

ESTIMATION OF THE UTILITY FUNCTION OF MONEY AND HOUSING BASED ON THE CUMULATIVE PROSPECT THEORY

Justyna Brzezicka^{1*}, Mateusz Tomal²

¹Department of Spatial Analysis and Real Estate Market, University of Warmia and Mazury in Olsztyn, ul. Oczapowskiego 1, 10-724 Olsztyn, Poland, e-mail: justyna.brzezicka@uwm.edu.pl, ORCID: 0000-0001-9500-1054.

²Department of Real Estate and Investment Economics, Cracow University of Economics, Cracow, Poland, e-mail: tomalm@uek.krakow.pl, ORCID: 0000-0002-8393-1614.

* Corresponding author

ARTICLE INFO	ABSTRACT
Keywords:	This article addresses the issue of the utility of money and the utility of housing with a value equivalent to that amount of money. The literature provides many reports on the shape of the utility function for money, but much less research has been devoted to the utility function for housing. The aim of this study was to estimate the utility function of money and housing according to the cumulative prospect theory (CPT) developed by Tversky and Kahneman (1992). Parameters alpha (α), beta (β), and lambda (λ) were estimated to compare the utility value of money and housing. The most important conclusions of the study are as follows: parameters alpha and beta were greater than 0 and less than 1 for both housing and money. Function $v(x)$ was concave in the gain domain and convex in the loss domain, which is consistent with the CPT. The differences in the lambda parameter denoting loss aversion were not significant, and the value of the utility function was somewhat higher for money than for housing. This study was undertaken to estimate the CPT parameters for housing, which, according to the authors' best knowledge, has not been investigated to date.
Utility function, cumulative prospect theory, certainty equivalent, housing	
JEL Classification:	
C93,D10, D81, D91, R21, R29	
Citation:	Brzezicka, J., & Tomal, M. (2023). Estimation of the utility function of money and housing based on the cumulative prospect theory. <i>Real Estate Management and Valuation</i> , 31(3), 83-92. https://doi.org/10.2478/remav-2023-0024

1. Introduction

The aim of this study was to estimate the utility function of money and housing worth an equivalent amount of money. The shape of the utility function curve for money has been analyzed extensively in the literature, but the utility function of housing has been less widely researched. The utility function of money represents the utility of the amount of money at the consumers' disposal for purchasing various goods. In turn, housing is a commodity that enables the owner to derive benefits from own-occupied housing or to invest money and derive future income streams from a housing unit. However, in addition to its material value, housing also serves non-material functions and delivers non-material benefits, such as a sense of security and a place to live and raise a family.

This study makes a reference to the prospect theory developed by Kahneman and Tversky (1979)

and the cumulative prospect theory (CPT) which is an extension of their original work (Tversky & Kahneman, 1992). The CPT is the most popular model for describing decision-making under risk and uncertainty, and it elaborates on the normative model of expected utility theory. The CPT can be applied to explore the inconsistencies (paradoxes) between observed consumer behaviors and the postulates of the expected utility theory. The main aim of this study was to estimate the parameters of the CPT for money and housing. An attempt was also made to determine the degree of loss aversion and the attitudes towards risk associated with the convex-concave value function of both money and housing. The study involved a survey to determine Polish consumers' attitudes towards pure gain, pure loss, and mixed-outcome lotteries.

The research hypothesis postulates that housing has higher subjective value than an equivalent amount

of money because money is a purely material asset, whereas housing serves both material and non-material functions. However, this problem is more complex. Property is becoming a risky investment due to rising real estate prices, fluctuations in market and non-market factors that influence housing prices and potential income streams, as well as high and rising inflation.

