people often use simplified rules of judgment and inference (called the heuristics), especially under conditions of uncertainty (Tversky & Kahneman, 1973, 1974). One of them is the anchoring and adjustment heuristic, where some information is taken as a reference point and then the evaluation and inference process is adjusted to it. The existing research has indicated that this heuristic influences people's decisions by prompting them to make judgments that are consistent with the initially presented value. This corresponds to a mechanism where a certain outcome is suggested to subjects who then take it as a benchmark, adjusting their estimations accordingly (Epley & Gilovich, 2006). Studies proving the existence of such heuristics usually involve separating two groups of people and assigning them specific tasks, with participants in one group being suggested a certain outcome. The participants are usually unaware of the intentionality of this suggestion. However, it is not possible to conduct analogous research experiments for the market. This is because it is not possible to isolate a group of reference markets that have not been suggested a specific outcome of a specific task, and a group of markets with appropriate suggestions, to then compare their reactions. However, the natural tendency of people to act under the influence of heuristics makes it reasonable to make research hypotheses about the anchoring effect being present in the real estate market, where prices are often formed based on prior information and the adopted benchmarks. For many years, the behavior of market players has been explained by their rational assumptions and the efficient market hypothesis. However, research has shown that individuals often make suboptimal decisions, which is an important but often overlooked issue in the real estate market literature. The real estate market is complex, and its actors make varying decisions depending on their goals and under a variety of circumstances (Ball, 2006, 2010). There have been calls to introduce assumptions into analyses of real estate market behavior that the homo oeconomicus model treats the motives of market participants in an oversimplified manner (Brzezicka & Wisniewski, 2012). Studies on the effect of anchoring and the adjustment heuristic in the real estate market have been conducted since the 1980s. In 1987, American researchers showed that, when appraising real estate, both experts and non-professionals are susceptible to the influence of previously acquired information (Northcraft, & Neale, 1987). Other studies have indicated that real estate appraisers are also influenced by information on previous sales prices, which biases their appraisal process (Wolverton, 2000). In Poland, too, researchers deal with the effect of the anchoring heuristic on the real estate market. According to their findings, survey participants who were suggested the wrong level of a property's market price made incorrect estimations (Brzezicka, 2016). Moreover, it has been proven that knowledge of the pre-established transaction price affects the price given by professional appraisers (Kucharska-Stasiak, 2014). To date, there have been too few studies in the literature that attempt to complement the traditional factors determining housing prices with factors of a behavioral nature. The impossibility of proving their influence on market mechanisms by means of the typical research methods of psychology and sociology, which involve conducting appropriate experiments, makes it necessary to look for other research methods by means of which it is possible to ascertain, or at least deem probable, the existence of the price anchoring effect. There are still many unresolved issues in this area. According to the current state of knowledge,

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studies indicating the existence of a price anchoring effect in the market consist of identifying the impossibility of fully explaining the mechanism of price formation based on objective factors and proposing a way to explain this mechanism more fully by supplementing these factors with factors that may have a basis in influencing the anchoring and adjustment heuristics undertaken by individual market participants. These types of analyses do not conclusively prove the existence of a price anchoring effect, but they do hint at the possibility. However, it seems fair to assume that the emergence of enough related studies which indicate the possibility of the existence of a price anchoring effect will demonstrate that the real existence of this effect is very likely. Research on modeling real estate prices using anchors based on historical prices, has already been undertaken. Leung and Tsang proved that price anchoring in conjunction with loss aversion are important determinants of real estate price dynamics. When sellers have periodic profit and loss preferences or when buyers attach value to historical housing prices, changes in the prices of real estate are predictable (Leung & Tsang, 2013). On the other hand, a paper (Cheung, et. al., 2022) used property values set by periodic valuations for tax purposes as anchors, proving the existence of a price anchoring effect in the secondary housing market. Other studies argue that the anchoring effect, analogously to the stock market, can relate to the highest periodically quoted prices (Shie, 2019). The first research on the anchoring effect of housing prices in Poland was presented in a paper by (Kokot, 2023). Using econometric models developed under modified backward stepwise regression procedures, he indicates the presence of an anchoring effect on housing prices based on an analysis of 17 local real estate markets. This study has shown that the addition of anchoring factors, such as lagged prices, to classical variables used in the models in order to explain the price levels has led to significant improvement in the quality of these models. In the author's opinion, the results clearly indicated the influence of behavioral factors on housing price levels in local markets. An answer was sought to the question of whether housing price levels could also be determined by the fact that certain characteristic prices were "anchored" in the minds of both sellers and buyers. Such an assumption rests on a transformed concept of the anchoring and adjustment heuristic, which relates to the behavior of individuals, or to the entire population of real market players. The housing market prices arise from the perception of market conditions by a large number of individuals. As each of these individuals acts according to the heuristic, their actions will result in typical housing prices being the outcome of decisions made by the mass of these individuals (Kokot, 2023). When such reasoning is accepted as logically sound, empirical studies indicating the possibility of an anchoring effect make the actual existence of this effect more likely.

