

HOUSEHOLDS' HOUSING PREFERENCES IN THE PERIOD OF EXTERNAL SHOCKS - POLISH CASE STUDY

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ARTICLE INFO	ABSTRACT
<i>Keywords:</i> housing preferences, housing choices, intertemporal housing decisions	In the study, we examine the stability of housing preferences, comparing past – revealed ones and future declarations. The dynamically changing environment after two very significant external shocks, the Covid-19 pandemic and the influx of immigrants after the Russian aggression in Ukraine, may change the factors important for households when making housing decisions. We focus primarily on ownership, location and property type patterns. In this article, we use association analysis to identify the most important patterns of change in meeting housing needs. The results of a questionnaire survey confirmed the important role of location in households' preferences for purchasing apartments and the significant importance of budget constraints. Moreover, the rules related to moving further from the center and to single-family houses turned out to gain on importance.
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1. Introduction

Purchasing real estate is very important in the process of capital accumulation and, in the long term, contributes to the development of the labor market and economic growth. The heterogeneity of the housing market implies that households, when purchasing a flat, have different preferences regarding the way of satisfying their housing needs, which also determines the apartments' features. Also, with ongoing changes in macroeconomics, geopolitics and the environment, households' needs and preferences may change over time. The dynamically changing environment, after two very significant external shocks (the COVID-19 pandemic and the influx of immigrants after the Russian aggression in Ukraine), may also have an impact on the factors important for households when making housing decisions.

From a microeconomic point of view, the decision to purchase an apartment is multi-factor and multi-level. It concerns, i.e. the choice of the form of satisfying the housing need (buying an apartment, renting, living with parents, etc.), the type of residential property (single-family house, semi-detached house, apartment in a new or old multi-family building) and a number of housing features (location, size, standard etc.). Changes

in preferences may also cause temporary trends towards property segments with specific characteristics, which in turn causes excessive price increases and results in high price levels (NBP, 2023).

Misleading conclusions about the market equilibrium may be due to the fact that, in many models, housing is treated as homogenous. Consumers are trying to optimize their home-purchase decisions, but are limited by the fact that each housing unit has a set of features, that cannot be easily substituted, or cannot be changed at all. For example, small housing units in one location are only found in older buildings, while newer buildings only have larger apartments. Consumers will be forced to make suboptimal choices, which will not only impact the housing market but will also lead to inefficiencies in other sectors of the economy. Another issue is that housing can be bought for consumption purposes, for investment purposes or for various other reasons, which also determines the increase in demand for residential properties with specific characteristics.

This empirical study was conducted in a period of rising inflation, high interest rates and large increases in real estate prices. We collected data on household preferences from the largest Polish cities. Apartment

prices in these cities are higher than in other Polish urban markets, but their changes over time are similar (see NBP, 2023). Waszczuk (2024) argues that Polish housing prices have similar dynamics to other European countries. However, since 2016, Central and Eastern European (CEE) countries have recorded higher house price growth than in rest of Europe (Augustyniak et al., 2021). Therefore, the conclusions of this study can also be applied to agglomerations in other Central and Eastern European countries.

The aim of the study is to investigate the housing choices of households. Our approach is interdisciplinary, combining knowledge from economics, sociology and psychology. The study was conducted right after two demand shocks to determine whether the results indicate changes in household preferences by comparing revealed preferences and future declarations. In this study we use association rule learning, which is a rule-based machine learning method for discovering interesting relationships between variables in databases. Data mining methods have so far been used in real estate market research (Abulatif & Oliveira, 2024), but due to the increasing availability of large data sets, they still have a potential to be used. Our study sheds light on several aspects of household housing behaviors in a transition economy. In such economies, homeownership is preferred over renting (Stephens et al., 2015; Łaszek et al., 2017; Broulíková & Montag, 2020; Łaszek & Olszewski, 2023). Therefore, homeownership, also in CEE countries is usually a key determinant of social status, which probably indicates a greater influence of behavioral factors (Waszczuk, forthcoming).

This paper is organized as follows: the next section focuses on the literature review, Section 3 contains the methodology, Section 4 describes the empirical results of our study, Section 5 focuses on the discussion and finally Section 6 formulates the conclusion.

2. Literature review

Research on the demand side of the real estate market concerns various aspects of decision-making (Diaz & Hansz, 2007; Marsh & Gibb, 2011), as well as some reactions to external shocks (Fan, 2022). Housing decisions are determined by a number of individual determinants: changes in the family situation, income, education, age, job, etc. (Olszewski & Matel, 2022), which illustrate the multidimensional motives for purchasing residential real estate. Moreover, due to the heterogeneity of apartments, preferences for specific housing features are also important (Rosen, 1974).

