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Eliciting Utility Functions for International Migration Decisions

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ABSTRACT

Migration is a highly complex and uncertain process that has the potential to have large impacts on societies around the world. One key driver of this complexity and uncertainty is the autonomous agency of the actors involved, particularly the decision-making processes of potential migrants. Most theories and models rely on simplistic decision rules or a decision-making process that assumes rational agents. However, a considerable body of research in psychology and behavioural economics raises doubts about such assumptions. To inform the description of migration decision processes, we elicited and compared non-parametric utility functions for both finance and international migration decisions. This allowed us to directly test, using individual-level experimental data, whether the aspects of prospect theory that are commonly found in utility functions elicited within a financial context are also present for migration decisions. Across both financial and migration-related contexts, we found that participants were generally loss-averse and their utility functions were concave in the domain of gains. However, findings for convexity in the domain of losses were mixed. This evidence of loss aversion, risk aversion, and diminished sensitivity further from the reference point suggests that migration decision-making is more consistent with the key tenets of prospect theory than with expected utility.

1 | Introduction

Migration is a highly complex and uncertain process that has the potential to have large impacts on societies around the world. There are many potential sources of uncertainty within the migration process. One key aspect that contributes to this uncertainty and is not currently well understood is the psychology and decision-making process of migrants and potential migrants (for a recent overview, see Czaika et al. 2021). Many authors attempting to understand and predict migration regularly assume that migration decision-making follows a rational process (DaVanzo 1980; Groeneveld et al. 2017; Klabunde and Willekens 2016; Schlüter et al. 2017; Wallace et al. 1997).

However, despite advances in the description of decisions based on the notion of rational utility (e.g., Kennan and Walker 2011, with their extension to multiple choices), a large body of research in behavioural economics and psychology has shown that human decisions regularly violate assumptions of rationality (Barberis 2013; Kahneman 2003; List 2004). Therefore, rather than relying on untested and simplistic assumptions about migration decision-making, it is important to engage in a more in-depth examination of this process. The key aim of the current study is thus to examine migration decision-making by applying methods that have regularly been used to examine decision-making in other domains, primarily with financial decisions. To that end, we present elicited utility functions for decisions in the context of hypothetical international migration.

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Doing so allows us to compare utility functions between the migration and financial decision contexts (throughout this paper, we use the term 'context' to denote either migration or financial decisions, fully recognising the broader ambiguity of this term), and to examine whether the migration utility functions are consistent with the rational decision-making models and assumptions often used to model migration.

In this paper, after a brief overview of selected problems related to migration decisions and eliciting their related characteristics (Section 2), we present the experimental methodology used in this study (Section 3), followed by a summary of the main results (Section 4) and a general discussion of their implications for migration studies (Section 5). Detailed task instructions and some additional results of the sensitivity analysis are also included in the Supporting Information, respectively in Appendix A and Appendix B.

2 | Modelling Migration Decisions: State of the Art

Klabunde and Willekens (2016) reviewed the theories of decision-making that underpin the types of decision-making commonly used in agent-based models of migration. They found that the decision rules in many models of migration, especially those involving decisions, such as with agent-based models, assume that people maximise utility. They also found that some models of migration rely on decision-making rules/processes based on theories from psychology. However, research into human decision-making has identified important violations of the key economic assumptions underlying utility maximisation. Further, even the decision-making rules/processes that are based on psychological theories do not account for many of the findings from the literature on human judgement and decision-making. For example, research has shown that the framing of a problem can strongly influence the decisions that people make, and it is also regularly observed that people are more sensitive to losses than gains (Barberis 2013; Blake et al. 2021; for the mediating role of emotions, see Nabi et al. 2019; and for further nuance and context, see also Gal and Rucker 2018). Real-world observations also provide evidence that calls into question many of these assumptions. For example, patterns of economic migration within the EU do not line up with the patterns that would be predicted from utility maximisation based on economic differences between the countries.

Prospect theory is a prominent theory that can account for several of the systematic deviations from rationality that have been found in human decision-making. Prospect theory was initially developed by Kahneman and Tversky (1979) and was later updated in the form of cumulative prospect theory (Tversky and Kahneman 1992). Prospect theory accounts for aspects of human decision-making such as loss aversion, overweighting and underweighting of probabilities, framing effects, and differential response to risks (i.e., risk seeking in some situations and risk aversion in others). Since its initial development, a large body of research has demonstrated support for the key tenets of prospect theory, such as asymmetry between losses and gains reflected in the shape of utility curves (for reviews, see Barberis 2013 or Wakker 2010).[1] In particular, prospect theory stipulates that in the domain of gains, the utility curve is concave, and in the domain of losses, convex, as outlined in Figure 1. This indicates greater responsiveness to losses than to gains of similar magnitude (loss aversion), but also that under risk, people will exhibit greater risk-seeking propensity in the domain of losses rather than for gains.

Because of this wide body of existing research, a decision-making process that is consistent with prospect theory is a promising candidate for better understanding migration

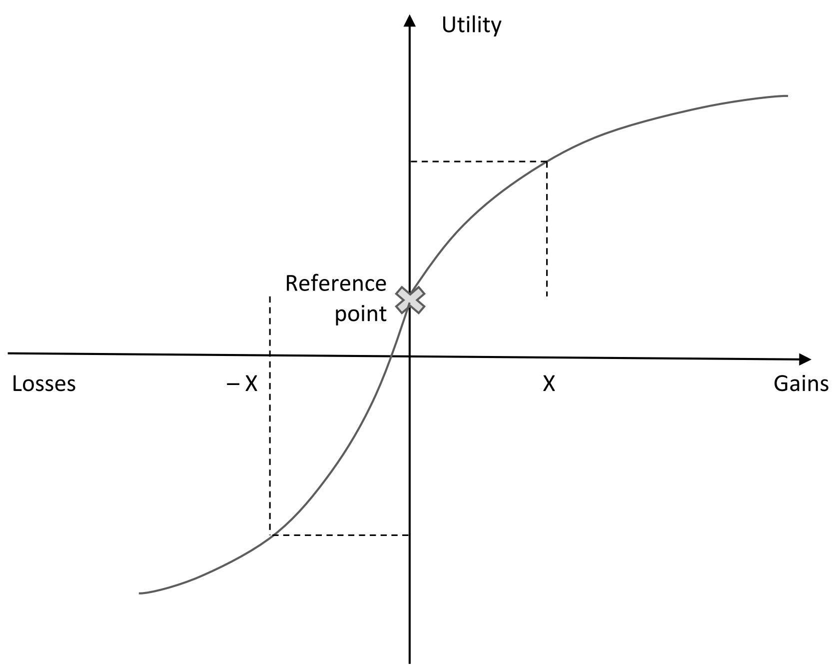

FIGURE 1 | A stylised diagram illustrating utility from losses and gains according to prospect theory. *Note:* Gains and losses of the same absolute magnitude (X and –X) result in different changes in utility. *Source:* Own elaboration, based on Kahneman and Tversky (1979).

