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## THE ROLE OF UTILITY THEORY IN RISK MANAGEMENT FOR STRATEGIC DECISIONS

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### Abstract

*This study investigates the shape of the utility function across the total outcome domain to determine whether its shape differs across decision makers. However, the objective of the study is to examine whether the differences in the global shape of the utility function affect strategic behavior. In an attempt to achieve this objective, the study adopted EXP-IPT method and the two-piece utility function method. Findings from the result reviews that there is heterogeneity in the shape of utility functions of real decision makers and that this heterogeneity affects strategic decisions. Utility is often measured using the certainty equivalence technique in empirical studies that deal with decision making under risk. In prospect theory, the shape of a decision-makers' utility function is assumed to differ between the domain of gains and the domain of losses. The proposed convex/concave utility function predicts risk-prone behaviour in the domain of losses and risk-averse behavior in the domain of gains*

**Key Words; Utility, Risk, Measurement, Portfolio Managers and Organizations**

### 1.0 INTRODUCTION

Utility is an important theoretical concept in economics, marketing, finance, and the management science and has been extensively used to derive optimal behaviour of decision-makers or to describe actual behaviour (schoemaker, 1982). The validity of the utility concept, particularly in an expected utility framework, has been questioned because of its inability to predict revealed behaviour. There is an extensive body of literature that discusses these anomalies (e.g., Rabin, 1998; 2000, Camerer, 1995). A particular challenge with utility is how to quantify the concept to permit testing of its empirical merits. Utility is often measured using the certainty equivalence technique (or elicitation techniques derived from it) in empirical studies that deal with decision making under risk (Keeney and Raiffa 1979; Farquhar 1980). In the certainty equivalence technique the researcher asks the decision maker to compare a lottery  $(x_1p; x_h)$  with a certain outcome, where  $(x_1p; x_h)$  is the two-outcome lottery that assigns probability  $p$  to outcome  $x_1$  and probability  $1-p$  to outcome  $x_h$ , with  $x_1 < x_h$ . The researcher then varies the certain outcome until the respondent reveals indifference between the certain outcomes denoted by CE ( $p$ ). Substituting in the expected utility model with the von Neumann Morgenstern utility  $u$  one obtains:  $u(CE(p)) = pu(x_1) + (1-p)u(x_h)$ . After obtaining a set of certainty equivalents corresponding to different utility levels a function is fit to arrive at the decision maker's utility function.

Studies that use the certainty equivalence technique or related utility elicitation procedures to obtain the decision maker's utility function  $u(x)$ , use the curvature of the utility function as measured by the Pratt-Arrow coefficient,  $-u''(x)/u'(x)$ , as a proxy for the decision-makers risk attitude. E.g. (Binswanger, 1980, 1981; Smidts 1997). The failure to find a relationship between decision-makers' utility functions and actual behavior may be attributed to the fact that the curvature of the utility function is a local measure, often conceptualized as an unidimensional construct. For example, Penning and Smidts (2006) estimate an exponential function to relate the certainty equivalents to the corresponding utility levels. Scaling the  $u(x)$  between 0-1 only one parameter is needed to be estimated and the interpretation of that parameter is straightforward, (i.e., it represents a decision-makers risk attitude), the procedure condenses the potential multidimensionality of a decision-makers utility function to a single dimension which can result in a significant loss of valuable information. Specifically, this approach does not explicitly take into account the entire outcome range of the relevant attribute  $x$  used to obtain the utility function (often money is used as relevant attribute).

### 1.1 Hypothesis of the study

$H_0$ : that there is no significant relationship between the Shape of the utility Function and Strategic Decisions for portfolio managers and Cattle farmers

$H_1$ : that there is a significant relationship between the Shape of the utility Function and Strategic Decisions for portfolio managers and Cattle farmers

## 2.0 THEORETICAL FRAMEWORK

### 2.1 Global shape of utility Functions

Utility has been a concept that has been used throughout the history of economics. In 1789 Bentham discussed the concept of utility as being a central concept in understanding human behavior. The utility concept has been used in various ways in economics literature, and is used to represent preferences (e.g., von Neumann Morgenstern context) or to determine preferences (neoclassical context). Furthermore utility has often been discussed in terms of "cardinal" and "ordinal" utility (Von Neumann and Morgenstern 1944). Range  $x$ , and hence the curvature of the utility function does not take the total outcome range into account.