The housing market is characterized by a significant discrepancy between the features that buyers demand and market developers offer (Wessel & Lunke, 2021; San Juan, 2023). This reduces consumers welfare and makes the market even more vulnerable to demand shocks. Moreover, migrations may also cause an increase in the demand for housing. Migrations are usually related to the need to provide housing in large urban areas for people staying there temporarily (tourists, students) and taking up permanent work (labor market mobility). Recently, attention should be paid to migrations related to the geopolitical situation and the influx of refugees, which resulted in a huge number of migrants in CEE countries. Such sudden inflows of large masses of people cause demand shocks on the housing market, which was observed in Poland, for example in the form of an increase in rents (Gluszak & Trojanek, 2024).

Recently, several articles have been published which, based on questionnaire research, prove that young adults in Poland prefer to own an apartment (Rubaszek & Czerniak, 2017; Bryx et al., 2021). Moreover, Rubaszek and Czerniak (2017), stress that households prefer to own rather than rent, mainly for behavioral and psychological reasons. This means, that homebuyers want to have a safe place for their family, while the rental market is perceived as a temporary way to meet housing needs.

So far, several articles have been written analyzing the impact of the Covid-19 pandemic and migration caused by the war between Russia and Ukraine on various aspects of the functioning of the real estate market. Trojanek et al. (2021) analyzed the impact of COVID-19 on rents and house prices in Warsaw, the capital of Poland. Based on the calculated hedonic indices, they found, that there was a slight increase in prices and a significant decrease in long-term rents after the external shock caused by the outbreak of the pandemic.

Trojanek and Gluszak (2022) focused on examining the impact of migrations related to the Russian invasion of Ukraine on rents in the largest cities in Poland. The results of the study on a national scale may be biased due to the concentration of the rental market in large agglomerations in CEE countries. The authors showed a stronger impact at the city level than at the country level, which is particularly evident in the CEE region.

The results of Czerniak's (2024) study suggest that the impact of Ukrainian war refugees on the housing market through rental prices across Europe was less significant than expected. Moreover, in the CEE region,

characterized by an underdeveloped rental market, the impact of Ukrainian war refugees on rental prices was stronger in countries with a higher share of owner-occupiers. Due to the smaller number of apartments available for rent, i.e. supply rigidity, even a small increase in the number of migrants can result in a large increase in rental prices.

Attempts were also made to conduct hedonic analyses of rental data before and after the occurrence of external shocks in Poland (Hebdzyński, 2024). Preferences were compared based on changes in the valuation of price-setting factors. After the pandemic, rents for the leisure-related apartment characteristics (the availability of a balcony and a private garden) increased, while the war caused a reluctance to use gas heating. However, it should be remembered that buying a property is a long-term decision and the purchase process itself, i.e. finding the right premises and formalities, also takes time, so the results may be spread out over time. Marona and Tomal (2023) argue that it can be expected for changes in preferences for specific housing features reported by consumers after the COVID-19 pandemic to become permanent.

3. Material and methods

To shed light on the households' housing choices and preferences, we conducted a questionnaire study to gather microeconomic data. The survey questionnaire was sent out in December 2022 right after two important, external shocks: the COVID-19 pandemic and the influx of immigrants after the Russian aggression in Ukraine. There is not much research on people's preferences and choices in a new environment. We investigate changes in human' behaviour during a rising inflation, relatively high interest rates and large housing prices increases. By comparing the households' present situation with their declared future choices, we may draw some conclusions on the stability of their preferences and identify main patterns in their behaviors, which also have an impact on the housing situation.

The survey was carried out at the end of 2022 in Polish households, among those aged 18-65, in six voivodeship cities (Gdansk, Krakow, Lodz, Poznan, Warsaw and Wroclaw). The empirical design of this study is similar to other studies aimed at understanding households' housing preferences and their future expectations (Case & Shiller, 2003; Case et al., 2012; Niu et al., 2014; Bover, 2015). The questionnaire contained a number of questions regarding housing related issues, i.e. respondents' housing tenure choices,

housing preferences, the importance of housing attributes and their expectations. We also collected data on socio-demographic information about respondents (age, family size, education, occupation and income). To ensure compliance of the distribution of respondents with the population, stratified sampling was used. A total number of 1,000 observations was gathered, excluding missing values (see Table A1, Appendices).

In this study, we are interested in extracting frequent sets of past and future housing preferences of households. We use the association rule method to create a collection of if-then rules, where on the one side, we have the current information (which is the result of past decisions) and, on the other side, the future declarations. Association rule learning is a rule-based machine learning method which helps to identify interesting relationships between variables (Agrawal et al., 1993; Dasseni et al., 2001).

Let $I = \{i_1, i_2, \dots, i_n\}$ be the set of households preferences and $\mathcal{D} = \{t_1, t_2, \dots, t_3\}$ - the set of observations (one per respondent). For each observation in $\mathcal{D}$ there is a subset of I elements. The form of the association rule is $\{X \Rightarrow Y\}$, where $X, Y \subseteq I$ and $X \cap Y = \emptyset$. The elements X are called the antecedent (left-hand-side) of the rule, while on the right side are elements Y - the consequents (right-hand side), which are usually restricted to only one element. $P(X)$, $P(Y)$ are the percentages (or probabilities) of cases containing X or Y . The intuition behind association rules is that if all preferences $\{X\}$ are held by households, then the declaration $\{Y\}$ is most likely to be important as well.