The study presented in this paper is based on similar assumptions. In the face of difficulties to accurately explain the processes of housing price formation through traditional socio-economic factors, an attempt has been made to explain these prices through both socio-economic and behavioral factors rooted in the anchoring and adjustment heuristic. Under this concept, the anchoring and adjustment heuristic is revealed not only in the actions of individuals, but also in the actions of the collective as a whole. Similarly to the referenced work and for the sake of conceptual clarity, a direct reference to the term "heuristic" has been avoided in further parts of the study, since using it in reference to a collective entity could be considered a misuse. Accordingly, the terms "anchoring effect" or simply "price anchoring" are used.

The main purpose of this paper is to prove that housing price levels can be subject to the anchoring effect in the sense outlined above. If such a phenomenon occurs, it means that prices in the real estate market are shaped not only by socio-economic factors, but also by the fact that market players accept certain price levels due to gradually getting accustomed to these levels. In formal terms, this implies strong housing price inertia, whose impact on current prices is stronger than that of variables representing other factors, particularly social and economic ones. It should be borne in mind, however, that historical prices are widely known, and knowledge of them is readily available both in official publications on the websites of state institutions (National Bank of Poland, Central Statistical Office) and many commercial portals. It is the ease with which housing buyers and sellers can obtain such information that makes it possible for historical prices to act as anchors.

In several econometric studies, the prices of individual properties are explained solely by their characteristics (Doszyń, 2020, 2022, 2022a; Parzych, 2007; Zbyrowski, 2010). The present study is

concerned with describing the average housing prices in relation to the general socio-economic situation. The dynamics of real estate prices was analyzed by means of econometric methods in (e.g. Drachal, 2015; Englund & Ioannides, 1997; Jud & Winkler, 2002; Oikarinen et al., 2018). Determinants of real estate prices are also analyzed in (Leszczyński & Olszewski, 2017; Tomal, 2022).

2. Data

In this study, the purpose of econometric modeling is to verify the hypothesis of the strong inertia of housing prices, using the example of the secondary housing markets in Warsaw and Szczecin. Strong inertia means that prices in period t are strongly related not with socio-economic factors in the same period t, but with prices in previous periods (t-1, t-2, ...). Warsaw is the capital of and also the largest city in Poland, with a population of 1.8 million, or about 5% of the country's population. Szczecin, on the other hand, with a population of 400,000, despite the fact that it is included among the large cities and is the capital of the West Pomeranian Voivodeship, is seen as a relatively small and limited market. It seems that basing the study on two such different markets will give an objective view of the occurrence of the studied phenomenon of price anchoring in the housing market. House prices were considered to be a more "natural" variable than, for example, hedonic house price indices. In addition, it should be weighed that market participants making purchasing decisions are guided by prices and usually have no knowledge of published price indexes. To confirm the inertial nature of prices, it is necessary to study the strength of factors directly affecting them. It is relevant to consider both the variables determining the demand for housing and its supply. The demand for residential properties depends on the wealth of the population (income, wage levels, assets), the accessibility of credit (interest rates on home loans), or the general economic climate which affects, for example, the number of businesses.

The housing supply depends on the situation in the construction industry, which is correlated with the phase of the business cycle. E.g., in the year 2023, both the construction sector and the economy are in good condition. It is also determined, among other things, by the labor market situation as measured by the registered unemployment rate. The study analyzes the secondary housing market, thus the increase in housing construction costs is much less important than in the primary market. The change in housing supply, for example, is reflected by the number of units being completed. Although this variable directly increases the supply of new dwellings, it can also indirectly boost supply in the secondary market. This is because owners of properties in the secondary market can purchase new apartments and sell old ones, which expands the supply in the secondary market. In addition, newly completed units obviously increase the existing housing stock.