The study was conducted in 2022 - a difficult year for the Polish housing market, which had witnessed a marked increase in property investment risk. The COVID-19 pandemic changed the consumers' housing preferences and led to price fluctuations on the rental market (Renigier-Biłozor et al., 2020; Tomal 2021; Tomal & Marona, 2021; Tomal & Helbich, 2022; Żróbek-Różańska, 2022). Poland has opened up to a flood of refugees fleeing the conflict in Ukraine. Millions of Ukrainians have crossed the Polish border and were granted temporary or permanent residence, which led to a demand shock on the housing market. According to Border Guard data, 3,180,897 Ukrainians entered Poland in the first quarter of 2022 (3,046,762 across the Polish-Ukrainian border) (Report 1, 2022), and more than 5 million Ukrainians relocated to Poland in the first half of 2022 (Report 2, 2022). Growing housing prices pose yet another problem. According to the National Bank of Poland, housing prices on the primary and secondary market increased by 15-17% in the 1Q and 2Q 2022 (year-to-year) in Poland's ten largest cities (Report 3, 2022). Based on Statistics Poland estimates, the annual inflation rate reached 15% in June and 17% in September. Between October 2021 and October 2022, the Monetary Policy Council increased the reference rate eleven times (once per month, from 0.5% to 6.75%). The Polish economy and the housing market are therefore facing unprecedented difficulties. In this context, the undertaken research is particularly significant, but it is burdened by the consequences of co-occurring and interconnected market forces and non-market factors.

The paper is organized as follows. The next section contains a review of the literature. The main emphasis was placed on the utility function of housing in classical economics, as well as research conducted in the context of the prospect theory. The empirical framework section discusses sources of information and the model for assessing the parameters of the CPT. Our findings are presented and compared with previous studies in the results section. Conclusions are formulated in the last section of the paper.

2. Literature review

Investment decision-making, risk perception, and the utility of selected options play a particularly important role in real estate research. The utility of housing is a complex problem. Property transactions involve the transfer of ownership to real estate. In turn, property valuation is a process during which the characteristic attributes of housing are described and assigned weights. Therefore, from the consumer's point of view, each of these characteristics has a certain utility value, and a product's price is the sum of all utilities gained from specific characteristics because the attributes of property are not traded on the market. The price of a housing unit represents the overall value of its characteristic attributes. These attributes change dynamically over time under the influence of numerous variables (Tomczyk & Widłak, 2010). Consumer decisions are influenced by income (budget constraint), preferences (indifference curve), interest rates, housing prices, including mortgage costs, and the prices of other goods (Łaszek et al., 2017). These variables affect the demand for housing, and their elasticity is determined by consumer preferences which have an individual, variable, and scattered character.

Choices in the housing market simultaneously realize two functions: housing and investment, and involve two approaches. The consumption goal approach leads to the purchase of an owner-occupied housing (OOH) and is financed with a loan. The analysis of housing as a consumer good highlights its heterogeneity both as a durable consumer good or a capital good that generates consumption services, and at the same time a capital good that generates income and is valued by the market. In the case of OOH housing, the two choices are intertwined, since what we observe in the market as housing demand is the sum of investment and consumption demand. Consequently, the basic problem when analyzing consumer and investor choice in the housing market is the multidimensional nature of housing value and, as a result, its choice, which is an optimization of many variables (Łaszek et al., 2013, pp. 204-205). In the first approach, the consumer/housing owner maximizes utility by allocating different proportions of the budget to housing and other goods. However, the household does not only consider the potential imputed rent it could pay, but also the mortgage payment it could afford (Matysiak et al., 2021). In the second approach, housing is regarded as a capital asset, and imputed rent is the money homeowners

save by paying themselves instead of a landlord (Frick et al., 2010). The return on the investment is a critical consideration for a model buyer/investor. An investor will invest when the expected return on the investment exceeds the alternative cost of capital, including mortgage costs, depreciation, and the expected increase in housing prices. In this model, the investor maximizes utility by deciding on the proportion of the budget that can be spent on housing and on other goods. This attitude stems from the conviction that housing is an investment as well as a consumer good (Salzman & Zwinkels, 2017, p. 80; Brzezicka et al., 2018, p. 527), housing assets can effectively diversify investment portfolios but mostly due to low correlation with other traditional assets and low risk (Ibbotson & Siegel, 1984). Solutions that combine both models have also been described in the literature (Flavin & Yamashita, 2002).

Interestingly, Rubaszek (2019) surveyed Polish households and found that strong tenure preferences toward owning can be attributed to both economic and psychological factors. Ownership is perceived not only as a form of satisfying housing needs, but also as the only way to provide a safe place for the family. Therefore, non-material factors such as sentiment and a sense of security can increase the value of real estate (Renigier-Biłozor & d'Amato, 2017; Lepinteur & Walzl, 2021). Bratt (2002) observed that housing is the foundation of family life, without which other activities would be severely challenged or impossible to carry out. Housing well-being refers to the cumulative positive and negative affect associated with purchasing, preparing, owning, using, and maintaining the current home, selling the previous home or buying a new one (Grzeskowiak et al., 2006). Non-material factors and attachment to one's place of residence also affect the perceived value of property and the relationship between primary and secondary housing (Perkins & Thorns, 2006).