There are many algorithms used to look for meaningful rules (Vijayarani & Sharmila, 2016), i.e. A-priori, Eclat, FP - growth, Carte, etc. In this study we used the most commonly used a-priori algorithm. The A-priori algorithm generates frequent item sets iteratively and identifies association rules using support and confidence measures to derive the most interesting ones. Support, confidence, lift and coverage indicators were calculated to determine how or why certain declarations of past and future preferences are related. Support is an indicator of how frequently a set of future and past preferences occurs among households. The measure determines the extent to which respondents are characterized by this rule.

$$\text{support}(X \Rightarrow Y) = P(X \wedge Y) \quad (1)$$

Confidence is a measure of how often the rule has been proven true relative to the probability of the occurrence of cases containing X preferences.

$$\text{confidence}(X \Rightarrow Y) = P(Y|X) = \frac{P(X \wedge Y)}{P(X)} \quad (2)$$

Lift is a measure of association using both support and confidence. Lift shows how often respondents claim past and future preferences compared to the expected frequency if both sides occurred independently.

$$\text{Lift}(X \Rightarrow Y) = \frac{\text{confidence}(X \Rightarrow Y)}{P(Y)} = \frac{P(X \wedge Y)}{P(X)P(Y)} \quad (3)$$

If the lift is more than 1, it allows us to know the degree to which the two subsets are dependent on each other, and the given rule is potentially useful for prediction in future data sets.

In this study, in order not to reject rules that are important for small segments of respondents, it was assumed that support should be higher than 0.01 and confidence more than 0.2. In the analyzed data set, many events occur rarely, so a low support threshold > 0.01 was used, while Confidence > 0.2 allows to capture important rules that, despite their low frequency, may have analytical value. The *arules* and *arulesViz* packages in RStudio were used to generate association rules.

The statistical significance of the generated relationships was checked using two tests: the Chi-squared test and the Fisher test, which are based on the contingency matrix.

The formula for the Chi-squared test is as follows:

$$\chi^2 = \sum \frac{(O_i - E_i)^2}{E_i} \quad (4)$$

where:

O_i is the observed number of cases for the i -th cell,
 E_i is the expected number of cases for the i -th cell, calculated based on the independence hypothesis.

The sum (Σ) is calculated for all cells of the contingency matrix. Table x shows the contingency matrix of association rules.

Table 1

Contingency matrix of association rules

	RHS (plans)	-RHS (opposite plans)
LHS (decision)	O_{11}	O_{12}
-LHS (opposite decision)	O_{21}	O_{22}

Source: own elaborations.

The expected values E_{ij} in the contingency matrix for each cell can be calculated based on the formula:

$$E_{ij} = \frac{R_i \times C_j}{N} \quad (5)$$

where:

R_i is the sum of the i th row,

C_j is the sum of the j th row,

N is the total number of observations.

The null hypothesis (H_0) states that there is no relationship between the LHS and RHS variables of the generated rules, and the alternative hypothesis (H_1) states that there is a relationship between LHS and RHS. For p-values with a significance level of less than 0.05, the hypothesis H_0 , stating the lack of statistical significance, can be rejected.

Additionally, the Fisher exact test was performed, which is used for small samples because it does not require approximations, as is the case in the Chi-square test. In Fisher's exact tests, the probability of a given 2x2 matrix is calculated basing on the hypergeometric distribution:

$$P = \frac{\binom{O_{11}+O_{12}}{O_{11}} \binom{O_{21}+O_{22}}{O_{21}}}{\binom{n}{O_{11}+O_{21}}}, \quad (6)$$

where:

O_{11} , O_{12} , O_{21} , O_{22} are the values in the cells of the contingency matrix (number of observations),

n is the total number of observations ($n = O_{11} + O_{12} + O_{21} + O_{22}$),

$\binom{x}{y}$ is the number of ways (combinations) to select elements y from x .

Similarly to the Chi Square Test, the null hypothesis (H_0) of the Fisher Test states that there is no relationship between the LHS and RHS variables of the generated rules, and the alternative hypothesis (H_1) states that there is a relationship between the LHS and RHS. For p-values with a significance level of less than 0.05, the H_0 hypothesis stating no statistical significance can be rejected.

4. Results

Demand studies on the real estate market explore various aspects of decision-making and reactions to external shocks. Housing decisions are multidimensional in terms of motives, as they are made under the influence of many individual factors. In addition, due to the diversity of apartments, preferences for specific housing features also affect the market situation. Substitution in the housing market is limited due to frictions such as transaction costs, information asymmetries, and the heterogeneity of housing, all of which make moving or switching between dwellings difficult. Additionally, housing choices are constrained by the limited supply available at any given time. In the survey of preferences and declarations, households indicated approximately which factors are important to them when making housing decisions. It turned out, that permanent

property features are the most important (see Figure 1). Households indicated location as an important factor influencing their decision. Moreover, they also indicated that they take price into account when

choosing an apartment, which proves the significant role of budget constraints, while the layout of the apartment, the condition of the building and the standard of the apartment played a relatively small role.