decision-making. However, most of the previous theoretical and empirical developments regarding prospect theory have occurred within the financial domain rather than in the area of migration. Therefore, it is important to establish whether these effects will generalise beyond the financial domain to migration decision-making. Several studies have found support for prospect theory when the outcome of a risky decision was health related, number of lives saved, or measured in time, suggesting there is reason to be optimistic that prospect theory will generalise to migration (Abdellaoui and Kemel 2014; Attema et al. 2013; Attema et al. 2016; Kemel and Paraschiv 2018).

Some previous research has also specifically applied prospect theory to migration or other forms of human mobility. Czaika (2014) outlined a model for applying prospect theory to migration and then analysed intra-European migration inflows into Germany to test whether the migration patterns observed at the national level were consistent with prospect theory. Czaika (2014) found that after controlling for absolute differences in living standards, changes in economic prospects influenced migration flows (suggesting reference dependence), and there was also evidence of both loss aversion and diminished sensitivity. These findings provide evidence of violations of several of the assumptions that underpin migration theories based on standard economic models, as well as positive evidence that some aspects of prospect theory are relevant for migration. However, this analysis was conducted using macro-level data and therefore relies on inferring that individual migrants were behaving according to prospect theory based on these macro-level patterns.

In addition to using macro-level data, it is also important to examine the migration-related decision-making of individuals. Mironova and Whitt (2017) and Ceriani and Verme (2018) examined the risk preferences of migrants and non-migrants in conflict zones. Both papers found that those who migrated away from conflict zones were more risk-averse than those who stayed. These findings may initially seem surprising, as previous research on economic migration has generally found the opposite pattern, with non-migrants being more risk-averse than migrants (Akgüç et al. 2016; Jaeger et al. 2010). However, one likely explanation for this pattern is that determining whether migrating or staying is riskier is highly situationally dependent. Therefore, if within conflict zones migrating is generally judged to be the less risky option, it is not surprising that risk aversion would increase the likelihood of migrating. Further nuance, involving the role of individual traits, such as risk tolerance and persistence of preferences, but also familiarity with the context, has been added by a recent study of tourism-related mobility under crisis conditions (Chen et al. 2025).

Work examining the strength of the endowment effect for migration decisions has also demonstrated the relevance of prospect theory for understanding migration decision making (Clark and Lisowski 2017, 2019; Morrison and Clark 2016). The endowment effect refers to the finding that people tend to place a higher value on something they already have (Marzilli Ericson and Fuster 2014). There are a variety of competing explanations for the endowment effect, but key among them is the role of reference dependence (i.e., potential outcomes are considered relative to the status quo, thereby imbuing an endowment) and loss aversion (Marzilli Ericson and Fuster 2014). For migration decision making, this suggests that people will be less willing to move than models assuming utility maximization would predict because they consider the potential gains and losses of any move relative to their current situation (e.g., their current dwelling or living situation) and therefore overweigh losses relative to gains. Consistent with this prediction, Clark and Lisowski (2017, 2019) found that both risk attitudes and endowment effects were significant predictors of moving (or staying), highlighting the applicability of prospect theory and the role of risk and loss aversion in contributing to migration decisions.

The studies listed above examined risk attitudes and asylum migration or similar mobility patterns, as well as the role of the endowment effect. However, they did not examine whether other aspects of prospect theory were related to asylum migration. In another recent paper, Bocquého et al. (2018) addressed these issues by using the parametric method proposed by Tanaka et al. (2010) to elicit a utility function from a group of asylum seekers in Luxembourg. The data were, again, more consistent with prospect theory than expected utility theory. However, the asylum seekers exhibited lower loss aversion, less probability distortion, and less curvature of the utility function than had been found in previous studies with more general populations.

Although previous studies have examined risk preferences and elicited utility functions from migrants, the decision-making tasks used have all been related to a financial context and have not specifically asked about migration decisions. In a series of papers, Baláž and Williams (2017, 2018) have highlighted the potential for experiments to provide a greater understanding of migration (for a related recent overview on tourism mobility, see Lin et al. 2024). Particularly, they have pointed out that experimental methods are rarely used in migration research, even though there are many relevant questions that experimental methods can help to answer. For example, experimental methods provide the ability to tightly control and manipulate variables to determine causation. Additionally, one specific area where Baláž and Williams (2017) suggested experimental methods may be of use is to test for framing effects or contextual changes on decisions, some aspects of which were later tested in the tourism context by Chen et al. (2025).

Therefore, we built upon the previous research, in particular on Baláž and Williams (2017, 2018), by conducting two experiments in which we elicited separate utility functions for migration and finance decisions. This allowed us to test whether the utility function for migration decisions, specifically international migration decisions between countries, is similar to the utility function for finance or if the two functions differ in important ways. We used a non-parametric methodology adapted from Abellaoui et al. (2016), in which participants made a series of choices between two alternatives (for more details, see the Method section of the current paper as well as Abdellaoui et al. 2016). An advantage of the methodology proposed by Abdellaoui et al. (2016) is that it is empirical and does not require making any a priori assumptions about the shape of the utility function. We elicited six points of the utility function for gains and six points of the utility function for losses. These points were then analysed to establish the shape of the utility function (e.g., concave utility for gains, convex utility for losses).