The following variables were used in the study:

- p_t - average transaction prices of apartments on the secondary market (dependent variable),
- w_t - average gross wages,
- r_t - average interest rate on new and renegotiated PLN real estate loan contracts (at the end of the quarter),
- e_t - number of private sector business entities (this symbol is often reserved for residuals, but not in this research),
- a_t - housing units completed,
- un_t - registered unemployment rate,
- d_t - dummy variable equal to one in the four quarters (2022:2 - 2023:1).

Data on average housing prices were taken from the Polish central bank's (Narodowy Bank Polski) quarterly information provided on its website. The data on loan interest rates also come from the Narodowy Bank Polski. Other data were obtained from the Bank of Local Data of the Polish Central Statistical Office (GUS).

All the variables refer to the situation in Warsaw or Szczecin. The data have been collected on a quarterly basis. The analysis covers the period between 2012 and 2023 (up to, as well as including, the first quarter of 2023). The variables measured in PLN have been adjusted by the quarterly inflation rate for the West Pomeranian and Masovian region and expressed in prices at the level of the first quarter of 2023.

Salary data for Szczecin and Warsaw are published only on an annual basis, so this particular variable was disaggregated. As observed, between 2012 and 2023, the average wage ratio in Szczecin to the whole West Pomeranian Voivodeship was 1.07, which means that salaries in Szczecin are, on average, 7% higher. The average wage ratio in Warsaw to the whole Masovian Voivodeship is 1.09. Accordingly, the data on wages in the voivodeship (which are available on a quarterly basis) were multiplied by 1.07 and 1.09, respectively, and these variables were taken as wages in Szczecin or Warsaw.

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As the last four quarters (2022:2 - 2023:1) were not typical, the set of proposed independent variables also includes a dummy variable equal to one in those quarters. This was the time directly following Russia's invasion of Ukraine, which changed the economic picture both in Poland and globally and triggered high inflation. Economic mechanisms changed during that period, which should be reflected in the estimated econometric model. Therefore, a dummy variable d_t was included.

3 Methods and results

In the first stage of building the econometric model, the structure of the time series under study was examined. For this purpose, partial autocorrelation functions (PACF) were estimated for each variable. This function is described, in, for example, (Maddala & Lahiri 2009). The results for the lag up to and including Q9 are shown in the tables below (partial autocorrelation coefficients that were significant at the 0.01 significance level are shown in bold).

Table 1

Partial autocorrelation coefficients (PACF) for the studied time series (Warsaw

Variable/delay	1	2	3	4	5	6	7	8	9
p_t	**0.975**	-0.365	-0.232	-0.086	-0.259	0.108	0.075	-0.030	-0.047
w_t	**0.901**	-0.009	**0.388**	0.132	**-0.597**	-0.006	0.175	-0.022	-0.188
r_t	**0.851**	**-0.418**	-0.215	-0.037	0.151	-0.076	0.037	-0.138	0.072
e_t	**0.913**	-0.030	-0.022	-0.012	-0.027	-0.030	-0.016	-0.012	-0.018
a_t	**0.426**	-0.187	**0.486**	0.266	-0.026	-0.213	0.280	-0.030	-0.025
un_t	**0.968**	-0.147	-0.232	-0.049	-0.327	0.030	-0.020	0.041	-0.116

Source: own study.

Table 2

Partial autocorrelation coefficients (PACF) for the studied time series (Szczecin)

Variable/delay	1	2	3	4	5	6	7	8	9
p_t	**0.969**	-0.209	-0.099	**-0.397**	0.103	0.052	-0.013	-0.200	-0.090
w_t	**0.905**	0.136	0.162	0.225	**-0.476**	-0.183	0.126	0.054	-0.300
r_t	**0.851**	**-0.418**	-0.215	-0.037	0.151	-0.076	0.037	-0.138	0.072
e_t	**0.853**	-0.059	0.004	0.057	0.013	-0.129	0.028	0.018	0.025
a_t	0.313	0.235	0.013	0.172	0.268	-0.148	0.204	-0.132	0.047
un_t	**0.958**	-0.083	-0.143	-0.124	-0.217	0.003	0.019	-0.029	-0.193

Source: own study.