In this case, two types of property values and two processes of establishing the value of property should be considered, namely professional valuation and owner-perceived valuation. This problem was addressed by Salzman and Zwinkels (2017, p. 80) in the chapter entitled "Real Estate Finance and Investment: The Price of a House or the Value of a Home?". Professional valuation is a formal process that is conducted by a licensed surveyor with the use of standard valuation methods and techniques. The purpose of the valuation, the type and location of property, its intended purpose in the local zoning

plan, the condition of the property, and information about prices, rents and attributes of similar properties are taken into consideration in the valuation process. The valuation process is objective and professional (based on standard valuation methods and techniques), and the valuation report is generated by a third party (exogenous) (Renigier-Biłozor et al., 2020; Walacik et al., 2020; Żróbek et al., 2020). In turn, during owner-perceived valuation, the value of a housing unit is determined by the owner or a potential buyer (endogenous) during an informal and non-professional appraisal. Therefore, valuation is a set of subjective and simplified (heuristic) judgments which are formulated based on the decision-maker's needs, plans, motivations, beliefs, and observations concerning the property market, as well as the perceived utility of the property on offer (Chmielewska et al., 2022). Individuals rely on personal valuation strategies to determine the extent to which a given property meets their needs and expectations relative to other properties. Property valuation and price expectations also rely on heuristics (Diaz, 1999; Meng, 2020; Bro & Eriksen, 2021) such as the anchoring effect, endowment effect, and loss aversion, as well as individual attitudes towards risk and other phenomena identified in behavioral economics and economic psychology.

The psychological approach assumes that the utility function is represented by an S-shaped curve according to the prospect theory (Kahneman & Tversky 1979) and the CPT (Tversky & Kahneman, 1992). The prospect theory states that investors assign different value to gains and losses, depending on the reference point. The value function is generally concave for gains and convex for losses, and the curve is steeper on the loss side. Small probabilities play an important role in large decision weights, as demonstrated by the non-linear probability weighting function that exhibits diminishing sensitivity – the marginal value of both gains and losses declines with size. The prospect theory introduced additional effects to describe decision-making under risk and uncertainty, including the certainty effect, reflection effect, and isolation effect, as well as the loss aversion component represented by parameter λ .

The prospect theory and the CPT have been applied to explain consumer behaviors in various areas of life (Barberis, 2013), but they were less frequently used to explore decision-making strategies on the housing market and in urban studies. Hui et al. (2014) investigated the housing preferences of the

elderly in Hong Kong in an indirect approach. They analyzed the factors that affected seniors' housing expectations and, consequently, housing preferences in the context of the prospect theory based on the concepts of the reference point and utility function. Buisson (2016) proposed a model of the decision to sell a house when the seller was averse to loss. The model revealed that the theoretical effect of loss aversion proceeds in a direction opposite to the hypothesized effect: loss aversion tends to decrease the reservation price. These estimates suggest that the strength of the effect depends on the time horizon: the longer the time horizon, the weaker the effect. Yan and Bao (2018) proposed a theoretical framework based on the prospect theory to explain the determinants of housing satisfaction among relocated residents and to capture the impact of psychological and social factors on residential satisfaction. Their research confirmed that displaced households use both internal and external reference points (or comparable groups) in determining their housing satisfaction, and their responses to loss and gain are not uniform, with loss mattering more than the same amount of gain in relocation outcomes. Li et al. (2019) modeled home sellers' pricing decisions in the prospect value function and demonstrated that a simple disposition effect is caused by reference dependence when sellers are risk-neutral. Tomal and Brzezicka (2022) examined risk attitudes towards gambles involving housing and money in gain and loss domains for different payoff values and attempted to determine whether the difference between the expected value and the certainty equivalent is significantly different for housing and money. They found that estimates for money and housing differed significantly due to the higher utility of the latter. Ebrahimigharehbaghi et al. (2022) applied the CPT framework to examine Dutch homeowners' attitudes towards energy efficiency renovations. Research results indicate that CPT explains decision-making behaviors more effectively than the expected utility theory.