For the purposes of these experiments, we consider migration decisions to consist of two key aspects. One key aspect of the decision is whether to leave the initial country. The second key aspect of the decision is which country to migrate to. Within the current experiments, participants responded to items that related specifically to the second step of the migration decision process: choosing a country to migrate to. This allowed us to use changes in monthly income as the potential outcomes of choosing a country to migrate to, in line with economic explanations for migration. This setup has also meant that there was less risk that participants would consider other aspects that may influence a migration decision but were not part of the current study. That is, because participants were choosing which of two countries to migrate to, it is more likely that they focused solely on the changes in monthly income and did not consider external factors that were not part of the study but might influence a migration decision (e.g., relationships with friends and family, the strength of the endowment effect for their current living situation). This methodology allowed us to manipulate whether the decision took place in a financial or migration context, but kept all other aspects of the elicitation items identical. Additionally, focusing on the choice of country to migrate to meant that the decision process involved can generalise across both forced and non-forced migration decisions because this aspect of the decision is likely to be similar regardless of the motivation for leaving the original country.

This study has been done in the context of broader work on modelling migration processes by using empirically-informed agent-based models, presented in (Bijak 2022) from the point of view of the modelling process. In this paper, we report on one specific set of experiments and their results (a high-level summary of these results is included in Prike et al. 2022).

3 | Methodology

3.1 | Participants

We conducted two experiments, both of which used the same design but differed in the samples recruited. Conducting Experiment 2 also enabled us to test the replicability of the findings from Experiment 1 in an independent sample. In Experiment 1, we recruited 133 undergraduate participants from the University of Southampton for a lab-based study. In Experiment 2, we recruited 403 online participants using Amazon's Mechanical Turk and TurkPrime (Litman et al. 2016). In the latter case, we collected data from Mechanical Turk users based in the United States of America. Although Mechanical Turk samples are more representative of the general population than university student samples, it is important to note that Mechanical Turk samples are generally younger, more educated, and have lower income than nationally representative samples, and may also overrepresent men (Levay et al. 2016; Sheehan 2018). Participants were excluded if they answered yes to any of the questions on a questionnaire aimed at identifying problem gambling, as stipulated by the ethics protocol; if any of their elicited values were smaller than zero; if they took either less than 10 min or more than 40 min to complete the study; or if they failed an online attention check. The attention check questions were added specifically for Experiment 2, and for Experiment 1, only the timing and gambling questionnaire exclusion criteria were pre-registered.

3.2 | Design

Both Experiment 1 and Experiment 2 used a 3 (*financial stake size*: small, medium, large) × 2 (*context*: financial investment, migration) mixed-model design, with financial stake size as the between-subject factor and context as the within-subject factor. The hypotheses, study design, statistical analyses, exclusion criteria, and number of participants for the two experiments were preregistered on the Open Science Framework (Experiment 1: https://osf.io/8epg7; Experiment 2: https://osf.io/95az3/). Data and analysis code are also available on the Open Science Framework (https://osf.io/vx4d9/). The design and procedure were vetted and approved by the University of Southampton Ethics Committee (Experiment 1 Approval: 45553; Experiment 2 Approval: 45553.A1). Experiment 1 data collection took place in November 2018, and Experiment 2 data collection took place in May–June 2019.

3.3 | Materials

In line with the methodology proposed by Abdellaoui et al. (2016), participants in both experiments were presented with a series of choices between two 'gambles', and these choices were used to elicit six points of the utility function for gains and six points of the utility function for losses. Before eliciting these points, several values within the gambles had to either be prespecified or elicited in an earlier step. To test the effect of the prespecified values on the elicited utility functions, participants were randomly assigned to complete the study with small, medium, or large prespecified values.

Table 1 shows the full list of the gambles used to elicit the utility functions as well as the prespecified values used. In line with Abdellaoui et al. (2016), the elicitation proceeded in three stages, with the step column showing the order in which values are elicited from participants in each stage. The indifference column describes the structure of each elicitation; in other words, which values of losses or gains, weighted by probabilities, were meant to be equivalent in terms of their utility. The values of the elicited quantities were thus initially chosen in such a way that the two options did not differ in terms of utility. The prespecified values were determined by setting the differences in utility to be approximately the same: this is to reflect the diminishing sensitivity to gains or losses that are further away from the reference point, which in this case is assumed to be zero.

After each choice, the value being elicited was either increased or decreased so that either the non-chosen gamble increased in value or the chosen gamble decreased in value, thereby increasing the relative value of the non-chosen gamble. The elicited value was increased or decreased by 50% of the initial value after the first choice, and the increment of change was

TABLE 1 | Outline of the procedure for eliciting utility functions.

Stage	Step	Elicited quantity	Indifference	Pre-set values: $x_0 = 0, p = 0.5$
1	1.1	L	$G_{(p)}L \sim x_0$	Small stakes: $l = 250$
	1.2	x_1^+	$x_1^+ \sim G_{(p)}x_0$	Medium stakes: $l = 500$
	1.3	x_1^-	$x_1^- \sim L_{(p)}x_0$	Large stakes: $l = 1{,}000$
2	2.1	L	$x^+_{1(p)}L \sim x_{0(p)}l$	Small stakes: $l = 50$
	2.2	x_2^+	$x^+_{2(p)}L \sim x^+_{1(p)}l$	Medium stakes: $l = 100$
	2.3	x_3^+	$x^+_{3(p)}L \sim x^+_{2(p)}l$	Large stakes: $l = 200$
	2.4	x_4^+	$x^+_{4(p)}L \sim x^+_{3(p)}l$	
	2.5	x_5^+	$x^+_{5(p)}L \sim x^+_{4(p)}l$	
	2.6	x_6^+	$x^+_{6(p)}L \sim x^+_{5(p)}l$	
3	3.1	G	$G_{(p)}x_1^- \sim g_{(p)}x_0$	Small stakes: $g = 50$
	3.2	x_2^-	$G_{(p)}x_2^- \sim g_{(p)}x_1^-$	Medium stakes: $g = 100$
	3.3	x_3^-	$G_{(p)}x_3^- \sim g_{(p)}x_2^-$	Large stakes: $g = 200$
	3.4	x_4^-	$G_{(p)}x_4^- \sim g_{(p)}x_3^-$	
	3.5	x_5^-	$G_{(p)}x_5^- \sim g_{(p)}x_4^-$	
	3.6	x_6^-	$G_{(p)}x_6^- \sim g_{(p)}x_5^-$	

