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Auteurs

Geraldine Bocquého, Marc Deschamps, Jenny Helstroffer, Julien Jacob, Majlinda Joxhe

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Bureau d'Économie Théorique et Appliquée

BETA Université de Strasbourg
Faculté des sciences économiques et de gestion
61 avenue de la Forêt Noire
67085 Strasbourg Cedex
Tél. : +33 (0)3 68 85 20 69
Fax : +33 (0)3 68 85 20 70
Secrétariat : Géraldine Del Fabbro
g.delfabbro@unistra.fr

http://www.beta-umr7522.fr

Risk and Refugee Migration *

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Géraldine Bocquého[†], Marc Deschamps[‡], Jenny Helstroffer[§], Julien Jacob[¶] and Majlinda Joxhe[||]

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Abstract

This paper uses the experimental setup of Tanaka *et al.* (2010) to measure refugees' risk preferences. A sample of 206 asylum seekers was interviewed in 2017-18 in Luxembourg. Contrary to studies which focus on risk aversion in general, we analyze its components using a cumulative prospect theory (CPT) framework. We show that refugees exhibit particularly low levels of risk aversion compared to other populations and that CPT provides a better fit for modelling risk attitudes. Moreover, we include randomised temporary treatments provoking emotions and find a small significant impact on probability distortion. Robustness of the Tanaka *et al.* (2010) experimental framework is confirmed by including treatments regarding the embedding effect. Finally, we propose a theoretical model of refugee migration that integrates the insights from our experimental outcomes regarding the functional form of refugees' decision under risk and the estimated parameter values. The model is then simulated using the data from our study.

Keywords: Refugee migration, risk preferences, experimental economics, cumulative prospect theory, psychological priming

JEL Classification Codes: , C93 , D74 , D81 , D91 , F22

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[†]Université de Lorraine, AgroParisTech-INRA, BETA

[‡]Université de Bourgogne Franche-Comté, CRESE

[§]University of Lorraine, CNRS, BETA. Corresponding author. Mail: jenny.helstroffer@univ-lorraine.fr

[¶]University of Lorraine, CNRS, BETA

[||]CREA, University of Luxembourg

1 Introduction

In the continuing refugee crisis, thousands of individuals needing to flee their country face choices between different routes and destinations. Some Middle Eastern refugees decide to stay in the region, some to head for the European Union via the Balkans, other head for Libya in order to cross the Mediterranean via the central Mediterranean route. Both routes are perilous, and many refugees have perished along them.[1] Not fleeing is no less dangerous.[2]

If policy makers are to find a solution to the refugee crisis, they need to know how people make choices in risky situations. For example, in order to design a system of distribution of refugees to destination countries[3] it is necessary to be able to predict its consequences on refugees' choices. How do we know that refugees will indeed let themselves be moved to a country that is safe, but that does not provide them with the best perspectives? Are many refugees willing to accept greater risk in order to reach a country in which they estimate to be able to lead a better life? In other words, what is it that determines refugees' migration choices: Is it trying to avoid the highest losses or focussing on the option with the highest gains? Are risks perceived accurately? To answer these questions requires studying their risk preferences.

Risk preferences have been studied for different types of populations. Various frameworks are available and more recent ones account for psychological biases in decision making, like giving different weightings to gains and to losses, to extreme outcomes or to different levels of probability. Further, research has shown that while these weightings vary accross individuals[4], some similar traits can be found according to the individuals' characteristics, such as their country of origin or whether they are migrants.[5] It is therefore inaccurate to infer the risk preferences of one population from those calculated for another.

In this paper, we aim to enrich the existing literature on risk preferences, migration and refugees by testing the risk preferences of a previously unstudied population, refugees, defined as persons fleeing armed conflict or persecution.[6] We find that their risk preferences have characteristics that clearly distinguish them from other populations found in the literature: refugees are shown to be less loss averse, to distort probabilities less and to put a higher weight on very good outcomes in their decision-making process.

We gathered information about the migration decisions of refugees by eliciting risk

[1]The UNHCR (www.unhcr.org) estimates the total number of persons dead and missing in the Mediterranean 2014 - 2017 at 15 500, about 1 % of the persons who attempted the crossing. Between January and September 2016, 421 persons died or went missing on the Eastern Mediterranean Route, and 3,074 on the Central Mediterranean Route.

[2]According to Reuters, by March 2017 465,000 persons were killed or missing in Syria's civil war (www.reuters.com, March 13, 2017, "Syrian war monitor says 465,000 killed in six years of fighting"). This number corresponds to 2.5 % of the total civilian population.

[3]See for example Delacrétaz *et al.* (2016); Fernández-Huertas Moraga & Rapoport (2015).

[4]See for example Guiso & Paiella (2004); Williams & Baláž (2014).

[5]For example, Hsee & Weber (1999) find significant differences in cross-national risk preferences. For a review of demographic differences, see Holt & Laury (2014). For a review of migration and risk, see section 2.1

[6]This is the definition used by the UNHCR. The legal definition distinguishes between asylum seekers (persons who have applied for the recognition of refugee status) and recognized refugees (persons who have obtained this status). We employ the broader UNHCR definition. For a discussion of the notion of refugee, see Dustmann *et al.* (2017a).

preferences from 206 refugees in Luxembourg in 2017-2018. Risk attitudes were observed using the protocol developed in Tanaka *et al.* (2010). The influence of emotional recollections of fear on the results is studied using the psychological priming protocol developed in Callen *et al.* (2014) and found to have a relevant impact on probability distortion. We further test the robustness of Tanaka *et al.* (2010)'s experimental design by including variations in the framing of lotteries. We study whether excluding particularly high or low payoffs has an impact on the decisions taken by subjects and therefore on the estimation of their risk parameters. On average, we find no significant differences between treatments, thus consolidating the robustness of the Tanaka *et al.* (2010) experimental results.

Based on the experimental insights of the advantages of cumulative prospect theory, we introduce the latter into a theoretical model of refugee migration. To our knowledge, we are the first to do so. This model allows us to identify threshold values for different parameters determining the migration of refugees to Western countries. A numerical simulation of the model, based on the socio-demographic information and the risk parameter values gathered in our empirical study is proposed.