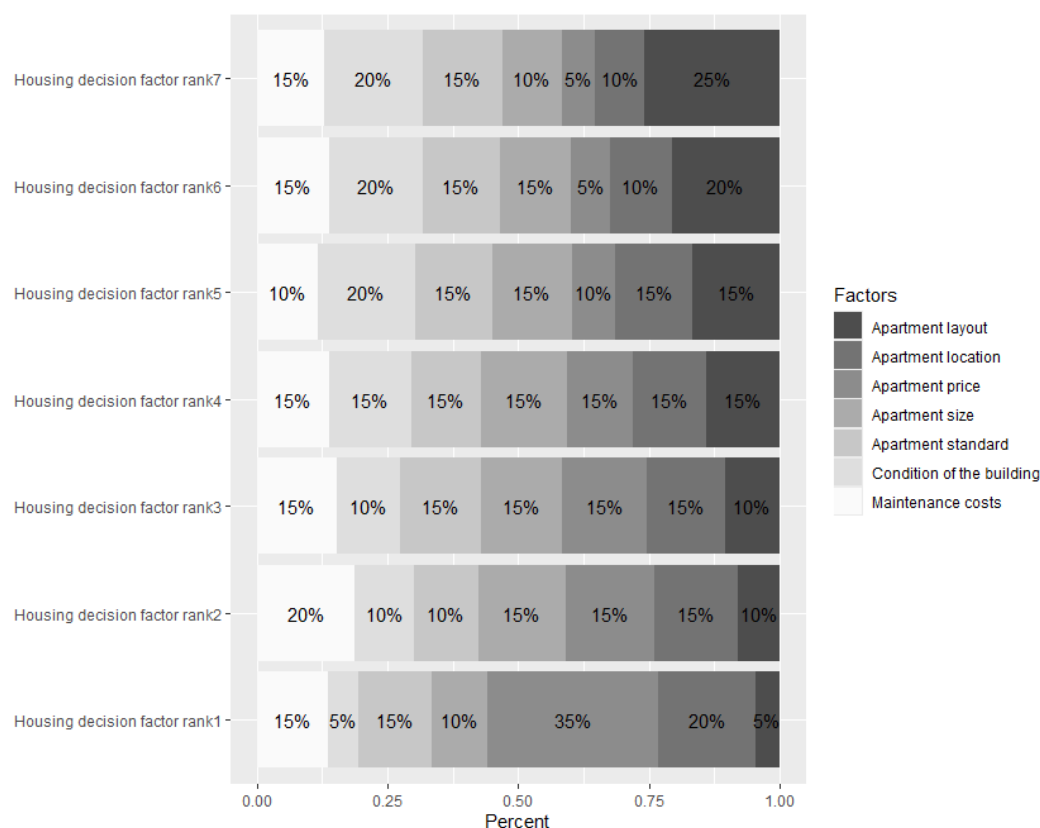


Fig. 1. Ranking of factors important when choosing an apartment – household declarations. *Source:* own study.

The location and immovability of the property are important according to households' declarations (see Table A2, Appendices). Changing the location is associated with buying or renting another property. Past housing choices and future declarations of households revealed the main direction of changes in location. It turned out that location preferences are quite stable (see Table 2, Figure 2). However, we can also see that some households have changed their preferences regarding the location of their housing. Households living in the city center declare that they prefer to move to more distant locations (neighborhoods between the center and the suburbs). These results confirm word-of-mouth about households' willingness to move post-pandemic to areas where they can afford more living space and have more outdoor areas. Another important pattern that can be noted is the move from the suburbs to neighborhoods located closer to the city center (between the center and the suburbs). These may be people who move to a central location to have better access to the job market and amenities. Some households wanted to live closer to places of work and

facilities in order not to travel long distances, as willingness to use public transport decreased after the pandemic. The results of Chi-square and Fisher's exact test proves that the relationships between current location preferences and future declarations revealed by the association rules are statistically important.

We also studied the relationship between household location choices and housing types (see Table A3, Appendices). Changing location preferences often correlates with changing property types. Expected destinations include suburbs, especially for young families, and areas near the city center with taller buildings to be closer to work, or for older people, to be closer to amenities (see Table 3, Figure 3). It appeared that moving further away from the city center (to the suburbs or out of town) tends to be associated with moving to a detached house. This is an important direction indicated by respondents because, after the pandemic, families were looking for more space for themselves. However, there is also an inverse pattern indicated by respondents. Housing choices were also clustered around more central neighborhoods and are correlated with a preference for living in a multi-family

block of flats, both new and second-hand. Only two association rules (the 2nd and 5th) turned out to be

statistically insignificant.