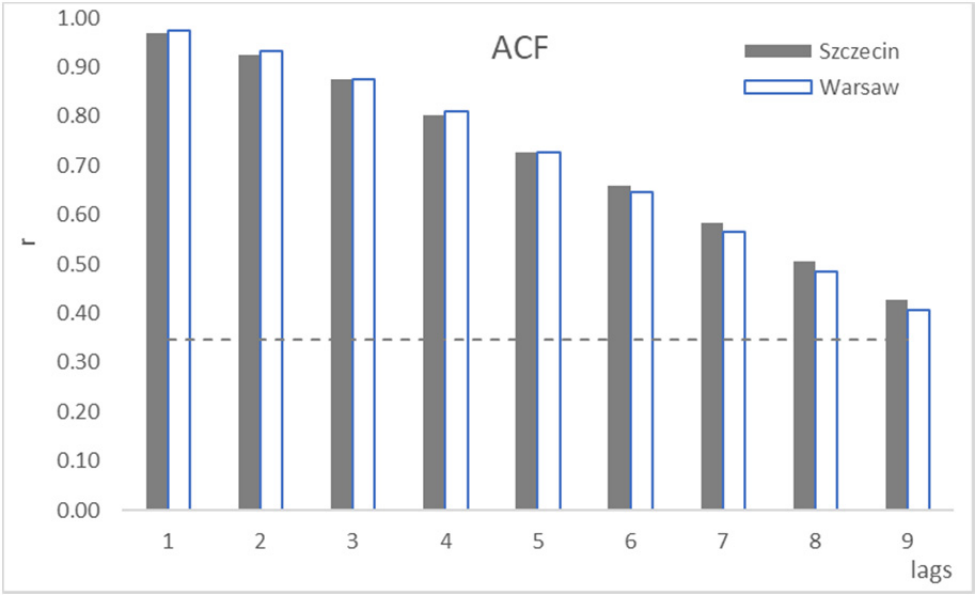

Fig. 1. Autocorrelation function (ACF) for average housing price in Warsaw and Szczecin - variable p_t. *Source*: own study.

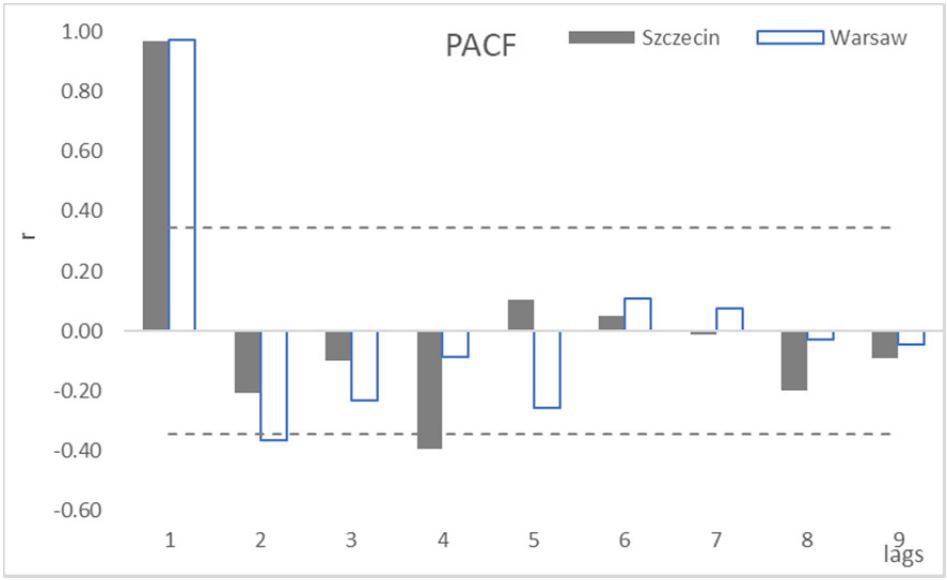

Fig. 2. Partial autocorrelation function (PACF) for average housing price in Warsaw and Szczecin - variable p_t. *Source*: own study.

For almost every variable, first-order autocorrelation coefficients were statistically significant and rather high (significance level of 0.01). The partial autocorrelation coefficients of higher orders were statistically significant only sporadically, and the values of these coefficients were not large.