In what follows, we will situate our contribution within the literature (section 2), explain the experimental design (section 3), present the results of the baseline sample (section 4) and of the treatments (section 5). The theoretical model of refugee migration and a numerical simulation of the model is presented in section 6.4.2. Section 7 concludes.

2 Contribution and related literature

2.1 Risk attitudes of migrants

Asylum seekers are forced migrants who have applied for refugee status in a foreign country. Most studies show that migrants are less risk averse than other populations.[7] As suggested by Umblijs (2012), migration may be a process of self-selection in which the least risk averse individuals migrate.

However, some authors show that there is not necessarily a difference between the degrees of risk aversion of migrants and non-migrants, or even that migrants may be more risk averse.[8] As a consequence, it is not possible to generally assume low levels of risk aversion among refugees. Rather, an empirical foundation for such an assumption is necessary.

Further, refugees may not share risk attitudes of other types of migrants. They are forced migrants: leaving their homes does not result from choice, but from necessity.[9] The lack of choice of whether to migrate or not undermines the process of self-selection. As a consequence, refugees' risk behaviour may well be very different from other migrants. However, this is not necessarily the case, because refugees may make choices in which they self-select according to their risk preferences at a later stage of their migration, for example when determining their country of destination.

2.2 Risk attitudes and the experience of traumatising events

Another characteristic that may be significant in distinguishing refugees from other migrants is the experience of traumatising events. Experimental studies since Lerner & Keltner (2001) show that trauma and conflict may alter risk choices and preferences.

The experiences of psychological trauma that have been found in the literature to have an affect on risk aversion can take various forms: it can be of natural origin or man-made, experienced personally or in the vicinity. The sign of the changes in risk attitudes of persons having suffered from trauma differs between studies.[10]

Callen *et al.* (2014) use experimental primers to trigger the recollection of traumatic experiences, asking persons to recollect happy, fearful or neutral memories before being tested. In their study based in Afghanistan, they find that both recent violence and its recollection increase individuals preference for certainty.

As a consequence, while migrants may or may not be more risk-seeking than other populations, refugees' experience of violence may change their attitude, either exacerbating the risk-seeking behaviour or diminishing it. *A priori*, predictions of refugees' risk attitudes are therefore hardly possible. Since refugees' behaviour when confronted

[7]See Akgüç *et al.* (2016); Bonin *et al.* (2009); Dustmann *et al.* (2017b); Gibson & McKenzie (2011); Jaeger *et al.* (2010).

[8]For a literature review on the question, see Hao *et al.* (2014).

[9]See for example Schmeidl (1997).

[10]For example, Eckel *et al.* (2009) and Voors *et al.* (2012) show that the experience of trauma may lead to risk-seeking behaviour, while for Li *et al.* (2011) the risk-seeking behaviour occurs only in the gain domain, and there is an opposite effect in the loss domain. Kim & Lee (2014) find that persons who experienced the Korean war in their childhood were more risk averse than other generations. Psychological studies (e.g. Lerner *et al.* (2003) on the effect of 9/11) agree that fear correlates with choices consistent with risk aversion.

with risk is essential to understanding their migration process, this study aims to provide empirical data on refugees' risk attitudes.

2.3 Experimental approach

The existing literature on migrants' risk attitudes consists mainly of the analysis of surveys including a non incentive-compatible question on how a person considers his risk attitude.[11] To our knowledge, no such survey exists for asylum seekers.[12]

Our use of the experimental approach is also founded on the inherent advantages of experiments, which avoid difficulties such as reverse causality and multifactor causes (risk perceptions, social norms, absence of incentives etc.) which are common to studies using household surveys. For example, if we observed risky migration choices when lower risk options were possible, is this because migrants have a preference for risk? Or did they found their decision on erroneous perceptions of probabilities and outcomes, thinking they were chosing the safer option?[13]

Experiments based on the setup developed in Fox & Tversky (1995) were applied by Balaz & Williams (2011) and Hao *et al.* (2014), who find little evidence in favour of increased risk tolerance of migrants. Voors *et al.* (2012) use a similar experimental setup in Burundi and find that individuals who have experienced violence directly or indirectly are more risk-seeking than others.

The experimental approach has the further advantage of providing more detailed insight into individuals' decision making under risk. While the aforementioned studies focus on risk aversion generally, the experimental design by Tanaka *et al.* (2010) (hereafter TCN) involves parameters distinguishing between probability distortion, loss aversion and the marginally decreasing utility in the cumulative prospect theory framework.

Prospect theory, developed in Kahneman & Tversky (1979) and Tversky & Kahneman (1992) has been shown by Czaika (2015) to be a good fit for explaining German migration flow data. However, no study has so far applied an experimental approach to studying whether prospect theory may provide a better model of refugee migration than expected utility theory. This study aims to fill this gap, as well as determining parameters for refugees' risk behaviour that are compatible with prospect theory.

The TCN framework has been used in a variety of non-migration related settings: Liu & Huang (2013) study risk preferences and pesticide use by cotton farmers in China, Nguyen & Leung (2009) study the risk attitudes of Vietnamese fishermen, Campos-Vazquez & Cuilty (2014) experiment on the role of emotions in risk aversion on Mexican students.

The TNC experimental protocol therefore allows us to examine whether, compared to other populations, refugees are more or less risk averse. Further, we can study the components of the risk decision in a cumulative prospect theory framework by comparing loss aversion, marginally decreasing utility and probability distortion of refugees and other populations.

[11]See Akgüç *et al.* (2016); Bonin *et al.* (2009); Dohmen *et al.* (2011); Dustmann *et al.* (2017b); Gibson & McKenzie (2011); Jaeger *et al.* (2010).

[12]The German Socio-Economic Panel (IAB-BMF-SOEP) includes asylum seekers, but does not ask questions or test their attitude towards risk.

[13]Dohmen *et al.* (2011) argues however that the survey questions have good predictive qualities.

2.4 Focus on asylum seekers

Ideally, to understand all refugee migration choices our sample should cover persons who have decided not to migrate, to migrate elsewhere, or who have not succeeded in their migration. In the current study it was not possible to access persons who had not arrived in Western Europe. We sampled only asylum seekers who had arrived in Luxembourg, whose socio-demographic characteristics are representative of asylum seekers in the European Union. Obtaining legal refugee status takes several years, during which time the risk attitudes might change. Recognized refugees were thus excluded from the sample.