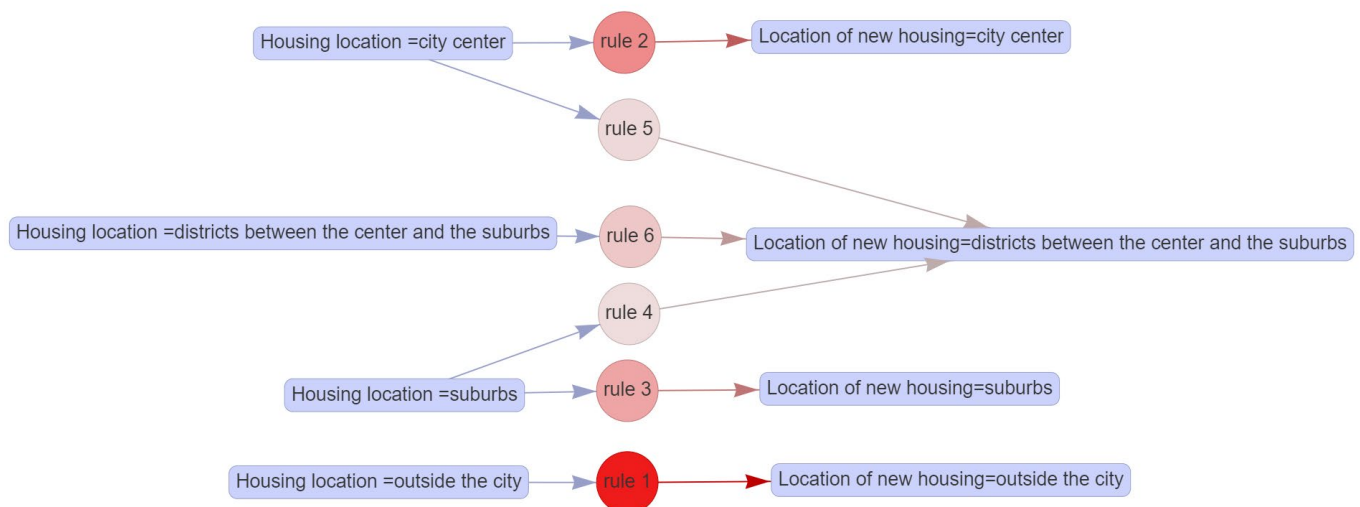


Fig. 2. Household location preferences and future declarations. Source: own study.

Table 2

The results of Chi-square and Fisher's exact test of statistical significance.

Rule	LHS	RHS	Chi-square test	Fisher test
rule 1	outside the city	=> outside the city	< 2.2e-16	3.39e-12
rule 2	city center	=> city center	< 2.2e-16	< 2.2e-16
rule 3	suburbs	=> suburbs	< 2.2e-16	< 2.2e-16
rule 4	suburbs	=> districts between the center and the suburbs	4.237e-16	< 2.2e-16
rule 5	city center	=> districts between the center and the suburbs	4.739e-14	3.164e-14
rule 6	districts between the center and the suburbs	=> districts between the center and the suburbs	< 2.2e-16	< 2.2e-16

Source: own calculations.

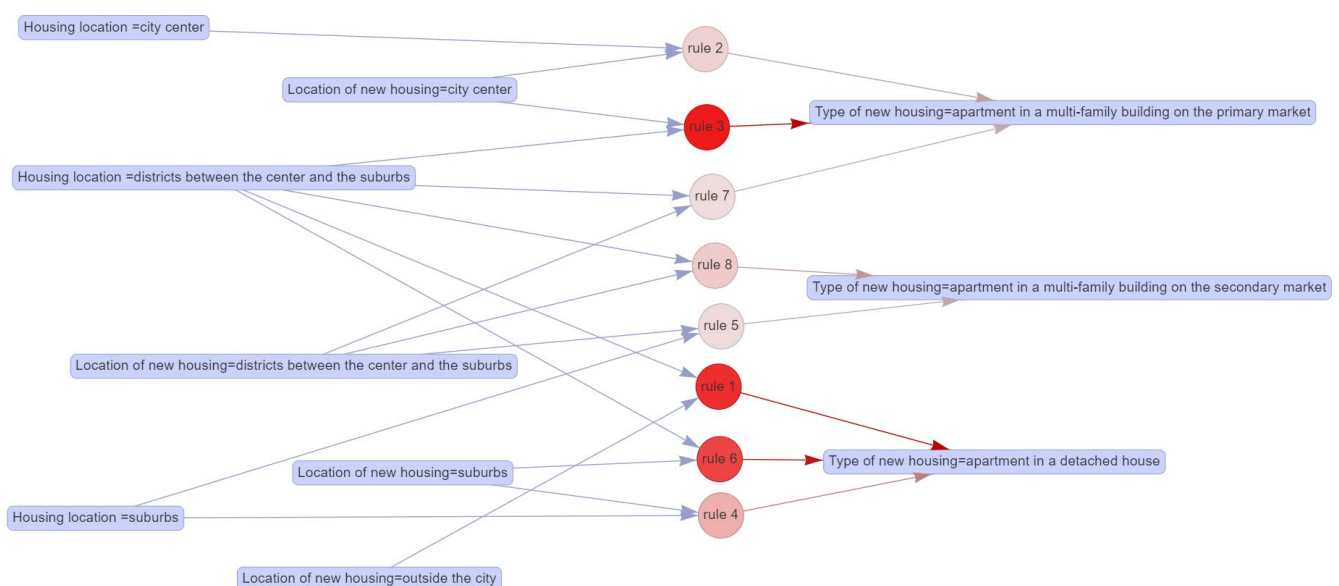


Fig. 3 Relations between households' preferences regarding location and housing type. Source: own study.