Tversky and Kahneman (1988) prospect theory, suggested that the global shape of the utility function, - its shape across the total outcome range-could be useful when trying to understand decision making under risk. In prospect theory, the shape of a decision-makers' utility function is assumed to differ between the domain of gains and the domain of losses. The proposed convex/concave utility function predicts risk-prone behavior in the domain of losses and risk-averse behavior in the domain of gains. Evidence for convex/concave utility functions across the total outcome domain has been found by, among others, (Fishburn, and Kochenberger 1979; Hershey and Schoemaker 1980; Budescu and Weiss; 1997 Kuhberger; Schulte-Mecklenbeck and Perner 1999) and Pennings and Smidts (2003).

### Strategic Decision Context

To examine whether the global shape of the utility function is driving strategic decisions we need a context in which strategic decision can be observed and in which the utility functions can be elicited from decision makers that make strategic decisions. To test whether the hypothesis on the relationships between strategic decisions and utility



functions holds for different domains we test the hypothesis in two domains that meet the requirements outlined above. The domains are portfolio managers making decisions regarding their portfolios, and cattle farmers making decisions regarding the production process they employ.

### **Portfolio managers' context**

Portfolio managers make important investment decisions on a regular basis, weighing risk and returns and making trade-offs between the two. Portfolio managers will at times evaluate the asset allocation classes in which they invest. One of the strategic decisions that portfolio managers have to make is whether to invest in assets that are not traded in a central exchange. These assets, often referred to as "bricks and mortar", are direct investments in commercial property or in private companies. These investments are not as liquid as stocks and bonds which can easily be sold and bought through exchanges.

Furthermore these assets have relatively high transaction costs (e.g., one has to manage the property etc.). The trading characteristics of bonds and stocks are very different from the non-exchange traded assets. While bonds and stocks can be easily sold and bought almost immediately and price quotations are almost always present, non-exchange traded assets cannot be bought and sold immediately and price information may not always be available.

### **Elicitation of utility Function**

We assessed the utility function of the portfolio managers and cattle farmers by means of computer-guided interviews. The utility function was measured using the certainty equivalence method (Keeney and Raiffa 1979; Smidts 1997). The certainty equivalents were obtained through choice-based matching (Keeney and Raiffa 1979; Fischer et al. 1999). In designing the lottery task, we took into account the findings of research on the sources of bias in assessment procedures for utility functions (Krzysztofowicz and Duckstein 1980; Hershey, Kunreuther and Schoemaker 1982; Hershey and Schoemaker 1980; Harrison 1986; Tversky, Satiath and Slovic 1968; Kagel and Roth 1995; Holt and Laury 2002). The main sources of bias arise when the assessment does not match the subjects' real decision situation. What is particularly powerful about the research design is that we are dealing with decisions in a relevant context ensuring that the task reflects the subjects' daily decision making behavior (Smith 1991). For the portfolio managers, this meant that certainty equivalence technique was formulated in terms of relatively high/low returns with a range of  $-5\%$  to  $+20\%$ , with a probability of 0.5 and a fixed return. The assessment of the certainty equivalents was an interactive process. If the manager chooses alternative A (the 50/50 high/low return), the computer would generate a randomly higher fixed return (alternative B) than the previous, thus making alternative A (alternative B) more attractive. The next measurement would start after the respondent had indicated an indifference between alternative A or B.

### **Cattle Farmers' Context**

The research design for cattle farmers was similar to the portfolio managers' research design except that the main attribute in the certainty equivalence technique is the price per kilogram live cattle weight. The outcome levels range from 1.06 Euro to 1.95 Euro per kilogram live weight, representing all price levels of slaughter cattles that have occurred in the last five years. The 50/50 dimension of the lottery reflects the environment in which portfolio managers and cattle farmers are exposed to. Various researchers have



shown the stochastic behavior of both commodity prices and stock prices (Schwartz, 1997 Hilliard and Reis 1999).

### Assessing the shape of Decision-makers' Global Utility Functions

Based on previous studies we identify two broad classes of shapes; fully concave, fully convex or S-shaped (convex/concave). Fully concave or convex utility functions have been widely used in economics literature. Evidence for fully concave or convex utility functions across the total outcome domain has been found by, among others, Binswanger (1982) and Pennings and Smidts (2000). An S-shape utility function has been proposed in prospect theory (Kahneman and Tversky 1979). In prospect theory, the shape of a decision-makers' utility function is assumed to differ between the domain of losses and the domain of gains. The proposed convex/concave utility function predicts risk-prone behavior in the loss domain and risk-averse behavior in the gain domain. We assessed the shape of the utility function using two distinctive methods to test whether the assessment of a decision-makers global shape of the utility function is robust.