The present experiment involved a lottery, and the certainty equivalent of two types of payoffs were compared. In economic theory, the certainty equivalent is defined as a payoff value that would be accepted regardless of whether it is certain or entails a certain risk. The certainty equivalent is associated with the expected utility theory, and it is applied in practice to describe the utility function of money. For the decision-maker, it is the smallest but acceptable

payoff whose utility is equivalent to a gamble with a risk option. The above implies that a decision-maker hoping to maximize the utility function has no preference for a random payoff or a non-random payoff that is equal to the certainty equivalent. The combinations of goods that leave the consumer indifferent or equally satisfied are presented on an indifference curve. Tversky and Kahneman (1992) relied on the certainty equivalent to build the CPT model, and this concept was later used in lotteries to define CPT parameters (Rieger, Wang, Hens 2017), the probability weighting function (Tversky, Fox 1995), other utility functions (Frittelli & Maggis, 2011), and to examine consumer preferences in gambling (Bostic et al., 1996).

3. Material and methods

3.1 The model

The parameters of the utility function were described with the use of the CPT values calculated by Tversky and Kahneman (1992). The implemented formulas and the survey questionnaire were based on the approach described by Rieger, Wang, and Hens (2017). According to the CPT, the utility of a lottery is described with Formula (1) for gains and formula (2) for losses:

$$CPT = (1 - w_+(p))v(A) + w_+(p)v(B) \quad (1)$$

$$CPT = (1 - w_-(p))v(B) + w_-(p)v(A) \quad (2)$$

where: A and B are the payoffs ($A < B$); p is the probability of obtaining a higher outcome B; w_+ is the probability weighting function for gains; w_- is the probability weighting function for losses; and v is the value function. The value of function $v(x)$ is a subjective assessment of the result x, namely a gain or a loss relative to the adopted reference point. Functions v , w^+ , and w^- are described by Formulas (3), (4), and (5), respectively:

$$v(x) = \begin{cases} x^\alpha & \text{for } x \geq 0 \\ -\lambda(-x)^\beta & \text{for } x < 0 \end{cases} \quad (3)$$

$$w^+(p) = e^{-(\ln p)^\gamma} \quad (4)$$

$$w^-(p) = e^{-(\ln p)^\delta} \quad (5)$$

where: $\lambda > 0$ is the loss-aversion coefficient; $\alpha, \beta > 0$ describe risk attitudes towards gains (α) and losses (β); $w^\pm$ is the weighting function; $\gamma, \delta \in (0, 1]$ describe the degree of overweighting and underweighting. In contrast to Rieger et al. (2017), the present study relied on the probability weighting function developed by Prelec (1998). According to Stott (2006),

the combination of the Prelec weighting function and the power value function (3) guarantees the best explanatory power within the CPT.

A mixed-outcome lottery was also used in the study:

$$0 = w_+(p)v(A) + w_-(p)v(B) \quad (6)$$

where: A is the amount that renders the participant indifferent to the lottery of outcomes A and B with a 50–50 chance, where $A < 0$ and $B > 0$.

The function w is the probability weighting function which describes the subject's attitude towards probabilities. The weighting function is relatively sensitive to changes in probability near the end points 0 and 1, but is relatively insensitive to changes in probability in the middle region. The probability weighting function (w) was not analyzed in this study.

3.2 Experiment

The experiment involved a questionnaire survey. Surveys are becoming increasingly popular in real estate research (Bao, 2020). The survey was outsourced to an external service provider. The studied population was divided into two groups. The first group answered questions about money, and the second group answered questions about housing worth an equivalent amount of money. A total of 102 responses were acquired in the first group, and 101 responses were acquired in the second group. The respondents were residents of Warsaw (Poland) with a university degree. This population group was selected on the assumption that better educated respondents would find it easier to understand the questionnaire and would give more reliable answers. In addition, the population sample was narrowed down to respondents aged 25–40 to increase the likelihood that the study would include subjects who actively participate in the property market. The survey was carried out in August 2020.