Focussing on the persons who succeed in migrating is of interest, because it complements studies in countries of origin on persons who have not migrated[14], and because risk attitudes of asylum seekers can provide valuable information on the choices of those persons who do become forced migrants.

Underlying this approach is the idea that the choices the asylum seekers make in our experiment can shed a light on the choices they made when migrating. Akgüç *et al.* (2016)'s finding that risk attitudes of migrants are unchanged by substantial changes in the environment, as well as Dohmen *et al.* (2011)'s and Highhouse *et al.* (2017)'s results show that there exist general traits underlying risk attitudes. Their studies provide evidence that there is consistency in risk attitudes across situations. We therefore assume that there is a strong correlation between choices made in the experimental context and during the migration.

2.5 Validation of the experimental setup

Several authors have tested framing effects in lottery experiments in order to evaluate the extent of this concern and identify methods which are preferable to obtain robust measurements of risk aversion. For instance, Lévy-Garboua *et al.* (2012) built several Holt and Laury lists of lottery pairs by varying display (simultaneously or sequentially), probability ranking (increasing, decreasing or random), and payoff range (low or high). They found that in all three cases respondents risk aversion was significantly altered. The psychological anchoring effect towards the middle row is one of the biases addressed by Andersen *et al.* (2006). The authors vary the cardinal scale of the probabilities in the Holt and Laury experiment by using two asymmetric frames where probabilities are skewed towards the highest or lowest values. They obtain mixed results. Bosch-Domènech & Silvestre (2013) tested four alternative modalities of embedding in 10-row lists by deleting the first 3 rows, rows 1, 2, 10, rows 1,9,10 or the last three rows. They found a systematic decrease in risk aversion when using the popular Holt and Laury list, which features pairs of lotteries with fixed payoffs and probabilities increasing or decreasing along the list. However, there was no significant bias when using a more recent elicitation method using only one and the same probability in the list. In the latter, the safe option is a sure payoff that increases along the list, while the risky one is a 50-50 fixed lottery.

In this paper we test the embedding effect in a third kind of paired lottery lists. In TCN lists probabilities of both options are fixed while payoffs increase or are fixed. We test whether the TCN protocol is prone to an embedding bias in order to provide

[14]See Voors *et al.* (2012) and Callen *et al.* (2014) on the risk preferences of persons who have stayed in war-torn areas that generated refugee flows.

i) a partial validation of the accuracy of estimates, *ii* to show whether the TCN test is adapted to low budgets for experiments and for rich countries, and *(iii)* to validate the relevancy of comparing estimates between full TCN tests and TCN without certain lines, such as to be found in Bocqueho *et al.* (2014).

2.6 Modelling refugee migration

The migration decisions of refugees as distinct from those of other types of migrants are theoretically modeled in Czaika (2009); Schaeffer (2010) and Djajić (2014) as a combination of economic and non-economic push and pull factors which influence individuals' decisions. Refugees decide to migrate to a Western country or to a safe country or refugee camp close to their country of origin on the basis of the expected utility of the different options. Flight to a western country is costly and risky, because the refugee obtains a legal status only with a probability inferior to one. If the status is not obtained, he is sent back to his country of origin.

The models differ in the different aspects of the refugee migration process which are included (see Table 12). The authors avoid the problems posed by the complexities of the migration process by designing basic models and then discussing variations of them. Djajić (2014) uses numerical examples to show the effects of changes in the values of the determinants of the utility functions. Schaeffer (2010) adds branches onto a basic set of decisions one by one and discusses them separately. Czaika (2009) uses comparative statics to predict the effects of changes of the values of the variables in his maximization model.

All the cited models maximize expected utility. While those of Djajić (2014) and Czaika (2009) include risk aversion, none allows for loss aversion or probability distortions. However, these aspects of refugees' choices, that are included in cumulative prospect theory, are shown by our empirical study to fit the reality better than the expected utility model. Our contribution to this literature is to propose a model of refugee migration that is based on cumulative prospect theory. It therefore takes account of decreasing marginal utility, loss aversion and probability distortion. We further discuss the implications of the model using numerical simulations which are based on the empirical data from our study. We thus provide a first step to create an appropriate model predicting refugee flows and policy impacts on forced migration.

3 Experimental design

This field study is designed to gather information about the migration decisions of refugees. For this, we study the attitudes towards risk of refugees, as well as their socio-demographic characteristics.

We elicited preferences from 206 asylum seekers in Luxembourg during the procedure of recognition of their asylum claim in autumn and winter 2017-2018. Interviews were completely anonymous and took place at the university of Luxembourg, as this setting conveyed a sense of safety to the interviewers and the interviewees. It also underlined the scientific nature of the study. Asylum seekers were randomly recruited by a research assistant using the interception sampling technique in refugee reception centers and mosques. The interviews were conducted face-to-face by the research assistant. Prior to the field work, the research assistant was tested on his comprehension of the questionnaire in Arabic and in English. The entire interview protocol was translated from English into Arabic, and back into English by a different translator. The research assistant, accompanied by a member of the research team, registered the answers online. Interviews took approximately 3/4 hour and included initial consent, questions on demography, education, language, work, income, networks and conditions before departure, migration path and conditions and future plans. This part of the interview was followed by the experimental protocols described in section 3.2.

As Figure 2 shows, the largest group of subjects originates from Syria (56%), followed by Iraqis (22%). These are also the main countries of origin in Luxembourg and in the European Union[15]. A majority of refugees in the sample (75 %) are male and the average age is 33 years. According to Eurostat, 75 % of asylum seekers in the the 18-34 age group arriving in the EU in 2016 were male, our sample is thus representative. The participants are well educated: 85 % have completed at least secondary education and 36 % have a college or university degree. Only 53 % are married, and only 51 % have ever worked. A minority of subjects earned low incomes in their countries of origin, while 35 % declare to have earned more than 600 €a month before fleeing. The latter are relatively wealthy: for comparison, the average monthly income in Syria before the war was 234 €, in Iraq (2017) it is 413 €, and in Afghanistan 42 €.[16]

3.1 Estimation methods

Cumulative prospect theory (CPT), developed as an alternative to standard expected utility theory (EUT) by Tversky & Kahneman (1992) is the predominantly endorsed theory of behaviour under risk, accounting for bounded rationality.