Table 3

The results of Chi-square and Fisher's exact test of statistical significance.

Rule	LHS		RHS	Chi-square test	Fisher test
rule 1	districts between the center and the suburbs - outside the city	=>	detached house	9.783e-05	0.00013
rule 2	city center - city center	=>	flat on the primary market	0.09354	0.09025
rule 3	districts between the center and the suburbs - city center	=>	flat on the primary market	0.00040	0.00066
rule 4	suburbs - suburbs	=>	detached house	0.00081	0.00095
rule 5	suburbs - districts between the center and the suburbs	=>	flat on the secondary market	0.3707	0.3371
rule 6	districts between the center and the suburbs - suburbs	=>	detached house	2.436e-09	1.148e-08
rule 7	districts between the center and the suburbs - districts between the center and the suburbs	=>	flat on the primary market	0.00045	0.00042
rule 8	districts between the center and the suburbs - districts between the center and the suburbs	=>	flat on the secondary market	6.533e-10	5.059e-10

Source: own calculations.

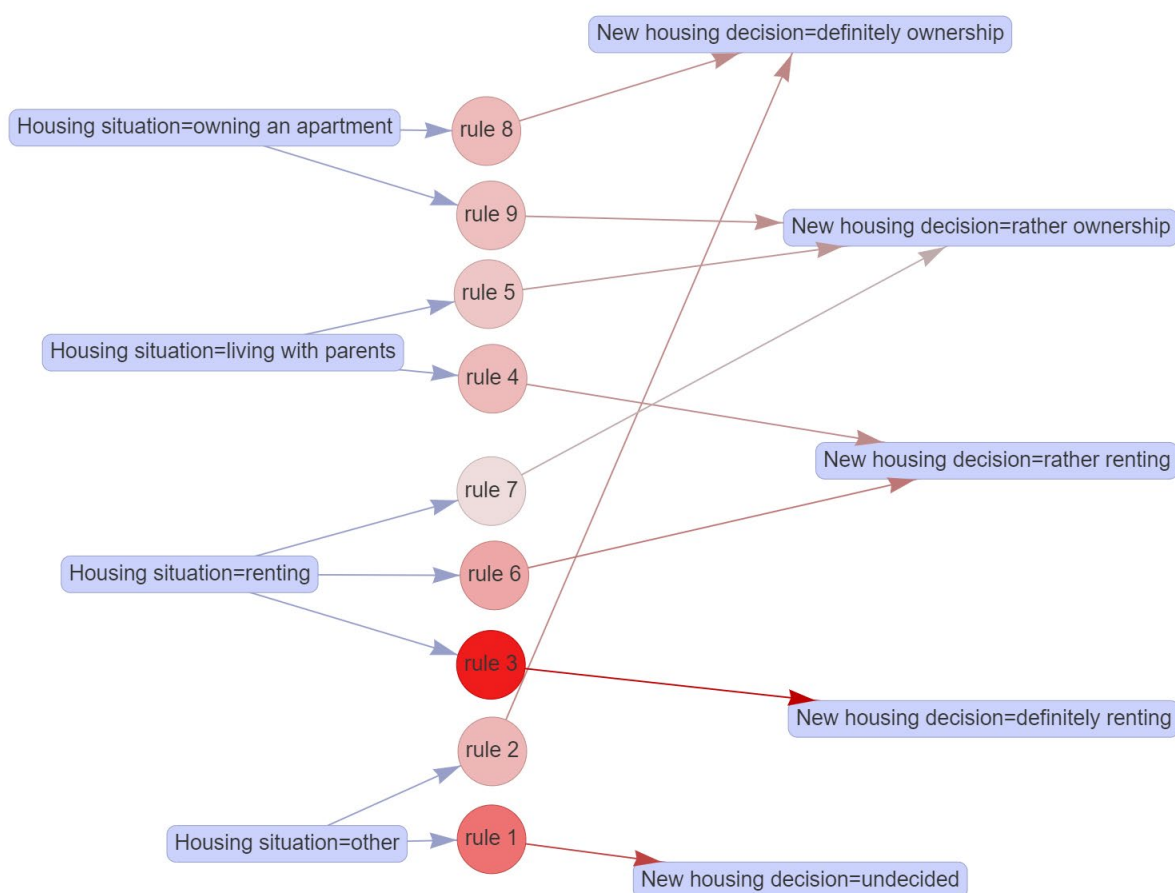

Fig. 4. Households' housing choices. *Source:* own study.