### 3.0 METHODOLOGY

In the first method, referred to as the EXP-IPT-method, we fit the observations for each decision maker (the nine assessed certainty equivalents) to both the negative exponential function (EXP) and to the log of the inverse power transformation function (IPT), and the latter being an S-shape utility function.

In the second method to assess the shape of the utility, the two-piece utility function method, we decompose the utility function into two exponential segments, one for consequences above the reference point (gain domain) and the other for consequences below the reference point (loss domain). As a natural reference point we took the stated target return on their portfolio for the portfolio managers (the average target return in our sample was 9.5%). For the cattle farmer context we used the average cost of production as reference point which was 1.31 Naira per kilogram live weight as identified by experts in that industry. By estimating the EXP-function for each segment, we obtain for each respondent two parameters:  $c_g$  for the gain domain and  $c_l$  for the loss domain (recall that  $c_l$  in the exponential function represents the Pratt-Arrow coefficient of absolute risk aversion). These parameters allow us to describe the decision-makers shape of the utility function as a combination of  $c_g$  and  $c_l$ . We can classify decision makers based on four different shapes of the utility function:  $c_l > 0$  and  $c_g > 0$  implying a concave utility function for both gains and losses;  $c_l < 0$  and  $c_g < 0$  implying a fully convex utility function;  $c_l = 0$  and  $c_g < 0$  implying a reversed S-shaped utility function, and  $c_l < 0$  and  $c_g > 0$  implying an S-shaped function.

### 4.0 RESULTS

First we describe the results for the estimates of the global shape of the utility function for portfolio managers and cattle farmers for both methods (EXP-IPT method and the two-piece utility function method), and discuss the classification of these decision makers by comparing the two methods. Subsequently, we examine the relationship between the global shape of the utility function and strategic decisions.

## Heterogeneity in the Global Shape of the Utility Function

We first determined which functional form best reflects each decision maker's utility function based on a pair wise comparison of the mean squared errors (MSE) and classify the decision makers in the corresponding groups (fully convex/concave or S-shaped). One group consisted of portfolio managers whose utility function is best described by the exponential function (an EXP-group;  $n=53(51\%)$ ), the other group consisted of portfolio managers whose function is best described by the S-shaped function (an IPT-group;  $n=51(49\%)$ ). A comparison of the estimation results from the homogeneous case (i.e., estimation result of the EXP and IPT function for all decision makers) with those from the heterogeneous case (estimation results for the EXP-group and IPT-group) indicated that the average fit for both functions increases and that the parameter estimates change substantially when taking heterogeneity into account. In particular, the mean MSE of the EXP- function drops from 0.007 for the total group to 0.004 for the 51 Exp-subjects. For the IPT-group, the increase is 0.002. Similar results were found for the cattle farmers. One group consisted of cattle farmers whose utility function is best described by the exponential function (an EXP-group;  $n=144(60\%)$ ), the other group consisted of cattle farmers whose function is best described by the S-shaped function (an IPT-group;  $n=95(40\%)$ ). Also here we find heterogeneity with respect to the shape of the utility function. The average fit for both the EXP and IPT functions have increased and that the parameter estimates have changed substantially by taking heterogeneity into account. These results show that decision makers differ regarding the global shape of their utility function. Next, we examine the global shape of the utility function using the two-piece utility function method, allowing us to examine whether the results of the EXP-IPT-method are robust.

The result for the two-piece utility function method for portfolio managers indicate that 47.1% ( $n=49$ ) of the portfolio managers have utility functions that are concave for both the loss and gain domain (i.e.,  $c_l > 0$  and  $c_g > 0$ ), and hence are said to be risk averse across the total outcome domain (e.g., Table1). A smaller group of portfolio managers (5.7%;  $n=6$ ) can be described as being risk prone across the entire outcome domain (i.e.,  $c_l < 0$  and  $c_g < 0$ ). Only a few portfolio managers (6.7%;  $n=7$ ) show a reversed S-shaped utility function (i.e.,  $c_l > 0$  and  $c_g < 0$ ) and 40.4% ( $n=42$ ) of the portfolio managers exhibit an S-shaped utility function. These results confirm our previous finding using the EXP-IPT method that portfolio managers differ regarding the global shape of their utility function. For cattle farmers, we also find that, using the two-piece utility function method, they differ regarding the global shape of the utility function, supporting our earlier findings. Table 1 shows that the two-piece utility function method results indicate that 47.1% ( $n=49$ ) of the cattle farmers have utility functions that are concave for both the loss and gain domain (i.e.,  $c_l > 0$  and  $c_g > 0$ ), and hence are said to be risk averse across the total outcome domain. A smaller group of cattle farmers (5.8%;  $n=6$ ) can be described as being risk prone across the entire outcome domain (i.e.,  $c_l < 0$  and  $c_g < 0$ ). Only a few cattle farmers (6.7%;  $n=7$ ) show a reversed S-shaped utility function (i.e.,  $c_l > 0$  and  $c_g < 0$ ). About 40.4% ( $n=42$ ) of the cattle farmers exhibit an S-shaped utility function.