In CPT, risk behaviour results from the interplay of utility curvature σ, loss aversion λ and probability weighting γ. Note that the CPT model reduces to the EU-power model (with a reflected utility function at zero) if $\lambda = 1$ and $\gamma = 1$.

CPT features two key factors in explaining expected utility theory[17] anomalies, namely reference dependence and probability weighting. Whereas EUT does not distinguish between gains and losses, in CPT outcomes are classified as either gains or losses with respect to a reference point, and people can behave differently in each of the two outcome domains. Probability weighting refers to people's tendency to distort

[15]Statistics from Eurostat (ec.europa.eu).)

[16]Data taken from the IMF Datamapper. Last data for Syria 2010.

[17]Von Neumann & Morgenstern (1945).

objective probabilities, which is accounted for in CPT through a non-linear valuation of outcomes with respect to objective probabilities.

The first parameter determines the shape of a power utility function exhibiting a different slope in the gain and the loss domain (Tversky & Kahneman, 1992):

$$u(y) = \begin{cases} y^{\sigma} & \text{if } y > 0 \\ 0 & \text{if } y = 0 \\ -\lambda(-y)^{\sigma} & \text{if } y < 0 \end{cases} . \tag{3.1}$$

In this specification, σ is an anti-index of utility concavity for gains ($\sigma > 0$) and λ is a second parameter representing the decision maker's coefficient of loss aversion ($\lambda > 0$). The decision maker is more (resp. less) sensitive to losses than to gains when $\lambda > 1$ (resp. $\lambda < 1$). The usual empirical finding is $\lambda > 1$, along with $\sigma < 1$ (concave utility in the gain domain). Following Tversky & Kahneman (1992), decision weights defined over cumulative probabilities are also introduced. The value of any binary lottery $(y_1, p; y_2)$ is as follows:

$$PU(y_1, p; y_2) = \begin{cases} \omega(p).u(y_1) + [1 - \omega(p)].u(y_2) & \text{if } y_1 \geq y_2 \geq 0 \text{ or } y_1 \leq y_2 \leq 0 \\ \omega(p).u(y_1) + \omega(1-p).u(y_2) & \text{if } y_1 < 0 < y_2 \end{cases} \tag{3.2}$$

where $\omega(.)$ is a probability weighting function which is strictly increasing from the unit interval into itself, and satisfies $\omega(0) = 0$ and $\omega(1) = 1$.

The form of the weighting function has been widely discussed. Following Tanaka *et al.* (2010), we choose Prelec (1998)'s specification:

$$\omega(p) = \exp\ [-(-\ln p)^{\gamma}] \tag{3.3}$$

where γ is a third parameter controlling the curvature of the probability weighting function ($\gamma > 0$). This parameter can be interpreted as an index of likelihood sensitivity, with $\gamma = 1$ reflecting the absence of probability distortion ($\omega(p) = p$). In other words, as γ decreases ($\gamma < 1$), the distinction between different levels of probability gets more and more blurred, and probabilities tend to be perceived as all being equal. This is the normal assumption, backed by a substantial amount of empirical evidence, and giving the weighting function an 'inverse S-shape'. In the case of a binary prospect such as a lottery, it characterises an overweighting of the low-probability outcome and an underweighting of the high-probability outcome. If $\gamma > 1$, the function takes the less conventional 'S-shape'. At the extreme, if γ is very high, probabilities tend to be perceived as either 0 or 1.

Figures 4 and 5 illustrate the difference between the utility functions in EUT and CPT. In Figure 4, the bisectrix designates the the utility function of a risk neutral individual, for which utility is a linear function of payoff. Incorporating a cognitive bias, the utility function becomes concave (*EUr*). If we reflect it at 0 in order to allow for negative payoffs and utility, we obtain a functional form which is a combination of *EUrn* and *EUr*. CPT adds a reference point (in this case at the origin) and adds a different weighting to losses. The function *CPT* (combined with *EUr* for the positive area) shows that losses have an increased negative impact on utility compared to the positive impact of gains. In total, we obtain an S-shaped utility function.

Figure 5 reflects the probability distorsion in CPT. While the bisectrix represents a perfect perception of risk (perceived probability is equal to actual probability), the inverse S-shaped weighting functions TNC and ω reflect the overrepresentation of low probabilities and the underrepresentation of high probabilities.

3.2 Experimental protocol

We adapt Tanaka *et al.* (2010)'s risk task.[18] This design is chosen because it estimates the different CPT parameters in detail without costing respondents much time. It also makes it possible to test for EUT (with a reflected utility function at zero) as well as CPT, EUT appearing as a special case of CPT. The drawback of this design[19], its complexity, was avoided by a one-to-one interview setup, in which the interviewer could make sure that the method was understood prior to beginning the test. This test elicits subjects' risk preferences. It provides results on all three of the parameters of CPT: utility convexity for gains (σ), loss aversion (λ) and likelihood sensitivity (γ).

The risk task consists of a succession of pairs of binary lotteries, each pair being composed of a relatively safe lottery (option A) and a risky lottery (option B) (see Table 7). The monetary values are expressed in *ecus* (10 *ecu* = 1 €) Initially, the expected value of lottery A is higher than that of lottery B. As one proceeds down the rows, the expected value of lottery B increases and surpasses that of lottery A. Risk neutral subjects are expected to choose lottery A first and switch to lottery B as soon as B's expected value is higher than that of A (ee column 4 in Table 7, not visible to participants). Very risk averse individuals will never switch, but prefer the safe lottery A even when it has a lower expected value. Risk lovers will switch to the risky lottery B even before its expected value is higher than that of A. There are two series of lotteries with positive payoffs and one series of lotteries which mixes positive and negative payoffs. The combination of the switching points of series 1 and 2 in Table 7 are used to estimate the curvature of the utility function σ and the nonlinear probability weighting parameter γ for each interviewee. We can then use the switching point from series 3 to estimate the loss aversion λ.[20]

In a variation of the original Tanaka *et al.* (2010) task, we add treatments. We amputate the price lists by the last or the first three lines in order to test for embedding effects.