Note: Elicitation procedure taken from Abdellaoui et al. (2016: 6, Table 1) with some prespecified values altered. Notation: $\boldsymbol{x_0} = 0$: pre-set reference value; $\boldsymbol{x_1^+}$ $\boldsymbol{x_6^+}$: six points of the utility function elicited for gains; $\boldsymbol{x_1^-}$ $\boldsymbol{x_6^-}$: six points of the utility function elicited for losses, $p = 0$: pre-set outcome probability; *G:* a prespecified gain, and *L:* an elicited loss in the first stage of elicitation, with *L* equivalent to *G* in terms of utility, *l:* a prespecified loss, and *L*: an elicited loss in the second stage of elicitation; *g:* a prespecified gain, and *G:* an elicited gain in the third stage of elicitation.
Source: Own elaboration (Prike et al. 2022).

halved with each subsequent choice (e.g., increased or decreased by 25% of the initial value at step 2, 12.5% at step 3, etc.). For each elicited value (15 value elicitations for migration and 15 for finance), participants made up to six choices between the two gambles. After making three choices, for choices four through six, participants also had the option to respond "I have no preference" to indicate that they were indifferent between the two gambles. An example of an elicitation path for a point of the gain utility function in a migration context is presented in Figure 2.

3.4 | Procedure

First, participants read an information sheet for the study and provided informed consent. Participants then completed the Brief BioSocial Gambling Screen (Gebauer et al. 2010). Any participant who was identified as being at risk of problem gambling was redirected to a screen that stated that they were ineligible to participate in the study and provided information about available support services. After completing the Gambling Screen exercise, participants who were not at risk of problem gambling began the main elicitation task. Participants were randomly assigned to a stake size condition. Participants then completed the elicitation task in the migration and financial decision-making contexts. The context manipulations were implemented through the instructions given to participants, which specified either "imagine that you are going to make an investment and as a result of this investment your monthly income will change" in the financial context, or "imagine that you are going to migrate to a new country and as a result of this move your monthly income will change" (see Appendix A for the full instructions). The order of the elicitation for the migration and finance contexts was also randomized. That is, for half of the participants, the migration utility function was elicited first and a financial utility function second. For the other half of the participants, the order was reversed. To minimise the potential for order effects, the order of elicitation for gains and losses was also randomised. Therefore, after completing steps 1.1–1.3 (necessary for later elicitations), participants were randomly assigned to either complete steps 2.1–2.6 and 3.1–3.6 in order or to first complete steps 3.1–3.6 and then steps 2.1–2.6 (see Table 1 for more details). After participants had completed both elicitation tasks, they were fully debriefed, in line with the study protocol.

4 | Results

As noted in the Materials section, using the methodology proposed by Abdellaoui et al. (2016), we elicited six points of the utility function for gains and six points of the utility function for losses. These elicited utility function points were then used to calculate indices to measure loss aversion and to test for concavity in the utility function for gains and convexity in the utility function for losses. The following paragraphs outline the procedure for calculating these indices in more detail.

We analysed the Area Under the (utility function) Curve (AUC) to establish whether the non-parametric utility function exhibited the S-shaped utility predicted by prospect theory (concave for gains, convex for losses). We also used non-linear least squares to estimate a power function, x^α. This function is commonly used (Abdellaoui et al. 2016) and has previously