The coefficients of autocorrelation (ACF) and partial autocorrelation (PACF) for the explained variable p_t for Warsaw and Szczecin are shown in Figures 1 and 2.

The above graphs show that average housing prices were marked by strong inertia, both in Warsaw and Szczecin. The level of this variable in period t is strongly determined by its level in the previous quarter.

To recapitulate, it appears that the analyzed time series follows the AR(1) process, so the current value is based on the preceding value. In AR models it is not necessary to analyze ACF (PACF is important), however ACF might support the hypothesis stating the strong inertia of the analyzed processes. As regards the first three variables (p_t ,w_t ,r_t), the individual coefficients for lags of higher orders were also significant, but the absolute values of these coefficients were much lower than for a lag of one. The (negative) signs of these coefficients may also be debatable. Therefore, it was assumed that the studied time series were generated by AR(1) processes, i.e. the processes of the type $x_t = \alpha_0 + \alpha_1 x_{t-1} + u_t$, where u_t is white noise.

When constructing an econometric model to describe the formation of average housing prices in Warsaw and Szczecin, the "general to specific" modeling strategy proposed by D. Hendry (Charameza, Deadman, 1997) was adopted. In the first phase of model construction, the set of independent variables was supplemented with a lagged dependent variable and the current as well as lagged values of the other variables (excluding d_{t-1}).

Thus, the set of potential independent variables included: p_{t-1} , w_t , w_{t-1} , r_t , r_{t-1} , e_t , e_{t-1} , a_t , a_{t-1} , un_t , un_{t-1} and d_t. Therefore, 12 candidates for independent variables were considered, of which 6 were lagged variables. In the next step, the procedure for selecting independent variables was applied, being the backward stepwise regression method. The significance level of 0.01 was adopted. Finally, the following were taken as independent variables: p_{t-1} , r_t. (Warsaw) andp_{t-1}, w_{t-1} and d_t (Szczecin). The results of the model estimation are shown in the table below.

Table 3

Estimation results

Warsaw					Szczecin				
Variable	Coefficient	Stand. error.	t-Student	p-value	Variable	Coefficient	Stand. error.	t-Student	p-value
$const$	603.23	267.29	2.26	0.03	$const$	-816.32	264.52	-3.09	0.004
r_t	-1.04	0.21	-4.97	<0.001	w_{t-1}	0.25	0.08	2.96	0.005
p_{t-1}	0.999	0.02	46.22	<0.001	d_t	-348.67	113.81	-3.06	0.004
					p_{t-1}	0.89	0.06	14.75	<0.001

Source: own study.

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In the case of Warsaw, besides the lagged dependent variable, only average interest rate on real estate loan contracts was found to be significant. The impact of interest rates was equal to -1.04. In econometric model for Szczecin, in addition to the lagged dependent variable, lagged average gross wages as well as the dummy variable d_t were also significant. The Impact of lagged wages was equal to 0.25. The evaluation of the parameter with the dummy variable d_t indicates a decrease in prices in quarters 2022:2 - 2023:1 by an average of PLN 348.67. This is a price decrease in real terms. Prices are quoted as of 2023:1, while in 2022:2 - 2023:1 the prices stabilized, which, in conjunction with high inflation, meant that they fell in real terms.

The average housing prices were marked by strong inertia. The coefficient on the lagged dependent variable is equal to as much as 0.999 (Warsaw) and 0.89 (Szczecin), which means that current housing prices depended very much on the price level in the earlier quarter. It is symptomatic that, out of a very large set of independent variables, only a few remained in the model. This indicates very strong price inertia. It can also be concluded that the sensitivity of average housing prices in the secondary market to the general economic factors is not high. Variables such as the interest rate on loans, the number of businesses, the number of housing units completed, and the unemployment rate were eliminated in the backward stepwise regression procedure.

The models are very well fitted to empirical values, the coefficient of determination R^2 is 0.981 (Warsaw) and 0.979 (Szczecin), and the standard errors of the residuals are 222.89 (Warsaw) and 171.6 PLN/m^2 (Szczecin) The parameters differ significantly from zero (significance level of 0.01).