After having completed the socio-demographic questionnaire, interviewees played the TCN lottery game subject to the treatments. They were shown colored balls to represent the probabilities of the payoffs of the lotteries. A comprehensive introduction of the method was given, including examples, to ensure comprehension.

[18]The interview design was approved by the French Research Ethics Board (*Comité d'Evaluation de l'Éthique de l'INSERM, CEEI-IRB*, CEEI-IRB opinion number 17-366) and to the Ethics Review Panel of the University of Luxembourg (ERP) (ERP opinion on research project ERP 17-22). The collection of data was declared to both the French and the Luxembourg Commissions for Data Protection. France: CNIL reference 2039994 v 0 of 23 March 2017; Luxembourg: CNDP reference R009671/T012217.

[19]For a discussion of advantages and drawbacks of different designs for risk elicitation see Charness *et al.* (2013).

[20]For a more detailed explanation of the parameter calculation, see Tanaka *et al.* (2010) and Liu & Huang (2013).

Subjects received an initial endowment of 10 €in shopping vouchers[21] for participation. In addition, they earned a payment that depended on their choices in the lotteries: at the end of the interview, one lottery row was randomly selected and the corresponding lottery was played for vouchers. The theoretical payment was comprised between 8 €and 180 €.[22] An average of 14,5 €was paid at the end of the interviews (between 8 and 32 €).[23] Given that asylum seekers in Luxembourg receive 25 €per month (in addition to housing and meals)[24], this payment gave them strong incentives to make thoughtful and careful decisions. Interviewees were informed that they could abandon the interview at any time and still receive the initial 10 €payment.

[21]These SODEXO vouchers are valid in major supermarkets in Luxembourg, as well as other shops that are accessible to asylum seekers. Their validity is one year, and the goods that can be bought cover most commodities.

[22]Monetary outcomes were rounded to the next full euro value for payment in vouchers.

[23]See 7 for the payment distribution.

[24]See **??** for more information on the aide given to asylum seekers in Luxembourg.

4 Experimental results

4.1 Baseline parameter estimates

For each subject, we calculate the corresponding CPT parameters using the common midpoint technique.[25] We subsequently derive estimates of mean values and corresponding standard errors for the underlying population (Table 3). We find that, on average, the parameter σ controlling utility curvature has a value of 0.708 and the loss aversion parameter λ has a value of 2.109. Regarding the likelihood sensitivity parameter, we find that the mean value of γ is 0.923. All three parameter values lie in the expected intervals. The CPT functions resulting from these values are the ones represented in Figures 4 and 5. All parameters are significant at the 1% level. The fact that λ (loss aversion) and γ (probability distortion) are significantly different from one implies that CPT is a more appropriate framework for assessing risk attitudes of refugees than EUT.

Figure 6 represents the distribution of the three estimated parameters. The figure shows that the three parameters follow different distribution patterns: σ (utility curvature) has a polarized distribution, while λ (loss aversion) and γ (probability distortion) are skewed. We find evidence of both convex and concave utility functions, of loss aversion as well as discounting of losses, and of over- and underestimation of probabilities.

Tables 4, 5 and 6 provide the estimations of the parameters including a set of exogenous individual characteristics. Both the σ and λ parameters lose their significance when including individual effects, whereas γ remains significant.

Coming from Iraq, having higher education levels and having worked are important for explaining utility curvature σ. Loss aversion λ increases in age but is reduced for subjects who have attended alternative education systems.[26] Subjects from Syria, compared to the other countries, distort probability γ less, while subjects who have attended alternative education systems and who have worked in their country of origin distort probabilities more.

4.2 Comparison of estimated parameter with other studies

The signs of our parameter estimates correspond to the classic pattern of the CPT framework. Figure 8 shows that the values obtained in this study are different from those in studies based on the same experimental setup.[27] Refugees exhibit lower loss aversion, utility curvature and probability distorsion than the other populations. A mean test comparing our parameter values to those in Bocqueho *et al.* (2014) and in Jacob *et al.* (2017) (Table 7) shows that the differences between the studies are significant.[28]

[25] Due to Tanaka *et al.* (2010)'s specific design, bounds for σ and γ can be jointly inferred by crossing responses to Series 1 and Series 2, each series providing several possible combinations of intervals for σ and γ. Then, depending on the σ value previously elicited, conditional bounds for γ can be inferred from Series 3. Parameter values are approximated by taking the midpoint of intervals. When there is no switch, the values at the boundary are used.

[26] All the persons who indicated having attended alternative education systems attended madrasas.

[27] Bauermeister *et al.* (2017); Bocqueho *et al.* (2014); Campos-Vazquez & Cuilty (2014); Jacob *et al.* (2017); Liu & Huang (2013); Tanaka *et al.* (2010).

[28] The only non-significant difference is for the value of sigma compared to Jacob *et al.* (2017).

Figure 9 compares the utility functions resulting from the parameter values in Tanaka *et al.* (2010) and in this study. Due to a lower utility curvature (higher value of σ), refugees obtain increasingly higher utility levels for positive payoffs. In other words, high prospective payoffs will affect the utility function of refugees more than of the TNC population.

In the area of negative payoffs, there are two effects: for negative payoffs close to zero, refugees suffer lower utility losses than in TNC, because refugees do not ponderate losses as highly as in TNC (they have a lower value of λ). Refugees are thus less sensitive to low losses compared to the TNC population. This effect is inversed for high losses, because refugees' low utility discounting σ has a stronger effect than their lower loss ponderation beyond a certain point. Thus, refugees are more sensitive to high losses than the TNC population. If refugees' reference point is very low, for example if the *status quo* is war, then they do not have much to lose, and they may well be less sensitive to negative outcomes than other populations.

Figure 5 compares the probability weighting γ of refugees to that of TCN. As in TCN, refugees underestimate low probabilities and overestimate high probabilities. However, they do so to a much lower degree. As probability distortion is comparatively low their perception of probabilities is very close to the true values.