Table 4

The results of Chi-square and Fisher's exact test of statistical significance.

Rule	LHS		RHS	Chi-square test	Fisher test
rule 1	other	=>	undecided	0.008427	0.009377
rule 2	other	=>	definitely ownership	0.4085	0.3578
rule 3	renting	=>	definitely renting	< 2.2e-16	< 2.2e-16
rule 4	living with parents	=>	rather renting	0.292	0.2478

rule 5	living with parents	=>	rather ownership	1	0.9102
rule 6	renting	=>	rather renting	3.608e-05	5.304e-05
rule 7	renting	=>	rather ownership	0.0003365	0.000201
rule 8	owning an apartment	=>	definitely ownership	1.257e-07	4.976e-08
rule 9	owning an apartment	=>	rather ownership	0.0001863	0.0001477

Source: own calculations.

Due to emerging research on sociological changes in the perception of how housing needs are met related to changes in the perception of ownership, renting and co-residence with parents (Kajta et al., 2023), as well as emerging statistics regarding the later (Mirdamadi & Khalid, 2023), we checked whether households' preferences for buying and renting apartments have changed (see Table A4, Appendices). The most important and common set of rules between current and future housing choices is that people who own housing will probably or definitely want to continue to do so (see Table 4, Figure 4). Households that rent housing do not have very clear preferences regarding the future. Many of them plan to continue renting, but there is a group of undecided respondents who consider both options, i.e. renting or owning. According to the survey results, 10% of respondents live with their parents, the majority of which, approximately 66%, are people under 35 years of age. These respondents live with their parents and do not have clear preferences for owning or renting in the future. International studies and statistics also indicate similar phenomena. Many young adults cannot decide to leave their family home due to financial constraints (Meen & Whitehead, 2020). Additionally, many young adults who have recently moved in with their parents have done so due to restrictions related to the COVID-19 pandemic (Prattley, 2022). The main drivers of these movements were job loss and an increased need for emotional and financial support. It appeared that all of the rules with the exception of the 2nd, 4rd and 5th are statistically important. These statistically insignificant exceptions are segments with a small number of observations.

5. Discussion

Housing is a heterogeneous good, and housing choices are multi-level and multi-factorial. This creates a need to investigate the extent to which these choices are periodically stable, especially during external shocks. The real estate market is very heterogeneous, which means that apartments have different features. Ultimately, the apartment buyer chooses an apartment composed of different bundles of features, i.e. located in a specific district, with an area appropriate for the needs and size of the household and other preferences

(Rosen, 1974). Household preferences are different, which results in an ambiguous effect of some features on the prices of residential real estate (de Araujo & Cheng, 2017). This affects the fact that the valuations of attributes change over time (Diewert et al., 2008; Chen & Harding, 2016), so the spatial distributions of dominant attributes may vary spatially depending on the period (Huang et al, 2010). Indeed, there are differences between declared and revealed preferences (Tomal & Brzezicka, 2024), which is very difficult to accurately take into account empirically. Households' stated preferences are influenced by the thoughts, feelings and judgments of other people, while revealed ones are related to actual choices.

Moreover, due to the imperfection of the market on the supply side, the issue of the mismatch of premises delivered to the market with the preferences of buyers and the budget constraint is important. It may turn out that the ideal apartment does not exist or is unavailable at a given moment. It is difficult to assess the real scale of the phenomenon of the shortage of premises, because most studies and analyses are usually conducted on a nationwide basis, and the shortage of apartments, due to the locality of the housing and labor markets, should be analyzed on a micro scale.

Emerging external shocks, such as the recent influx of migrants into the Polish market caused by the Russian invasion of Ukraine and the Covid pandemic, may also be an impulse that triggers changes in household preferences and housing choices. Most studies focus on choices that had already been made by households or their declarations, which is a significant limitation of these studies. However, even examining people's opinions allows us to draw some conclusions about the changes that are taking place. The expected effects in the change of preferences at the stage of designing the study assumed rather similar directional changes in the preferences of households located further away from city centers, because these properties have larger areas and plots, and more remote areas are less threatened by potential attacks during war. In addition, the possibility of remote work tends to lead to selecting properties located further away from city centers and reduces the pressure to live close to large agglomerations. This trend turned out to

be strongly highlighted in the obtained results.

6. Conclusions

The study focused on changes in households housing preferences right after two very significant external shocks, i.e. the Covid-19 pandemic and the influx of immigrants after the Russian aggression in Ukraine. These were two important events for households that influenced their decisions-making patterns and shaped their housing situation.

The study confirmed the important role of location in households' preferences for purchasing apartments and the importance of budget constraints. Another important observation is the relatively small role of the apartment layout, the condition of the building and the standard of the apartment.