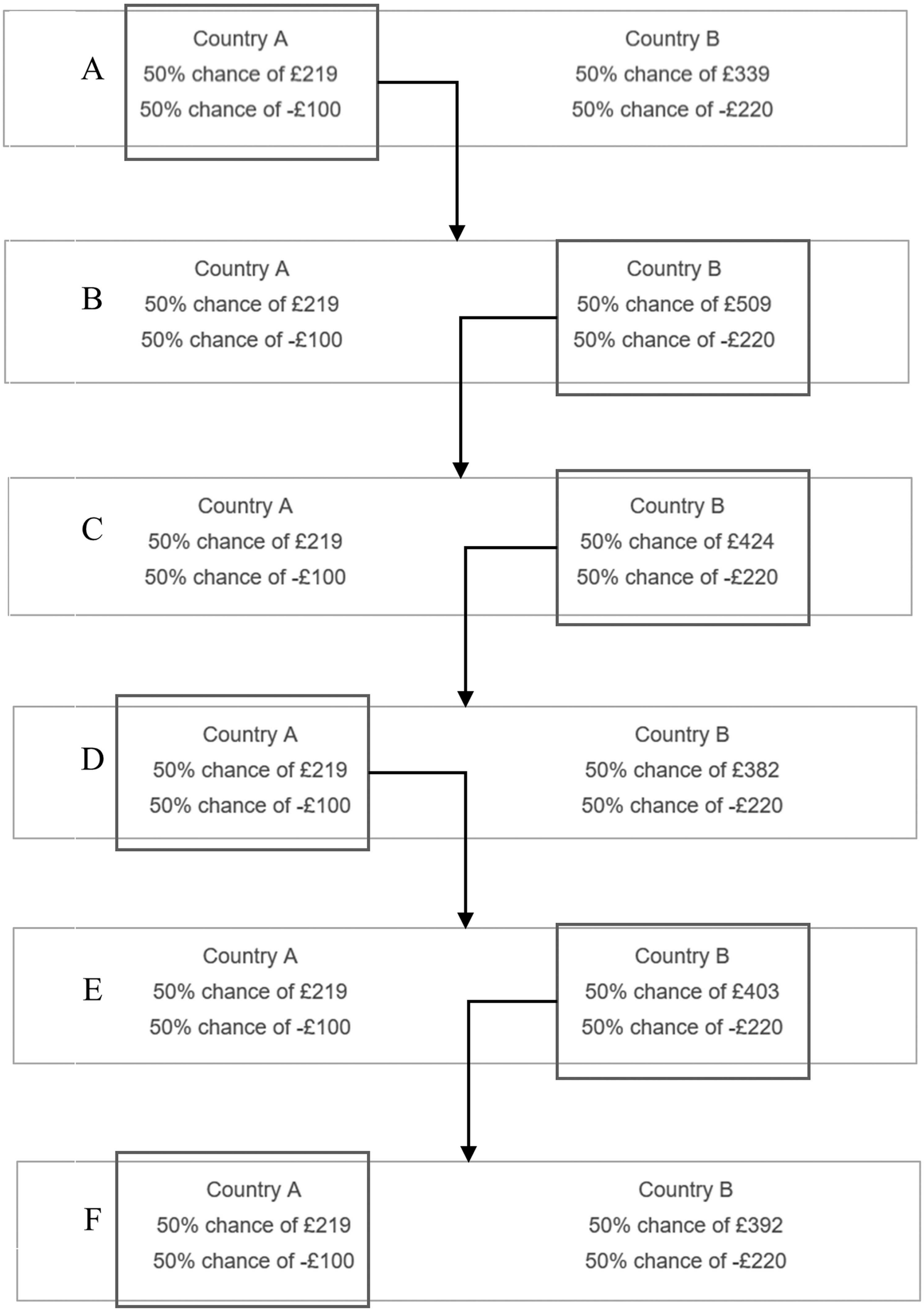

FIGURE 2 | An example participant trajectory through the elicitation exercise. *Notes*: Shows elicitation of the second gain (x_2^+), in a migration context, with medium stakes. In the first stage (A), the value of x_2^+ corresponds to both options having equivalent utility, and in the subsequent stages (B–F), x_2^+ is adjusted depending on the choices made, indicated by the black frames. The process yields the elicited value of x_2^+ corresponding to indifference between the two options.

been shown to be the best fitting function for value or utility (Stott 2006). The power function, x^α, was estimated separately for gains and losses within the migration and financial contexts, so with four separate parameters estimated in total.

Loss aversion was analysed according to the definitions of Kahneman and Tversky (1979) and Köbberling and Wakker (2005). According to Kahneman and Tversky's definition of loss aversion, for equivalent utility, the value of elicited gains is larger than the value of elicited losses (e.g., $x_2^+ > x_2^-$, $x_3^+ > x_3^-$), suggesting that losses are subjectively experienced as more aversive than numerically equivalent gains. We obtained an aggregate measure of loss aversion by regressing the points elicited in the gain domain on the points elicited in the loss domain (i.e., regressing x^+ on x^-). Values of the regression coefficient $\beta > 1$ in the model indicate loss aversion, $\beta < 1$ indicates gain seeking, and $\beta = 1$ indicates loss neutrality. Alternatively, Köbberling and Wakker (2005) defined loss aversion based on the inflection point of the utility function at the reference value. Therefore, according to their definition

$x_1^+/x_1^- > 1$ indicates loss aversion, $x_1^+/x_1^- = 1$ indicates loss neutrality, and $x_1^+/x_1^- < 1$ indicates gain seeking.

4.1 | Analysis Strategy

After using the elicited utility functions to calculate these various measures, the descriptive values of which are summarised in Table 2, we conducted a series of analyses to test for several core features that would be predicted by prospect theory: the presence of loss aversion, concavity in the utility function for gains, and convexity of the utility function for losses. Each subsequent section of the results starts by presenting these overall findings (i.e., whether the feature was present or absent) based on the results of one-sample *t*-tests (see Table 3). Following this, we present analyses testing for main effects and interactions of context and stake size (see Table 4). The effects of the stake size and decision context (migration or financial) on the following indicators – AUC, the estimated parameter a of the power function, and the measures of loss aversion – were analysed by conducting a series of separate 3 (*financial stake size*: small, medium, large) × 2 (*context*: investment, migration) mixed-model Analyses of Variance (ANOVAs). Bayesian equivalents of these mixed-model ANOVAs were also conducted using the JASP software with default priors (JASP Team 2018).

4.2 | Preregistered Analyses

4.2.1 | Loss Aversion

In Experiment 1, for the aggregate measure of loss aversion based on the Kahneman and Tversky (1979) definition, we found no evidence of loss aversion in either the financial or migration contexts. In Experiment 2, we found significant loss aversion in the financial context, but not in the migration one. Additionally, in Experiment 1, we found no significant effects of context or financial stake size and no significant interaction. Similar results, with no significant main effects and no significant interaction, were found for Experiment 2.

For loss aversion based on the inflection point of the utility function proposed by Köbberling and Wakker (2005), in Experiment 1, we found significant loss aversion in the financial context, but the measure of loss aversion in the migration context was only marginally significant. In Experiment 2, there was evidence of significant loss aversion in both the financial and migration contexts. Additionally, similar to results for the Kahneman and Tversky (1979) definition of loss aversion, in Experiment 1, we again found no significant effects of context or financial stake size and no significant interaction, with similar results identified in Experiment 2.

4.2.2 | Area Under the Curve

The AUC was calculated separately for gains and losses using the trapezoidal rule, and one-sample *t*-tests were used to test whether the AUC significantly differed from linearity, with linear utility being classified as having an AUC = 0.5. The detailed numerical results are presented in Table 3. For gains, in Experiment 1, we found significant concavity in both the financial and migration contexts. Similar results for gains were found for Experiment 2, with significant concavity for both contexts. For losses, in Experiment 1, there was significant convexity in the financial context, but the migration context did not significantly differ from linearity. In Experiment 2, significant convexity for losses was detected in neither context.

Additionally, the effect of context and financial stake size on AUC was analysed for gains and losses using two separate mixed-model ANOVAs. For gains, in Experiment 1, there was a

TABLE 2 | Descriptive statistics for key dependent variables.