In the survey, the respondents were asked to participate in a theoretical lottery with a risk option. The questionnaire consisted of 10 questions, including 6 questions for a pure gain lottery, 2 questions for a pure loss lottery, and 2 questions for a mixed-outcome lottery. The examples of questions for pure gain, pure loss, and mixed-outcome lotteries are presented below. In questions 1–6, the respondents were asked to indicate that amount of money they would be willing to pay to participate in the lottery. In questions 7 and 8, the respondents were asked to indicate the amount of money they would be willing

to pay to avoid the lottery. The latter amount was defined as insurance against potential gambling losses. The exact wording of the questions played an important role in this study. According to Harrison and Swarthout (2016), the origin of the money at decision-makers' disposal is significant, and support for CPT is greater when losses are covered out of an earned endowment rather than house money.

Question in a pure gain lottery: *You have been invited to participate in a lottery with two possible outcomes: A) a 40% chance of winning PLN 0; B) a 60% chance of winning PLN 300,000. Indicate the maximum amount of money you would be willing to pay to participate in the lottery.*

Question in a pure loss lottery: *You have been invited to participate in a lottery with two possible outcomes: A) a 60% chance of losing PLN 300,000; B) a 40% chance of not losing and not winning in the lottery. Indicate the maximum amount of money you would be willing to pay to avoid the lottery. This amount is equivalent to insurance against potential gambling losses.*

Question in a mixed-outcome lottery: *You have been invited to participate in a lottery with two possible outcomes: A) a 50% chance of losing PLN 300,000; B) a 50% chance of winning PLN X. Indicate the minimum value of X for which you would be willing to participate in the lottery.*

The questions were formulated and structured according to the approach described by Rieger, Wang, and Hens (2017). The amounts and probabilities in the lottery are presented in Table 1.

3.3 Estimation procedure

The parameters of the CPT were estimated with the use of the approach described by Rieger, Wang, and Hens (2017). In the first step, the error was calculated as the absolute difference between the predicted certainty equivalent and the elicited willingness to pay (WTP) in the lottery. The error was normalized by dividing the above difference by the lottery's maximum outcome. The summed error was then minimized to determine CPT parameters. This was accomplished with the use of a simple grid search method by checking all potential combinations of CPT parameters between 0 and 2 (for λ between 0 and 5) with a step width of only 0.005. The parameters of the value function and weight probability function were defined separately for gains and losses. In the last step, the loss aversion coefficient was calculated with the use of previously defined parameters ($\alpha, \beta, \gamma, \delta$)

and the mixed-outcome lottery. The CPT parameters were estimated for all respondents on the assumption that none of them could be regarded as identical.

4. Results

The values of the utility function and the weighting

probability function were estimated. The estimated values and the results obtained by Tversky and Kahneman (1992) are compared in Table 2. In Table 3, the obtained values were compared with the CPT parameters estimated in other studies.

Table 1

Payoffs in the lottery					
Lottery	Outcome (A)	Probability (A)	Outcome (B)	Probability (B)	Expected value
1	0	0.4	300000	0.6	180000
2	300000	0.1	400000	0.9	390000
3	0	0.1	300000	0.9	270000
4	0	0.4	500000	0.6	300000
5	0	0.9	300000	0.1	30000
6	0	0.4	400000	0.6	240000
7	-300000	0.6	0	0.4	-180000
8	-500000	0.6	0	0.4	-300000
9	-300000	0.5	X	0.5	-
10	-400000	0.5	X	0.5	-

Source: Rieger, Wang, and Hens (2017).

Table 2

Function parameters					
Money					
	Alpha	Beta	Gamma	Delta	Lambda
	α	β	γ	δ	λ
Mean	0.92	0.92	0.56	0.88	1.16
Median	0.93	0.95	0.55	1.00	0.80
Housing					
	Alpha	Beta	Gamma	Delta	Lambda
	α	β	γ	δ	λ
Mean	0.91	0.90	0.63	0.89	1.36
Median	0.93	0.92	0.76	1.00	1.12
Tversky and Kahneman (1992)					
	Alpha	Beta	Gamma	Delta	Lambda
	α	β	γ	δ	λ
Median	0.88	0.88	0.61	0.69	2.25

Source: own elaboration.