According to the White test, there is no grounds to reject the hypothesis of the error homoskedasticity. P-value was equal to 0.72 (Warsaw) and 0.12 (Szczecin). There is also no basis for rejecting the hypothesis that the distributions of residuals are consistent with a normal distribution. In the Doornik - Hansen test, p-values are equal to 0.04 (Warsaw) and 0.91 (Szczecin)). Moreover, the RESET test indicates that there is no reason to reject the hypothesis that the linear specification of the model is correct (p-value=0.16 both for Warsaw and Szczecin). The empirical and theoretical values of the average prices of housing units in the secondary market are shown in Figure 3.

Fig. 3. Empirical and theoretical values of average apartment prices on the secondary market in Warsaw and Szczecin in 2012 - 2023 (quarterly data). *Source*: own study.

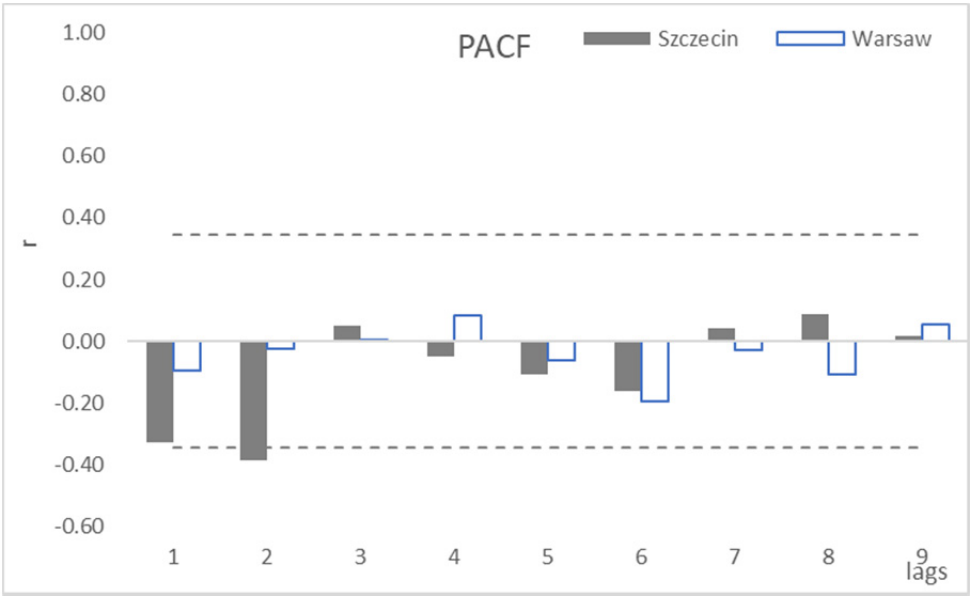

Fig. 5. Partial autocorrelation function (PACF) for model's residuals. *Source*: own study.

When building a model, there is always the question of whether the explanatory variables adequately describe the formation of the phenomenon under study. It can generally be assumed that this conviction increases significantly if the residuals of the model form a purely random process.

The PACF function (Figure 4) was used to evaluate the process of forming the residuals. Almost all partial autocorrelation coefficients of the residuals were statistically insignificant (significance level of 0.01). Only the partial autocorrelation coefficient for a lag of two quarters marginally exceeded the critical value in the case of the model for Szczecin. Thus, with some approximation, it can be assumed that the models correctly describe the dynamics of average apartment prices in the secondary market in Szczecin.

The regression strategy adopted is to study the time structure of the time series, on the basis of which the type of processes is determined. It was found that the variables form AR(1) type processes, so in addition to the "current" variables, their lags were added to the set of potential independent variables. Then, the backward stepwise regression procedure was employed to eliminate non-significant variables. The correctness of the model specification was confirmed by examining the properties of the model's residuals.

Other regression strategies can also be used in time series models. As regards non-stationary time series, their cointegration (and integration) might be investigated (Dickey & Fuller, 1979; Engle & Granger, 1987; Johansen, 1991; Maddala & Kim, 1998).

In the next step of the analysis it was verified - by means of the ADF test - if variables are integrated of order one. Higher orders of integration are rather uncommon in case of economic time series. P – values in ADF test are presented in the table below.

Table 4

P-values in ADF test

Variable	Warsaw	Szczecin
p_t	0.169	0.317
w_t	0.471	0.745
r_t	0.022	0.022
e_t	0.993	0.989
a_t	0.455	0.031
un_t	0.082	0.154

Source: own study.