Measure Experiment 1	Finance		Migration	
	Mean (SD)	Median [IQR]	Mean (SD)	Median [IQR]
KT loss aversion	39.16 (269.10)	1.76 [0.51–4.78]	19.09 (138.60)	1.78 [0.67–4.51]
KW loss aversion	4.25 (12.62)	1.35 [0.71–2.68]	4.17 (18.33)	1.43 [0.73–2.94]
AUC gain	0.56 (0.13)	0.57 [0.48–0.66]	0.53 (0.13)	0.53 [0.45–0.62]
AUC loss	0.53 (0.12)	0.54 [0.44–0.62]	0.49 (0.11)	0.49 [0.42–0.56]
Parameter a gain	0.92 (1.47)	0.74 [0.55–0.98]	1.14 (2.54)	0.83 [0.62–1.14]
Parameter a loss	1.00 (0.54)	0.85 [0.65–1.22]	1.16 (0.75)	1.01 [0.66–1.46]
Measure Experiment 2	**Finance**		**Migration**	
	Mean (SD)	**Median [IQR]**	**Mean (SD)**	**Median [IQR]**
KT loss aversion	12.40 (64.92)	2.07 [0.54–5.59]	38.19 (397.50)	1.76 [0.62–5.85]
KW loss aversion	6.32 (27.11)	1.29 [0.66–3.07]	9.49 (58.61)	1.39 [0.68–2.91]
AUC gain	0.55 (0.15)	0.55 [0.46–0.66]	0.55 (0.14)	0.55 [0.47-–0.66]
AUC loss	0.51 (0.13)	0.52 [0.44–0.59]	0.50 (0.14)	0.50 [0.40–0.59]
Parameter a gain	1.01 (1.74)	0.71 [0.49–1.03]	1.00 (2.35)	0.76 [0.53–1.07]
Parameter a loss	1.08 (2.98)	0.89 [0.61–1.22]	1.14 (1.26)	0.93 [0.64–1.37]

Note: KT Loss Aversion refers to loss aversion measured using the Kahneman and Tversky (1979) method. KW Loss Aversion refers to loss aversion measured using the Köbberling and Wakker (2005) method. AUC refers to the area under the curve, calculated using the trapezoidal rule.
Source: Own elaboration.

TABLE 3 | One-Sample *t*-test results checking for the presence of prospect theory characteristics.

Measure Experiment 1	Finance				Migration			
	t	p	d	BF_{10}	t	p	d	BF_{10}
KT loss aversion	1.62	0.11	0.14	0.35	1.49	0.14	0.18	0.29
KW loss aversion	2.94	0.004	0.26	5.86	1.97	0.051	0.17	0.64
AUC gain	4.88	< 0.001	0.43	4.356	2.51	0.01	0.22	1.96
AUC loss	2.79	0.006	0.24	3.92	1.19	0.24	−0.10	0.19
Parameter a gain	0.65	0.52	−0.06	0.12	0.61	0.55	0.05	.012
Parameter a loss	0.04	0.97	< 0.01	0.10	2.49	0.01	0.22	1.87

Measure Experiment 2	Finance				Migration			
	t	p	d	BF_{10}	t	p	d	BF_{10}
KT loss aversion	3.53	< 0.001	0.18	24.40	1.88	0.06	0.09	0.32
KW loss aversion	3.94	< 0.001	0.20	106.17	2.91	0.004	0.15	3.56
AUC gain	6.47	< 0.001	0.32	2.19×10^7	6.68	< 0.001	0.33	7.55×10^7
AUC Loss	1.44	0.15	0.07	0.16	0.44	0.66	0.02	0.06
Parameter a Gain	0.17	0.87	0.01	0.06	0.02	0.99	< 0.01	0.06
Parameter a Loss	0.50	0.62	0.03	0.06	2.20	0.03	0.11	0.61

Note: Experiment 1 $n = 113$, Experiment 2 $n = 403$. KT Loss Aversion refers to loss aversion measured using the Kahneman and Tversky (1979) method. KW Loss Aversion refers to loss aversion measured using the Köbberling and Wakker (2005) method. AUC refers to the area under the curve, calculated using the trapezoidal rule. t refers to the Student t test statistic. p indicates statistical significance. d refers to Cohen's d measure of effect size. BF_{10} indicates the Bayes Factor in favour of the alternative hypothesis relative to the null (default priors were used).
Source: Own elaboration in JASP.

TABLE 4 | ANOVA results testing the effects of context and stake size on prospect theory characteristics.

Measure Experiment 1	Context				Stake size				Context × Stake size			
	F	p	η_p^2	BF_{10}	F	p	η_p^2	BF_{10}	F	p	η_p^2	BF_{10}
KT loss aversion	2.24	0.14	0.02	0.43	1.12	0.33	0.02	0.41	2.30	0.105	0.04	0.51
KW loss aversion	< 0.01	0.96	< 0.01	0.13	1.19	0.31	0.02	0.21	1.08	0.34	0.02	0.20
AUC gain	4.52	0.035	0.03	1.29	0.82	0.44	0.01	0.17	0.14	0.87	0.002	0.08
AUC loss	17.23	< 0.001	0.12	185.93	0.04	0.96	< 0.01	0.11	1.44	0.24	0.02	0.22
Parameter a gain	0.61	0.44	< 0.01	0.20	< 0.01	0.995	< 0.01	0.06	1.67	0.19	0.03	0.37
Parameter a loss	4.56	0.035	0.04	1.25	< 0.01	0.996	< 0.01	0.07	0.06	0.95	< 0.01	0.08

Experiment 2	Context				Stake size				Context × Stake size			
	F	p	η_p^2	BF_{10}	F	p	η_p^2	BF_{10}	F	p	η_p^2	BF_{10}
KT loss aversion	1.66	0.20	< 0.01	0.19	0.76	0.47	< 0.01	0.03	0.56	0.57	< 0.01	0.06
KW loss aversion	1.00	0.32	< 0.01	0.13	0.31	0.74	< 0.01	0.02	0.13	0.88	< 0.01	0.03
AUC gain	< 0.01	0.97	< 0.01	0.08	0.73	0.48	< 0.01	0.07	0.26	0.77	< 0.01	0.04
AUC loss	2.92	0.088	< 0.01	0.03	0.06	0.95	< 0.01	0.32	0.52	0.60	< 0.01	0.05
Parameter a gain	0.01	0.91	< 0.01	0.08	0.77	0.47	< 0.01	0.04	0.15	0.87	< 0.01	0.05
Parameter a loss	0.19	0.66	< 0.01	0.02	0.22	0.80	< 0.01	0.09	0.78	0.46	< 0.01	0.07

Note: Experiment 1 $n = 113$, Experiment 2 $n = 403$. KT Loss Aversion refers to loss aversion measured using the Kahneman and Tversky (1979) method. KW Loss Aversion refers to loss aversion measured using the Köbberling and Wakker (2005) method. AUC refers to the area under the curve, calculated using the trapezoidal rule. F refers to the F test statistic. p indicates statistical significance. η_p^2 refers to partial eta squared effect size, indicating the proportion of variance explained. BF_{10} indicates the Bayes Factor in favour of the alternative hypothesis relative to the null (default priors were used).
Source: Own elaboration in JASP.

significant effect of context, but no significant effect of the financial stake size or any interactions. In Experiment 2, we found no significant effect of context or financial stake size on AUC, and no significant interaction, either. In the domain of losses, Experiment 1 yielded a significant effect of context; however, there was no effect of financial stake size, nor of interactions. In Experiment 2, we found no significant effect of context or financial stake size on AUC, again, with no significant interactions.