5 Treatments

5.1 Psychological priming

We adapt the experimental setup of Callen *et al.* (2014), we used field psychological methods to ask all subjects to describe an event of their lives prior to the experiment. We randomized three treatments[29] accross subjects, asking questions with the following formulation:[30]

- We are interested in understanding your daily experiences that may make you fearful or anxious. This could be anything, for example getting sick, experiencing violence, losing a job, etc. Could you describe one event in the past year that caused you fear or anxiety? (FEAR)
- We are interested in understanding your general daily experiences. This could be anything. Could you describe an event from the past year that was important or significant for your life? (NEUTRAL)
- We are interested in understanding your daily experiences that make you happy or joyous. This could be anything, for example birth of child, marriage of a relative, or success in your job. Could you describe an event in the past year that caused you happiness?(HAPPY)

Tables 4, 5, 6 (columns 3 and 4) include the psychological primer experience treatment. We find that it has no effect on the estimated risk parameters, except on probability distortion γ, which is reduced by remembering a fearful event.

5.2 Embedding effects

Tables 9 and 10 show the parameter values of the treatments designed to test for embedding effects. Treatment DELLASC amputates the TCN lottery table by the last three lines, while treatment DELFASC amputates the TCN lottery table by the first three lines. Table 11 shows that the differences between the treatments are not significant. This is evidence that the mean parameter values are robust to these embedding effects, validating their accuracy. We also contribute to showing that the TNC experimental protocol can be adapted to relatively low budgets by amputating the lines with the high value lotteries without significantly changing the results. Finally, results between TNC protocols with and without the amputation of some lines can be compared. Thus, this test validates the comparison of our results to that of **?**.

[29]A randomization test shows that the differences between the subjects allotted to the three priming treatments are not significant.

[30]Questions adapted from Callen *et al.* (2014).

6 Theoretical model of refugee migration

In this section, we will apply the insights gained by our experiment to design a theoretical model on refugee migration that takes risk attitudes into account. A basic model is developed in Section 6.1. As a benchmark, Section 6.2 applies an EU framework to the model. Section 6.3 proposes an alternative model of refugee migration, based on cumulative prospect theory. Finally, we propose a numerical simulation of the models, based on the socio-demographic information and the risk parameter values gathered in our empirical study.

6.1 Basic assumptions

We consider a decision-maker (DM) who lives in a developing-country, and enjoys an annual income of y_{ON}, in his country of origin in time of peace.[31] Let us suppose that a conflict arises. This conflict impacts the annual income, which falls to y_{OC} with $y_{OC} < y_{ON}$.

The DM faces three alternatives:
1/ Stay at home, earning only y_{OC}.
2/ Leave for a neighboring safe country, at no cost, and earning y_S.
3/ Attempt to reach a western country. This alternative is costly (see later), but it is also risky, because two different outcomes can be obtained: with a probability p (with $p \in]0,1[$), he obtains refugee status and earns an annual income of y_W. But with the complementary probability $1-p$, he fails to obtain asylum and is sent back to country of origin earning y_{OC}.

We suppose that annual incomes are constant during all periods, but we assume that the DM has a time horizon and discounts future incomes. To be more precise, considering as an example the case of staying in the origin country in time of conflict, the DM's lifetime income expectation is:

$$y_{OC}^T = \int_0^T y_{OC}.e^{-rt}.dt$$

with t a period, T the time horizon (i.e. the last period which is taken into account by the DM), and r the discount rate.
Following the same reasoning, we define $y_S^T = \int_0^T y_S.e^{-rt}.dt$ and $y_W^T = \int_0^T y_W.e^{-rt}.dt$ the lifetime income expectation in case of leaving for a neighboring safe country and leaving for a western country respectively. To simplify the analysis, we suppose that the conflict lasts all the periods until time horizon T: there is no end of the conflict in sight. Therefore, leading to a return to the initial situation, and so earning y_{ON} per year, is not a possibility.[32]

[31] To avoid confusion, we will refer to the decision-maker using the masculine pronoun. This choice is based on the observation that the majority of refugees are male.
[32] The lengths and the destruction of the conflicts in the three main countries of origin of refugees in Western Europe (Iraq, Syria and Afghanistan) lend credibility to this assumption.

Attempting to migrate to a western country is costly: we suppose that the DM has to pay a sum C, that may be borrowed.[33] As a consequence, choosing this alternative supposes to repay the loan, and this reduces the lifetime income expectation by the amount:

$$C^{Te} = \int_0^{Te} c.e^{-rt}.dt$$

with Te the repayment horizon, $c = \frac{C}{Te}$ the annual amount of repayment. It is important to note that this repayment has to be made whatever the outcome of the asylum procedure (i.e. whether the DM ultimately lives in the western country or is sent back to his country of origin).

6.2 Expected Utility

Consider first that the DM is a Von Neumann - Morgenstern (VNM) Expected Utility (EU) maximizer. In this case, he values the different alternatives as follows:

$$V_{EU}(West) = pU(y_W^T - C^{Te}) + (1-p)U(y_{OC}^T - C^{Te})$$

$$V_{EU}(Safe) = U(y_S^T)$$

$$V_{EU}(Origin - Conflict) = U(y_{OC}^T)$$

with $U(x)$ the VNM - Utility function from receiving payoff x (with x the final wealth, with $x \geq 0$).
We assume the DM has a power utility function: $U(x) = x^\alpha$, with $\alpha > 0$ This kind of utility function allows to consider different types of risk attitudes: risk aversion if $\alpha < 1$, risk neutrality ($\alpha = 1$), or risk-loving ($\alpha > 1$). Using a power function is widely recognized in the economic literature, and it has the advantage of giving us the ability to directly interpret α as an indicator of risk aversion.[34]

Applying these specifications, we obtain the following values for the three alternative destinations:

$$V_{EU}(West) = p(y_W^T - C^{Te})^\alpha + (1-p)(y_{OC}^T - C^{Te})^\alpha \tag{6.1}$$

$$V_{EU}(Safe) = (y_S^T)^\alpha \tag{6.2}$$

$$V_{EU}(Origin - Conflict) = (y_{OC}^T)^\alpha \tag{6.3}$$

and, by comparing these values two-by-two we obtain:

Proposition 1.
(i) $y_S^T > y_{OC}^T$ leads a VNM-DM to migrate.

[33] In our sample, only half of the respondents financed their journey using their own resources. If own resources are used, the model is still valid.