Table 3

CPT parameters estimated in other studies					
Reference		CPT estimates			
		α	β	γ	δ
Tversky, Kahneman (1992)		0.88	0.88	0.61	0.69
Camerer, Ho (1994)		0.32		0.56	
Wu, Gonzalez (1996)		0.52		0.71	
Abdellaoui, M. (2000)		0.89	0.92	0.6	0.7
Gurevich, Kliger, Levy (2009)	mean value	0.98		0.92	0.77
	median value	0.98		0.84	0.76
Harrison, Swarthout (2016)		0.21	0.06	0.44	0.97
Rieger, Wang, Hens (2017)	53 countries	0.26-0.87	0.21-1.72	0.30-0.84	0.34-1.0
	Poland	0.47	0.55	0.45	0.94
Tomal, Brzezicka (2022)	money, mean value	0.71; 0.71	0.50; 0.51		
	money, median value	0.72; 0.76	0.44; 0.47		
	housing, mean value	0.73; 0.77	0.54; 0.51		
	housing, median value	0.77; 0.84	0.44; 0.47		

Source: own elaboration.

The calculated parameters and their characteristics in the CPT model are discussed below.

Parameters $\alpha, \beta > 0$ describe the risk attitudes for gains (α) and losses (β). Alpha and beta are generally smaller than 1, which implies that the convex-concave function can be found globally. The value function is concave in the region of gains and convex in the region of losses; therefore, the increase at the end of the function decreases with a rise in gain or loss. When α and β are less than 1, the above function exhibits risk aversion over gains and risk seeking over losses and allows for losses to matter more than gains (Neilson & Stowe, 2002). Loss aversion is observed in the behavior of decision-makers who are more sensitive to losses than gains with the same absolute value. In the present study, α and β for the mean and the median were determined at $\alpha > 0$ and $\beta > 0$ for both housing and money. The results are consistent with the CPT as well as other authors' findings. In a study by Rieger, Wang and Hens (2017), α and $\beta > 1$ in only two out of 53 investigated countries.

Decision weighting functions γ (for gains) and δ (for losses) were also consistent with the CPT. These parameters were less than 1. The parameters for money and housing were similar on the loss side, and greater differences were observed on the gain side. Element v is the value function of the outcomes, and it describes the value attached by the respondent to money. It is generally assumed that $v(0) = 0$. Function v is S-shaped, and it reflects the principle of diminishing sensitivity in analyses of outcomes. For example, the subject discriminates less between 80 and 100 than between 0 and 20, both when these numbers concern gains and when they concern losses (Fennema & Wakker, 1997). Moreover, a different formula is adopted in the CPT for evaluating prospects with pure gains or pure losses. The CPT requires that the critical outcomes have the same sign and are all gains or all losses. The CPT has been designed to accept only these inferences (He & Zhou, 2011).

Parameter λ is referred to as the loss-aversion coefficient, and the respondent is loss-averse when $\lambda > 1$. In the authors' opinion, this is the most interesting part of the experiment. In the current study, λ was determined at 0.80 (money) and 1.12 (housing) for the median, and at 1.16 (money) and 1.36 (housing) for the mean. These values are much lower than in the work of Tversky and Kahneman (1992). Loss aversion was smaller than in the original study, but the respondents were much more averse

towards the loss of housing than the loss of money. However, these differences were not significant in the two-sample t-test ($p=0.23$ for two means) or the Wilcoxon rank-sum test ($p=0.13$ for two medians). The distribution of responses was clearly right-skewed, more so for money (skewness was determined at 2 for money and 1.5 for housing). Right-skewed distribution indicates that most results are below the mean, and a few responses are much higher than the mean. The box plots for median and mean values are presented in Figures 1 and 2 respectively. The histograms of lambda values are shown in Figures 3 and 4. In case of money obtained 61% for $\lambda \leq 1$ in total, and 39% $\lambda > 1.0$ (loss aversion). In case of housing, the responses are distributed in the direction of higher loss aversion (approx. 43% $\lambda \leq 1$ in total, approx. 57% $\lambda < 1.0$ in total). Higher aversion towards the loss of housing than money is an interesting observation. This result could imply that the non-material component significantly contributes to the value of housing. The above finding could also be attributed to the endowment effect which is characteristic of material goods, in particular owned property.

The estimated values of parameters α, β, γ , and δ were used to plot utility functions according to the CPT. The results for the mean are presented in Figure 5, and the results for the median are presented in Figure 6. The obtained results are not consistent with expectations. A higher utility value of housing was expected because non-material components significantly contribute to the value of housing. However, the results are nearly identical, and the utility function of money is even somewhat higher.