4.2.3 | *Estimated Parameter* a

The non-linear least squares method was used to estimate a power function, x^{α}, separately for gains and losses.

Subsequently, one-sample t-tests were used to establish whether the estimated parameter a significantly differed from linearity, with linear utility being defined as a situation with $a = 1$. The numerical outcomes are listed in Table 3. Thus, for gains, in Experiment 1, there was no significant concavity in either the financial or migration context, and these results were confirmed in Experiment 2. For losses, Experiment 1 indicated significant convexity in the migration context, but in the financial context, no significant departure from linearity was detected. Similarly, in Experiment 2, significant convexity for losses was identified in the migration context, but not the financial one.

In addition, as before, the effect of context and financial stake size on the estimated parameter a was analysed for gains and losses using two separate mixed-model ANOVAs. For gains, in Experiment 1, we found no significant effects of context or financial stake size and no significant interactions. In Experiment 2, we found no significant effect of context or stake size on the estimated parameter a for gains, and no significant interactions. For losses, Experiment 1 identified a significant effect of context on the estimated parameter a, but no significant effect of financial stake size was detected, and the interactions were found to be not significant, either. In Experiment 2, we found no significant effect of either the context or the financial stake size on the estimated parameter a for losses, nor of their interactions.

4.3 | Sensitivity Checks: Non-Preregistered Non-Parametric Analyses

Examination of the data indicated that many of the relevant variables had heavy tails and were not normally distributed. Therefore, because non-normal distributions violate the assumptions of standard parametric tests, the analyses reported above were redone using non-parametric tests. The one-sample t-tests for the presence of loss aversion and whether AUC and the estimated parameter a were redone using the Wilcoxon signed-rank test. As is customary for such tests, the effect sizes were measured through rank-biserial correlation (r_{rb}), measuring the strength of the relationship between a binary and a ranked (ordinal) variable on a standardized scale (from −1 to +1).

In addition, we have also conducted non-parametric analyses using the ARTool (v0.10.7; Kay and Wobbrock 2020) and npIntFactRep (v1.5; Feys, 2015) packages in R. Specifically, we used these two packages to conduct aligned ranks tests. Both R packages were used because ARTool conducts appropriate aligned rank tests for the main effects of the within-subject variable (context) and the between-subject variable (financial stakes size), but does not properly compute the interaction because it uses a between-subject × between-subject formula rather than a between-subject × within-subject formula. In contrast, npIntFactRep uses the appropriate between-subject × within-subject formula for the interaction, but only does an aligned rank test for the interaction and not for main effects. Therefore, by using these two packages in combination, we were able to conduct aligned ranks tests for both main effects and the interactions. Headline findings are summarised below, with detailed results listed in Tables A1–A2 in Appendix B.

4.3.1 | *Loss Aversion*

When testing for loss aversion by using the one-sample t-tests using the Wilcoxon signed-rank test found evidence of significant loss aversion for both definitions and both contexts, both in Experiment 1 and Experiment 2. For the aligned ranks ANOVAs on the aggregate measure of loss aversion based on the Kahneman and Tversky (1979) definition, in Experiment 1, we found no significant effects of financial stake size and no significant interaction. However, there was a significant effect of context. For Experiment 2, we found similar results, with a significant main effect of context, no significant effect of financial stake size, and no significant interaction. Finally, for the aligned ranks ANOVAs on loss aversion based on the inflection point of the utility function (Köbberling and Wakker 2005), we found no significant effects of context or financial stake size and no significant interactions in both Experiments 1 and 2. Detailed numerical results of all the tests are reported in Table A1 in Appendix B.

4.3.2 | *Area Under the Curve*

With respect to the Area Under the Curve metrics, the one-sample t-tests for AUC using the Wilcoxon signed-rank test found evidence of significant concavity for gains in both the financial and migration context in Experiment 1 and Experiment 2. Additionally, in both experiments, there was also significant convexity for losses in the financial, but not in the migration context. As before, the effect of context and financial stake size on AUC was also analysed for gains and losses using two separate mixed-model aligned rank ANOVAs. For gains, in Experiment 1, there was a significant effect of context. However, the effects of the financial stake size and the interactions were not significant. In Experiment 2, we found no significant effect of context, financial stake size, or their interactions on AUC for gains. Similarly, for losses, in Experiment 1, there was a significant effect of context, but no significant effect of financial stake size or interactions. In Experiment 2, we again found a significant effect of context on AUC for losses, with no significant effect of financial stake size or the interactions. The test details are listed in Table A2 in Appendix B.

4.3.2.1 | *Estimated Parameter* a

Finally, for the estimated parameter a – the exponent of the power function, one-sample t-tests *a using* the Wilcoxon signed-rank test found evidence of significant concavity for gains in both the financial and migration contexts in Experiments 1 and 2. In Experiment 1, losses did not significantly differ from linearity in either context, while Experiment 2 indicated significant convexity for losses in the financial context, but not in the migration one. As before, we have also analysed the effect of context and financial stake size on the estimated parameter a for gains and losses by using two separate mixed-model ANOVAs on aligned ranks. For gains, in Experiment 1, we found a significant effect of context, but no significant effect for financial stake size and no significant interaction, while for Experiment 2, we found no significant effect at all. For losses, in Experiment 1, there was also a significant effect of context on the estimated parameter a, but no significant effect of financial stake size or any interaction terms. Similarly, in Experiment 2, we also found no significant effect of financial stake size or interactions on the parameter α for losses. At the same time, although not strictly significant, the effect of context on the estimated parameter α for losses was close to the conventional significance threshold, with a p-value of 0.056. For detailed results, please see Table A2 in Appendix B.