[34] The Arrow-Pratt indicator of absolute risk aversion ($-\frac{u''(c)}{u'(c)}$) associated with a utility function $U(x) = x^\alpha$ reduces to $-\frac{(\alpha-1)}{x}$. α is directly linked to the degree of risk aversion, and the DM exhibits a decreasing absolute risk aversion: the wealthier he is, the less he is affected by an additive risk on his wealth.

(ii) The following condition is a sufficient (but not necessary) condition for a VNM-DM to prefer trying to leave to West over going to a safe neighboring country:

$$\alpha > -\frac{ln(p)}{ln(y_W^T - C^{Te}) - ln(y_{OC}^T)}$$

Proof: see section 7.

Proposition 1 states that the more convex (or the less concave) the utility function of the DM, the higher the likelihood the DM to prefer to aim for the West over going to a safe neighboring country. A higher convexity of the utility function means the marginal utility (of wealth) increases with the level of wealth. Because going to the West is associated with the highest, but not certain, payoff, this perspective is better valued by the DM in case of a more convex utility function. This can also be interpreted in terms of preference towards risk: more convexity leads to lower risk aversion. As a consequence, in case of a risky alternative associated with a high-payoff perspective and a low-payoff perspective, a less risk averse DM focusses more on the opportunity to reach the high-payoff perspective than he fears the threat of low-payoff perspective. Note that as $0 < p < 1$, an increase in p leads to a decrease in $ln(p)$: if the probability to obtain refugee status in the West is higher, then more risk averse persons decide to try to flee to the West.

6.3 Prospect Theory

Under VNM-expected utility, individuals' preferences towards risky perspectives are entirely captured by the degree of concavity of the utility function $U(x)$ (i.e. the value of α, for $U(x) = x^{\alpha}$). Following the observations made by Kahneman and Tversky (1979), Cumulative Prospect Theory (CPT) takes three additional features into account that many individuals exhibit when facing (risky) perspectives:

(i) valuations relative to a reference point (distinction between losses and gains)

(ii) loss aversion: a loss of X (relatively to the reference point) is more painful than a gain of X is enjoyable

(iii) Biases in assessing probabilities.

As a consequence, the values of the different alternatives for a DM having CPT preferences are:

$$V_{CPT}(West) = \omega(p)v((y_W^T - C^{Te}) - y_{OC}^T) + \omega(1-p)v((y_{OC}^T - C^{Te}) - y_{OC}^T)$$

$$V_{CPT}(Safe) = v(y_S^T - y_{OC}^T)$$

$$V_{CPT}(Origin - Conflict) = v(y_{OC}^T - y_{OC}^T)$$

with:

$v(x-z)$ being the valuation of a payoff x relative to the reference point z. In case of $x > z$ (positive perspective), the DM values the perspective as: $(x-z)^{\sigma}$, with $\sigma > 0$. In case of $x < z$ (negative perspective), the DM values the perspective as: $(-\lambda)(-(x-z))^{\sigma}$, with $\sigma > 0$ and $\lambda \geq 1$. σ represents the concavity of the value function, and λ represents loss aversion: in case of $\lambda > 1$, a loss of $z - x$ is more painful that a gain of a similar absolute value. Figure 4 illustrates the corresponding utility function with given levels of σ and $lambda$.

$\omega(p)$ is the weighting function of probabilities. It takes the following form $\omega(p) = 1/exp[ln(1/p)]^\gamma$. γ is defined in the interval [0,1] : if $\gamma = 1$ then $\omega(p) = p$, and if $\gamma = 0$ then $\omega(p) = 1$, $\forall p$. As a consequence, if there are two possible outcomes, the sum $\omega(p) + \omega(1-p)$ lies in the interval [1,2]. Hence, depending on the value of γ, the DM may be able to perfectly perceive the different probabilities (for $\gamma = 1$), or he can be completely unable to distinguish them (for $\gamma \to 0$) and thus attribute a similar weight to all possibilities. Indeed, the closer the value of γ is to 0, the more the perception of the probability is distorted. Figure 5 illustrates the probability weighting function for given levels of γ.

Recall that we assume the conflict to be persistent over all the periods of the time horizon. As a consequence, if the DM stays in the country of origin, he will earn y_{OC} at each t period from now until time horizon T. So, his lifetime income expectation in case of choosing the *statu quo* option is y^T_{OC}. This implies that y^T_{OC} is his reference point. As a consequence, employing the frame of a CPT decision model, all payoffs are valued relatively to y^T_{OC}.

Succeeding in getting asylum in a western country leads to a positive perspective ($y^T_W > y^T_{OC}$). Assuming $y^T_S > y^T_{OC}$, going to a safe neighboring country is also a positive perspective[35] (relatively to staying at home, with a conflict). However, because traveling to a western country is costly, being send back to the country of origin in case of failure in obtaining asylum in West leads to a negative perspective, which decreases lifetime income expectation ($y^T_{OC} - C^{Te} < y^T_{OC}$).

The values of the three alternatives for a Prospect Theory Decision-Maker are:

$$V_{CPT}(West) = \omega(p)((y^T_W - C^{Te}) - y^T_{OC})^\sigma + \omega(1-p)(-\lambda)(-((y^T_{OC} - C^{Te}) - y^T_{OC}))^\sigma \tag{6.4}$$

$$V_{CPT}(Safe) = (y^T_S - y^T_{OC})^\sigma \tag{6.5}$$

$$V_{CPT}(Origin - Conflict) = (y^T_{OC} - y^T_{OC})^\sigma \tag{6.6}$$

with $\omega(p) = 1/exp[ln(1/p)]^\gamma$ and $\omega(1-p) = 1/exp[ln(1/(1-p))]^\gamma$.
We remark that $V_{CPT}(Origin - Conflict)$ simplifies and is normalized to 0.

A comparison of the values of the different alternatives, and of how these values evolve with preferences (i.e. σ, γ, λ), allows us to state:

Proposition 2.
$y^T_S > y^T_{OC}$ leads a CPT-DM to migrate.

In this (very) simple model, the decision to migrate (whatever the destination) has the same trigger for a VNM-DM and for a CPT-DM. However, the choice of the destination does not have the same tenets.