## ROBUSTNESS OF CLASSIFICATION

To examine whether the EXP-IPT -method and the two-piece utility function method identify similar global shapes of the utility function for decision makers, we compare the two methods for the portfolio managers and cattle farmers.



**Table 1 correspondence in classification of the EXP-IPT-method and the Two-piece Utility Function Method for Portfolio Managers and Cattle Farmers**The EXP-IPT-Method

## Portfolio Managers

Two-piece Utility Function Method	EXP-function	IPT-function
Concave function ( $c_l > 0$ and $c_g > 0$ ) 47.1% (n=49)	91.8 % (n=45)	8.2% (n=4)
Convex function ( $c_l < 0$ and $c_g < 0$ ) 5.8% (n=6)	83.3% (n=5)	16.6% (n=1)
Reversed S-shaped function ( $c_l > 0$ and $c_g < 0$ ) 6.7% (n=7)	14.3% (n=1)	85.7% (n=6)
S-shaped function ( $c_l < 0$ and $c_g > 0$ ) 40.4% (n=42)	4.8% (n=2)	95.2% (n=40)
<b>Total</b>	<b>50.9% (n=53)</b>	<b>49.1% (n=51)</b>

Cattle Farmers

Concave function ( $c_l > 0$ and $c_g > 0$ ) 40.2% (n=96)	93.7% (n=90)	6.25% (n=6)
Convex function ( $c_l < 0$ and $c_g < 0$ ) 18.4% (n=44)	89.1% (n=40)	9.1% (n=4)
Reversed S-shaped function ( $c_l > 0$ and $c_g < 0$ ) 4.2% (n=10)	30.0% (n=3)	70.0% (n=7)
S-shaped function ( $c_l < 0$ and $c_g > 0$ ) 37.2% (n=89)	12.4% (n=11)	87.6% (n=78)
<b>Total</b>	<b>60.3% (n=144)</b>	<b>39.7% (n=95)</b>

The results in Table 1 show that classifying respondents with regards to the shape of their utility function is not dependent on the method used, providing evidence that the identification of the global shape of the utility function is robust.

**Shape of utility functions & strategic decisions**

After showing heterogeneity in the shape of the utility function of real business decision-makers, we investigate whether the shape of the utility function is reflected in decision-makers' strategic behavior using the results of the EXP-IPT method to identify the global shape of the decision-maker's utility function. We do not present the results based on the two-piece utility function method which are similar to those presented.

The upper part of Table 2 shows how the functional form of a portfolio manager's global utility function (EXP vs. IPT) is related to strategic behavior. Overall, 44.2% of the portfolio managers invested only in exchange traded assets while 55.8% invested also in assets not traded on an exchange. Of the portfolio managers with a concave or convex utility function (the EXP-group), 17.0% invested only in exchange traded assets and

83.0% invested all assets. In contrast, of the portfolio managers with an S-shape utility function (the IPT-group), 72.5% invested in only exchange traded assets, while 27.5% invested in non-exchange traded assets as well. These results indicate that portfolio managers whose global shape of the utility function can best be described by a EXP-type utility function (fully concave or fully convex over the total outcome range) have both exchange and non-exchange tradable assets in their portfolio, while portfolio managers whose global shape of the utility function can best be described by a IPT-type utility function (S-shaped utility function) invested only in exchange traded assets.