We also revealed the most common rules regarding the choice of location, tenure and type of apartment. In Poland, as a transition economy, the attachment to ownership has been confirmed. Households that own housing are likely or even definitely going to remain in this tenure status. Additionally, it turned out that the majority of renters would like to continue doing so, but there are also groups that are considering both renting and buying their own property. We also identified a group of people living with their parents. However, these people do not have clearly defined preferences regarding the choice of tenure with respect to renting or owning their apartments in the future.

According to the survey results, the housing preferences of households are relatively stable, but certain trends have also been identified. We found a group of households that would prefer to move further away from the city center and another group that would prefer to live closer to the city center, but not in it. People who prefer to live away from the center usually chose detached houses. The possibility of hybrid work most likely influences such decisions of households, who can afford better quality and larger properties with green areas around them in the case of more distant locations. On the other hand, those who changed their preferences towards the city center usually prefer to live in a multi-family blocks. This declared change among young people may be caused by the willingness to live closer to their workplaces and have better access to amenities.

Our study provides interesting conclusions regarding the comparison of housing preferences of households over time. During dynamic changes in the environment, it is extremely important to examine preferences because they influence the housing market

situation. The association rules method allows interesting and important patterns of behavior to be revealed in the data set.

Statements

The paper is a research article, presents the personal opinions of the authors and does not necessarily reflect the official position of the Narodowy Bank Polski or the Warsaw School of Economics.

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Appendices

Table A.1

Descriptive statistics of data sample								
Variable	Definition	in:	Descriptive statistics					
			Min	1Q	Median	Mean	3Q	Maximum
Age	Age	Years	18	30	39	40	48	68
Household size	Number of family members	Number	1	2	3	2.85	4	7
Categories		in:	Frequencies					

Sex	Man	%	0.478
	Woman		0.522
Marital status	Married	%	0.485
	Cohabitant		0.137
	Single		0.272
	Widowed		0.026
	Divorced		0.071
	Other		0.009
Employment type	Open-ended contract	%	0.594
	Fixed-term contract		0.159
	Self-employment		0.072
	Company owner		0.021
	Pensioner		0.042
	Unemployed		0.054
	Not working		0.058
Gross income (per person)	<2000	%	0.084
	2001-3000		0.198
	3001-5000		0.278
	5001-7500		0.192
	7501-10000		0.088
	10001-15000		0.058
	15001-20000		0.020
	>=20001		0.020
Material situation	No answer	%	0.062
	Poor		0.147
	Average		0.505
	Good		0.285
	Very Good		0.063
Owning an apartment	No	%	0.314
	Yes		0.686

Source: own calculations.

Table A. 2

Association rules – location choices

Housing location		Location of new housing	Support	Confidence	Coverage	Lift	Count
outside the city	=>	outside the city	0.019	0.528	0.036	5.997	19
city center	=>	city center	0.101	0.490	0.206	3.553	101
suburbs	=>	suburbs	0.101	0.577	0.175	2.697	101
suburbs	=>	districts between the center and the suburbs	0.049	0.280	0.175	0.500	49
city center	=>	districts between the center and the suburbs	0.067	0.325	0.206	0.581	67
districts between the center and the suburbs	=>	districts between the center and the suburbs	0.437	0.750	0.583	1.339	437

Source: own calculations.

Table A. 3

Association rules – renting vs owning

Current housing situation		New housing decision	Support	Confidence	Coverage	Lift	Count
other	=>	undecided	0.012	0.2857	0.042	2.086	12
other	=>	definitely ownership	0.013	0.310	0.042	1.269	13
renting	=>	definitely renting	0.052	0.254	0.205	2.850	52

living with parents	=>	rather renting	0.026	0.260	0.100	1.215	26
living with parents	=>	rather ownership	0.032	0.320	0.100	1.013	32
renting	=>	rather renting	0.066	0.322	0.205	1.504	66
renting	=>	rather ownership	0.043	0.210	0.205	0.664	43
owning an apartment	=>	definitely ownership	0.194	0.297	0.653	1.218	194
owning an apartment	=>	rather ownership	0.233	0.357	0.653	1.129	233

Source: own calculations.

Table A. 4

Association rules – type of housing							
Location preferences (current - future choice)		Housing type	Support	Confidence	Coverage	Lift	Count
districts between the center and the suburbs - outside the city	=>	detached house	0.020	0.588	0.034	2.108	20
city center - city center	=>	flat on the primary market	0.033	0.327	0.101	1.291	33
districts between the center and the suburbs - city center	=>	flat on the primary market	0.016	0.552	0.029	2.181	16
suburbs - suburbs	=>	detached house	0.043	0.426	0.101	1.526	43
suburbs - districts between the center and the suburbs	=>	flat on the secondary market	0.018	0.367	0.049	1.224	18
districts between the center and the suburbs - suburbs	=>	detached house	0.047	0.566	0.083	2.030	47
districts between the center and the suburbs - districts between the center and the suburbs	=>	flat on the primary market	0.135	0.309	0.437	1.221	135
districts between the center and the suburbs - districts between the center and the suburbs	=>	flat on the secondary market	0.176	0.403	0.437	1.342	176

Source: own calculations.