5 | Discussion

Overall, consistent with earlier suggestions and findings (in the migration context, e.g., Clark and Lisowski 2017, 2019; Czaika 2014; Williams and Baláž 2012), the general pattern of findings indicates that in both contexts, financial and migration-related, participants were generally loss-averse and their utility functions tended to be concave in the domain of gains.[2] The findings for losses were more mixed, with convexity found reasonably consistently in the financial context but rarely in the migration context. However, although losses were significantly more convex in the financial than migration context in Experiment 1 for both the parametric and non-parametric analyses, this was not found as consistently in Experiment 2. Specifically, for Experiment 2, there was a significant effect of context in the non-parametric analyses, but the difference was not significant in the parametric analyses. There was also sometimes a significant effect of context on gains and loss aversion, particularly in the non-parametric analyses, although this was not consistently found. Across all analyses, there were no significant effects of stake size and no interactions between stake size and context, suggesting that loss aversion and the shape of the utility function were not affected by variations in the stake size, at least for the values chosen in this experiment (the large stakes were four times the size of small stakes so we believe this covers a reasonable range of stake sizes).

The presence of loss aversion within this study is consistent with a wide body of research and a meta-analysis by Walasek et al. (2024). The presence of loss aversion within a migration context is also consistent with Czaika (2014), who found that migrants were more responsive to negative economic prospects than positive ones, and the endowment effect findings of Clark and Lisowski (2017, 2019). Additionally, the finding of concavity for gains is consistent with other research into prospect theory and the findings of Czaika (2014), who found diminished sensitivity for values further from the reference point (in our case, the participants' current monthly income level). One important implication of this finding is that when choosing between multiple potential destination countries, people may not differentiate as strongly between locations based on potential gains in income when these gains are further away from their current income level. For example, for someone moving to Europe from Africa, differences in potential income between various Western European countries may be less influential for their choice of destination than standard economic models would assume. Relative to wages in most parts of Africa, migrants to Western Europe would already be expecting large gains in income. Therefore, because potential income gains are already a long way from their income reference point, they may be less sensitive to income differences between potential destination countries (assuming they use their current income level as the reference point).

These findings have important implications for migration research and modelling. The results yet again call into question the commonly used rationality assumption, confirming earlier intuitions (Baláž and Williams 2018; Morrison and Clark 2016; Williams and Baláž 2012), meta-studies carried out across different contexts (Walasek et al. 2024), as well as findings obtained by using non-experimental data (e.g., Clark and Lisowski 2017, 2019; Czaika 2014). This strengthens the suggestion that in future work on migration decisions, it might be useful to incorporate loss aversion and attitudes to risk, and test how these variables influence the results in specific migration contexts.

Still, this study extends well beyond the replication of the previous work. In addition to the features of the migration decisions that were already established before, the main contributions of this study are threefold. First, we have demonstrated the applicability of the same theoretical background (prospect theory) and experimental instruments (the utility elicitation framework of Abdellaoui et al. 2016) across contexts, allowing, in most cases, for the transferability of some high-level findings from the financial to migration settings. Second, we have confirmed that migration decision-making is more consistent with the key tenets of prospect theory than with expected utility, as we have identified loss aversion, risk aversion, and diminished sensitivity further from the reference point in the experimental data. Third, we have identified important sources of sensitivity of the results, notably the operationalisation of the experiment, and the precise choice of statistical tests, which warrant interpreting the outcomes carefully, and focusing further research attention on these areas.

On the whole, the results presented in this study, enabled by using different experimental setups and statistical tests across two contexts, add subtlety and nuance to the state of the art in the area of migration decision making (Czaika et al. 2021). Of course, in common with other experimental studies, questions about the ecological validity of the results obtained from different populations than those potentially making migration decisions remain open (Prike et al. 2022). We address some aspects of this problem (experimental immersion to increase ecological validity) elsewhere (Modirrousta-Galian et al. 2024), but the results still need further confirmation.

Additionally, there are several key factors, such as age, gender, education, skills, experience, perceived competence, and so on, that are known to be associated with migration propensity and therefore likely impact migration decision making, often in non-trivial ways (Goss and Paul 1986; for recent examples, see e.g. Bütikofer and Peri 2017; Erdal et al. 2024, or Anastasiadou et al. 2025). Given our focus is on a migration decision between two alternative destinations (i.e., not a decision between staying and migrating), we believe our findings still make a strong contribution to understanding the decision-making process involved in choosing a destination (and thus helping understand the *migration distribution* effect, see Rogers et al. 2002). Nonetheless, it would be highly beneficial for future work to expand the focus to decisions to migrate or not, and to examine how this decision-making process varies between individuals based on demographic and other important factors. It would also be helpful for future work to examine other components of the migration decision-making process using similar methods, such as decisions to migrate or stay (related to the *generation* effect; Rogers et al. 2002), which precede the choice of a destination. Other important empirical knowledge gaps are related to the four areas reviewed by Hagen-Zanker et al. (2023): imagination, personality traits, feelings and emotions, as well as beliefs and values.

Possible further applications include modelling of decisions under incomplete or ambiguous information, especially with respect to the quest for "the cognitive rules for searching and evaluating information about migratory options" (see Czaika et al. 2021, 15). Separate strands of work on imperfect information in migration decisions exist (Baláž et al. 2016; Bertoli et al. 2020), but further work in this area could additionally explore differences and similarities between non-migrants and migrants, and between different groups of migrants, as well as the use of heuristics in decision making (Czaika et al. 2021, after Gigerenzer 2015). These efforts will hopefully contribute to making migration-related discourse and policy decisions more realistic.

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Conflicts of Interest

The authors declare no conflicts of interest.

Data Availability Statement

The data that support the findings of this study are openly available in the Open Science Framework at https://osf.io/vx4d9.

Endnotes

[1] In their work on prospect theory, Tversky and Kahneman (1979; Tversky & Kahneman 1992) used the term value function rather than utility function. However, for consistency with the broader literature, we have used the more common term utility function.

[2] Due to the noted violations of the assumptions required for parametric analyses, we primarily rely on the results of the non-parametric analyses within the discussion and for our conclusions because we believe these to be more appropriate and robust than the parametric results. However, we still explicitly note where there were differences in the findings for the parametric and non-parametric analyses in the interests of transparency.

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Supporting Information

Additional supporting information can be found online in the Supporting Information section.
Supporting File: psp70283-sup-0001-Appendices_corrected.docx.