All variables were integrated of order one (have unit root). The p-values of the ADF test exceeded the significance level of 0.01.

In contrast, the model's residuals in Table 3 were stationary, i.e. the hypothesis of the presence of a unit root in the model's residuals had to be rejected. The p-value in the test for the residuals was less than 0.0001, hence it can be assumed that the residuals were stationary, and the relationship described by the model was not spurious. To verify both short-term and long-term relations ECM can also be applied, which will be done in future research. Because the variables were non-stationary, models for their first differences were also estimated. Instead of variable levels, the first differences (which are stationary) were used in the

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estimation process. In the first step, all differenced variables were taken as explanatory variables. Then, backward stepwise regression was applied to eliminate insignificant variables. However, for the significance level of 0.01, all variables have to be eliminated from the set of explanatory variables. Therefore, it turned out that it is impossible to estimate econometric models for differenced variables. Differencing variables (counting their first differences) eliminates long-term information. The elimination of this type of information in average real estate price models made it impossible to identify factors influencing prices. It turns out that short-term information is not sufficient, thus the analyses should rather be based on (dynamic) models built for variable levels.

4 Discussion

The empirical part estimates a models of average transaction apartment prices in the secondary market in Warsaw and Szczecin, where the set of independent variables included a number of socioeconomic variables that potentially have a strong impact on housing prices. However, it was found that the strongest impact on current average housing prices was that of average prices delayed by one quarter. This demonstrates the strong inertia of average housing prices. Current prices depend not on "objective" factors, but primarily on their previous levels, which is consistent with the widely shared view of the low efficiency and low flexibility of local housing markets.

The results obtained are difficult to compare directly with other studies, as such attempts have rarely been made to date. However, these results confirm the conclusions presented in the work in papers addressing the price anchoring effect (Leung & Tsang 2013; Shie, 2019; Cheung et al., 2022; Kokot, 2023). This effect occurs and significantly improves the predictive quality of price models. As there is not a lot of such research to date, the study presented in this paper still fills a significant gap in the area of identifying factors influencing housing prices. The bulk of previous research into how the anchoring and adjustment heuristic apply to the real estate market has focused on how potential market participants make decisions after receiving an implied property price or value. These studies have explicitly proven that market participants are susceptible to such suggestions. On the other hand, researchers examining the factors that influence real estate prices in local markets have encountered some challenges when explaining price levels. The present study has shown that housing prices can be successfully explained by incorporating into the set of independent variables both the ones relating to objective socioeconomic factors and the ones that reflect information about the market anchored in the minds of market participants. Importantly, information on historical average prices in the market is generally available in publications compiled by the GUS (Central Statistical Office) and the NBP (Polish central bank). Consequently, since market participants have access to this information, they are under its influence when making price decisions when selling or buying a property. The findings of this research imply that the influence of this information on the decisions of market participants is significant. Therefore, it can be confidently concluded that the above is a key factor that has impeded the explanation of housing price levels in traditional studies using variables relating to objective factors.

5. Conclusions

The introduction of lagged prices as independent variables in the econometric models of the average unit house prices considerably improves the quality of the models, making them better fitted to the empirical data. It is worth mentioning that models built for differenced (stationary) variables did not allow the identification of factors influencing average apartment prices.

When summarizing the presented research, a key question remains to be answered: is this merely a statistical relationship, or does it truly reflect the real effect of price anchoring, the latter understood as the impact of behavioral factors on the market, that, after all, reveals trends driven by the conscious and subconscious decisions of many market players. It is obvious that housing prices in a given quarter are partly determined by the prices in the preceding quarter. However, when housing price levels depend less on objective social and economic factors and more on historical prices embedded in the minds of market players, the anchoring heuristic is more likely to affect their decisions. In this context, it is worth noting that the survey covered a long period of 46 quarters, which means that it was conducted under changing market conditions. The results of the survey are relatively conclusive and suggest that at least a part, perhaps a significant part, of the recorded housing price levels can be attributed to behavioral

factors.

Nevertheless, research on the effect of price anchors in housing markets should be seen as a research area still not well explored, which, similarly to behavioral economics as a whole, requires the development of specific research methods and techniques. Future research should focus on the search for other types of anchors than historical prices and new tools that provide opportunities to identify and measure this effect.

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