5. Conclusions

The present study contributes to the discussion on the utility function of housing and money based on the subjective perceptions of market participants. The utility function of housing and money was estimated according to the CPT. Recent years have witnessed a steep rise in housing prices in Poland. An increase in the house price index, calculated based on the data provided by the National Bank of Poland, indicates that housing prices in the last five years increased by around 160-170 points between 3Q2017 and 3Q2022, both on the primary and the secondary market. At the same time, the inflation rate has been rising on a year-to-year basis, reaching 18% in December 2022, which points to a rapid decrease in the value of money over time.

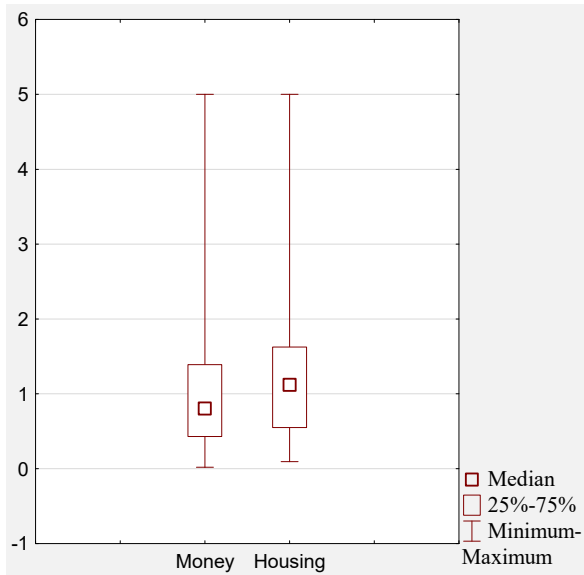


Fig. 1. Box plots of lambda values for money and housing - median. Source: own elaboration.

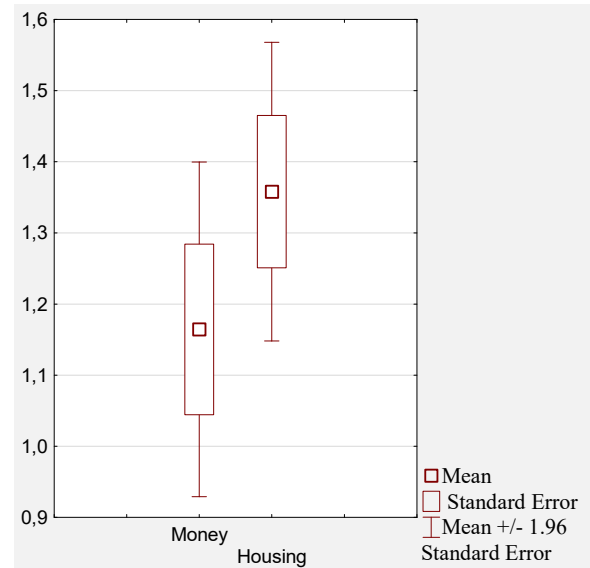


Fig. 2. Box plots of lambda values for money and housing - mean. Source: own elaboration.

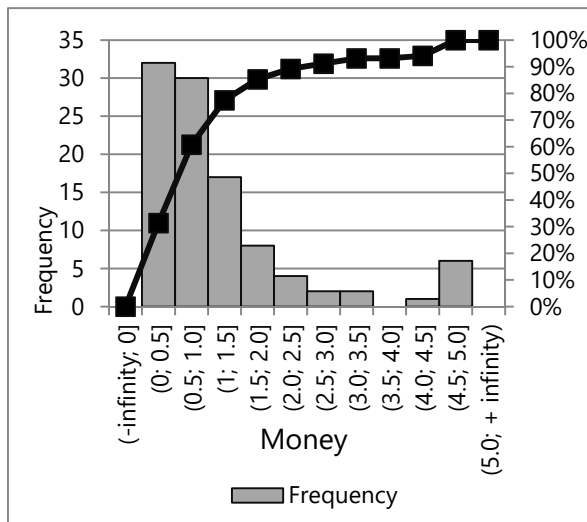


Fig. 3. Histogram of lambda values for money. Source: own elaboration.