**Tables 2 Relationship between Shape of the utility Function (IPT vs. EXP) and Strategic Decisions for portfolio managers and Cattle farmers.\***

Portfolio Managers			
	Invested only in exchange Traded assets	Invested in all asset classes	Total
Total	44.2%	55.8%	100 % (n=104)
EXP-group	17.0%	83.0%	100 % (n=53)
IPT-group	72.5%	27.5%	100 % (n=51)

  

Cattle Farmers			
	CPS	OPS	Total
Total	54.4%	45.6%	100 % (n=239)
EXP-group	77.8%	22.2%	100 % (n=144)
IPT-group	18.1%	81.1%	100 % (n=95)

The lower part of Table 2 shows the relationship between the shape of the utility function and strategic behavior for cattle farmers. Overall, 54.4% of the farmers employed the CPS production system and 45.6% employed the OPS system. Of the farmers with a concave or convex utility function (the EXP-group), 77.8% employed the CPS and 22.2% employed OPS. In contrast, of the farmers with an S-shape utility function (the IPT-group), 18.9% employed CPS, while 81.1% used OPS.

The results of the portfolio manager domain and the cattle farmer domain show that the global shape of the utility function is related to strategic behavior. To further gain insight in the predictive power of the global shape of the utility function we statistically test and the relationship between the global shape of the utility function and strategic decisions by means of a logistic regression analysis with the dichotomy of whether portfolio managers invest in all assets (exchange and non-exchange traded assets) or only in exchange traded assets, and whether cattle farmers employs the CPS or OPS as the dependent variables and group-membership (EXP vs IPT global utility function) as the independent variable. In the analysis for the portfolio managers, we controlled for the size of the portfolio managers' portfolio, age, education, and debt-to-asset ratio. In the analysis for the cattle farmers, we controlled for, age, education, and debt-to-asset ratio.



Table 3 shows that the model for the portfolio managers significantly improves the fit, when compared to the null model, which includes only an intercept ( $p < 0.002$ ); Nagelkerke  $R^2=0.39$ , correctly classified choices 76.9%. the regression coefficient of the shape of the utility function was significant ( $p=0.04$ ) in the logistic regression. The variables age ( $p=0.15$ ), education ( $p=0.15$ ), debt-to-asset ratio ( $p=0.16$ ) and value of portfolio ( $p=0.38$ ), were not significant. Table 3 shows also the result for the hog farmers. The model significantly improves the fit, when compared to the null model, which includes only an intercept ( $p < 0.00$ ; Nagelkerke  $R^2=0.42$ , correctly classified choices 79.1%).

**Table 3 Results of Logistic Regression in which the shape of the utility function (IPT vs. EXP) predicts strategic Decisions**

Portfolio managers		Cattle farmers		
Trading in all assets (=0) or		Production system employed by		
Trading in only exchange		Cattle farmers: OPS (=1) or		
Traded assets (=1)		CPS (=0)		
B	P	B	P	
Shape of the utility function: (IPT = 1; EXP = 0)	-1.768*	0.04	2.83*	0.00
Age	0.07	0.15	-0.03	0.11
Education	-1.15	0.15	0.20	0.35
Debt-to-asset ratio	0.06	0.16	0.16	0.28
Average value of portfolio for Which portfolio manager was Responsible in 2000	0.53	0.38		
Nagelkerke $R^2$	0.39		0.42	
Correctly classified choices	76.9%		79.1%	

The regression coefficient of the shape of the utility function was clearly significant ( $p=0.000$ ) in the logistic regression. The variables age ( $p=0.11$ ), education ( $p=0.35$ ), and debt-to-asset ratio ( $p=0.28$ ) were not significant. These results further support the relationship between the global shape of the utility function and strategic behavior.

**DISCUSSION OF FINDINGS**

In this paper, using the elicitation procedures developed by Penning and Smidts (2000), we investigate how strategic decisions are related to the entire (global) shape of the utility function rather than to the curvature of the utility function measure of risk attitude (Pratt-Arrow). Specifically, we first investigate the shape of the utility function across the total outcome domain  $x$  to determine whether its shape (i.e., fully concave or convex vs. S-shaped), differs across decision makers. We then examine whether the differences in the global shape of the utility function affect strategic behavior. Strategic decisions are those that determine the overall direction and organization of an enterprise and have far

reaching effects on its structure (e.g., Quinn, Mintzberg and James 1998). These decisions have an impact on the whole outcome domain of the firm. Since the global shape of the utility function takes that total outcome domain into account (i.e., the total range of attribute  $x$ ), we suspect its shape to be a predictor for strategic decisions. Kahneman and Tversky (1979), Rabin (2000), Rabin and Thaler (1992) and Smidts (2003), who argued that a local measure of utility may not be of great interest when trying to understand decision-makers behaviour over a wide outcome range seem to support this hypothesis.