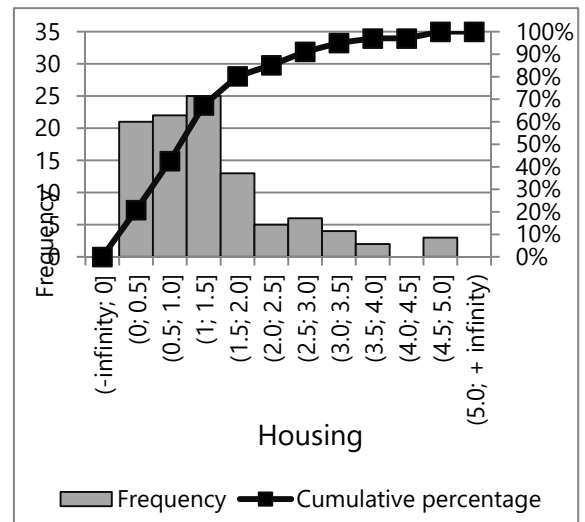


Fig. 4. Histogram of lambda values for housing. Source: own elaboration.

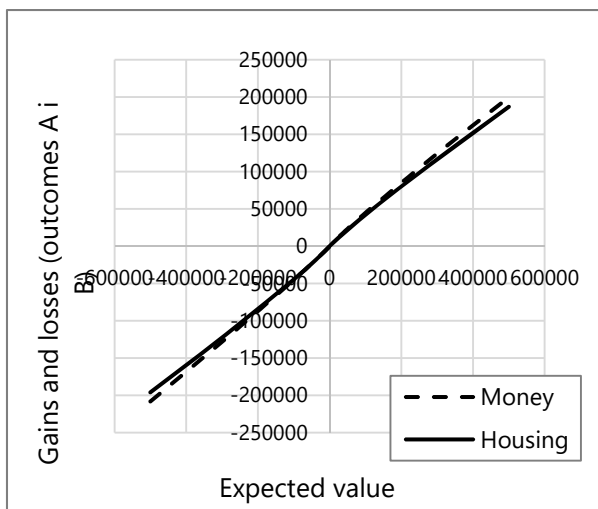


Fig. 5. Utility function based on mean values. Source: own elaboration.

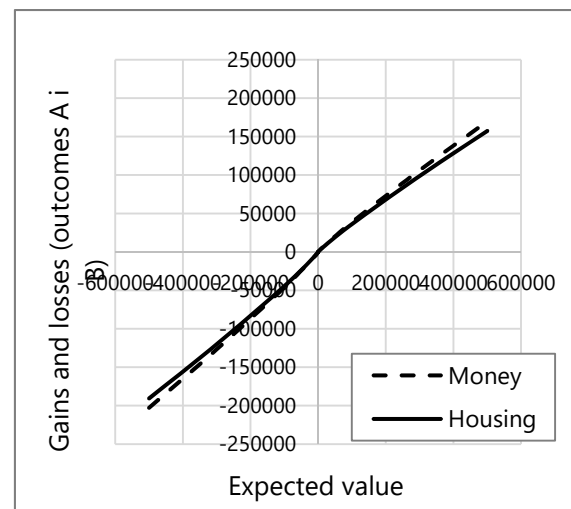


Fig. 6. Utility function based on median values. Source: own elaboration.

In this context, the results of the current study are surprising. Parameters alpha and beta assumed similar values for both housing and money (as predicted by the CPT). The mean value of lambda, which reflects loss aversion, was higher for housing, but the difference was not significant. These results are not consistent with expectations. In view of the current economic outlook, the utility value of housing could be expected to be higher because non-material components contribute to the perceived value of housing and investments in tangible assets such as real estate offer effective protection against inflation. However, it cannot be assumed that the respondents were aware of such economic features of residential properties (the survey was conducted in August 2020 when inflation was not at a high level, so the conclusions should be deepened and refined by further research). Moreover, the results were nearly identical, and the utility value of money was even somewhat higher. Future research should also verify whether the results obtained are variable according to the characteristics of the respondents as well as for different purposes of purchasing a residential property.

The results of this study suggest that money has higher utility value than housing in the respondents' subjective assessment. Another explanation is also possible. The difficult situation on the Polish real estate market, the steep rise in housing prices, and high inflation disrupt consumer perceptions regarding the value of money and housing. The respondents could attach greater value to money than housing because high inflation decreases the value of money. Inflation could be a short-term phenomenon lasting two-three years, whereas housing prices in Poland have been rising steadily for many years, with a particularly steep increase in the last one-two years. In view of the above, the study should be repeated when inflation has stabilized, but the long-term increase in prices has been maintained, to determine the relationship between the utility function of housing and money in the new economic outlook.

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