To test our hypothesis we assessed the utility function of 104 portfolio managers who were managing their firms' equity investments or who were managing their own portfolios. The certainty equivalents were obtained through choice-based matching, as per (Keeney and Raiffa 1979). Furthermore, accounting data were available from these managers regarding their strategic behaviour (e.g., whether or not they invest in non-exchange traded assets). In addition, we elicited the utility function of 239 cattle farmers using a similar research design and obtained accounting data regarding their strategic decisions (e.g., production system employed). This research design allows us to test whether the hypothesized relationships between strategic behavior and the shape of the utility function holds for different domains. The cattle farming context has been used in Penning and Smidts (2003) as well to investigate the relationship between farmers' utility functions and their organization behavior, allowing us to further examine the robustness of their results.

The contribution of the research are twofold. We show that global shape of the utility function differs across decision makers (fully concave or convex versus S-shaped), and that the global shape predicts strategic decisions (e.g., asset allocation strategy in the case of portfolio managers; type of production process employed in the case of cattle farmers). These findings support the notion that the often criticized concept of utility is a useful concept when studying actual behavior, and highlight the importance of considering decision-maker behaviour over a wide outcome range when examining strategic behavior.

It is important to note that the research does not explain strategic behavior; rather it shows that strategic behavior can be predicted by the global shape of the decision-maker's utility function. Further, the research does not answer the question what drives the global shape of the utility function. We elaborate on this issue in the discussion section.

## 5.0 SUMMARY AND CONCLUSION

The results show that there is heterogeneity in the shape of utility functions of real decision makers and that this heterogeneity affects strategic decisions. The empirical results are robust with regards to the method used to determine the shape of the decision-makers global shape of the utility function and the domain of the decision makers. These results indicate that the information that is embedded in the shape of the utility function is a predictor of actual strategic behavior. Furthermore, the results show that while the utility concept has been critiqued for not being useful when predicting actual behavior, it is a powerful concept when the decision-maker's global utility function is examined instead of the local utility function (e.g., curvature of the utility function).

There is an extensive body of literature that outlines the potential pitfalls of eliciting utility functions using certainty equivalent technique types of experiments. While the experimental design for this research was hypothetical in the sense that the choices that the decision makers made did not affect their actual wealth or well being, they were not hypothetical with regards to decisions that the respondents make. The certainty equivalent technique was designed so that the choices made during the experiments resembled their



daily decision. Hence, these decision makers were very experienced with regards to the consequences of these decisions. One of the portfolio managers even offered the comment “this isn’t difficult; I make these decisions daily”.

To test whether the elicitation technique suffered estimation biases as Identified in the aforementioned references, we conducted two additional tests. First, we obtained two measurements at  $u(x)=0.5$  and two at  $u(x)=0.625$  during the utility elicitation process (for both portfolio managers and cattle farmers), in order to investigate the internal consistency of the assessments. When tested, the differences between the assessed certainty equivalents for the same utility levels were not significant ( $p > 0.99$  (*pairwise test*))) for both consistency measurements for the portfolio managers and cattle farmers, showing that respondents assessed the certainty equivalents in an internally consistent manner. Second the parameter estimates of the S-shape utility function (IPT-group) allow us to calculate the average point of inflexion for the decision makers that best could be described by a S-shape utility function. The calculated point of inflexion for cattle farmers is 1.33 Naira per kilogram live weight cattle, which corresponds closely to the production costs of 1.31 Naira per kilogram estimated by experts from the industry at the time of the research. For the portfolio managers we used their target return to statistically compare the point of inflexion of portfolio manager I with the target return for portfolio manager i. when tested, the differences between the point of inflexion and the target return were not significant ( $p > 0.99$  (*pairwise test*))). These analyses clearly indicate that by using a realistic decision context using real business decision makers valid utility functions can be elicited.

In this paper we implicitly assumed that the global shape of the utility function drives strategic decisions. The rationale for this causality is that one could see the elicited utility function as a reflection of the decision-maker’s behavior. However recent literature on constructed preferences argues that due to limited processing capacity, decision makers often do not have well-defined preference, but these are constructed on the spot by an adaptive decision maker (see Bettman, Frances and Payne; Butler 1998). This literature argues that the decision context in which decision makers operate shapes their utility functions. Only longitudinal research can provide some empirical insight on this topic. Such a research design would investigate whether decision makers change their strategic behavior and determine whether the shape of their utility function changes after a shapes change in strategic behavior.

In this paper we did not explain strategic behavior. The question that needs to be addressed in future research is: what drives the shape of the utility function? While early work in economics focused on the drivers of utility (e.g., Lange; Armstrong) identifying the factors that determine the particular global shape of the utility function is unexplored dimension.

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