[35] Czaika (2009), p. 4, says that a neighbor-safe country guarantees security but "limitations in self-reliance impose worse economic conditions". This is true relatively to the situation before conflict: $y_S < y_{ON}$. However, in case of highly violent conflict, and if the income function takes safety into account, we can suppose that the neighbor-safe country provides better living conditions that the origin country with conflict. So we have: $y_{OC} < y_S < y_{ON}$.

Proposition 3.

(i) The following condition is a necessary (but not sufficient) condition for a CPT-DM to prefer trying to leave to West over going to a safe neighboring country:

$$\sigma > \frac{ln(\omega(1-p)) - ln(\omega(p)) + ln(\lambda)}{ln((y_W^T - c^{Te}) - y_{OC}^T) - ln(-((y_{OC}^T - c^{Te}) - y_{OC}^T))} \tag{6.7}$$

(ii) To satisfy the condition:

$$\left[\frac{(y_W^T - C^{Te}) - y_{OC}^T}{-((y_{OC}^T - C^{Te}) - y_{OC}^T)}\right]^{\sigma} > \frac{\omega(1-p)\lambda}{\omega(p)} \tag{6.8}$$

is necessary (but not sufficient) for an increase in σ (i.e. less concavity / more convexity of the value function) to lead to an increase in the likelihood for West to be preferred over Safe.

(iii) An increase in loss aversion λ increases the likelihood of Safe to be preferred over West.

(iv) If the relative gain in lifetime income expectation when obtaining refugee status in West is higher than the relative loss in lifetime income expectation when failing to obtaining the status, if the loss aversion is low and if the probability of refugee status is lower than 0.5, then a stronger misperception of probabilities (in the sense of CPT, i.e. a lower γ) increases the likelihood of West to be preferred over Safe.

Proof: see section 7.

Proposition 3 calls for comments. Since only West in associated with a negative perspective. So, an increase in loss aversion reduces the CPT-value of West, and Safe has a higher likelihood to be chosen (Point iii). Points (i) and (ii)bmerit some discussion. Condition (6.7) is a condition for which the CPT-value of West is positive, which is a necessary condition for West to be preferred over Safe. As a consequence, if (6.7) is not satisfied, West cannot dominate Safe (the value of which is always positive). Condition (6.8) is a condition for which the CPT-value of West increases with the value of σ, which is a necessary condition for a higher convexity of the CPT-value function to lead to a higher likelihood for West to be preferred over Safe. From (6.8), we can remark that the effet of a higher convexity depends both on the initial degree of convexity (σ), and on other preference parameters (loss aversion λ, and probability weighting $\omega(.)$, via the value of γ). Hence, we can see that when p and $1-p$ are similarly perceived (i.e. $\gamma \to 0$) and when $\lambda \to 1$, then the right-hand-side of condition (6.8) reduces to 1: this increases the likelihood for an increase in σ to increase the relative value of West. When p and $1-p$ are sufficiently different and tend to be perfectly perceived (and/or when λ is sufficiently high), then the condition in Equation (6.8) has a low likelihood to be satisfied and an increase in σ decreases the likelihood for West to be preferred over Safe.

These observations show that for a CPT-DM, the interactions between risk aversion (value of σ), loss aversion (value of λ) and probability perceptions (value of γ) are of paramount importance: a higher/lower degree of risk aversion leads to opposite results, depending on the DM's assessment of probabilities and loss aversion.

Having developed EU and CPT frameworks for refugee migration, and highlighted the impact of some features of preferences (risk aversion, loss aversion, ...) on the relative value of each alternative, we now turn to a numerical analysis, in order to compare the DM's choice in different according to the two frameworks.

6.4 EU vs CPT: a numerical analysis

Numerical calculations aim at comparing choices made under EU and CPT for a given context, and to simulate how a change in the context and/or in preferences affect the ranking between the three alternatives.[36]

6.4.1 Baseline

To set a baseline, we calibrate our models with data from different surveys[37] . As a consequence, we consider the following context variables:

Table 1. Context

Name of variable (notation)	Value
Time horizon (T)	20
Discount rate (r)	0.02
Local income, peace (yearly, y_{ON})	7200
Local income, conflict (yearly, y_{OC})	2400
Income in Safe (yearly, y_S)	2500
Income in West (yearly, y_W)	14200
Prob. asylum (p)	0.1
Cost of trip to West (C)	4000
Repayment horizon (Te)	5

We consider periods of one year. 70 % of the refugees we interviewed declared to have earned more than 600 Euro per month. We assume a mean income of 600 Euro, hence 7200 Euros by year.We consider that conflict reduces by 2/3 this annual income (2400 Euros in case of conflict). In order to be in line with our theoretical assumptions, we choose to set the income the migrants can earn in the safe neighboring country as slightly higher than the home income in case of conflict (2500 Euros). The mean cost of trip to West is 4000 Euros, while the probability to succeed in arriving in West and obtaining refugee status is 0.1[38]. For the basic scenario, we set the time horizon at 20 years (but we study the impact of a variation in time horizon).
Given exponential discounting, $T = 20$ (time horizon of 20 years) and $r = 0.02$ (discount rate of 2%), we find: $y^T_{ON} = 118684.78$; $y^T_{OC} = 39561.594$; $y^T_S = 41209.99$; $y^T_W = 234072.77$. The discounted cost of travel, C^{Te}, is: 3806.50.

We set the following values of preference parameters. They result from the calculations in our study.

Table 2. Preferences[39]

Name of variable (notation)	Value
VNM-Utility concavity (α)	0.723
CPT-value concavity (σ)	0.723
CPT loss aversion (λ)	1.854
CPT prob. weighting parameter (γ)	0.921

[36]This is a very preliminary version of the numerical analysis.

[37]The values of the parameters are based on our field study and others (marked with *). Robustness checks are still required.

[38]The acceptance rate in Luxembourg in 2016 was 61 %. However, not all refugees are successful in reaching the destination.

[39]The correspond to a smaller sample version of the parameter estimates and will be updated

For these baseline values, we obtain the following ranking:

Table 3. Baseline: ranking of alternatives

Alternative	EU-Value	CPT-Value
Origin	2107.80	0
Safe-neighbor	2170.93	**211.81**
West	**2516.39**	111.84

Here, given our parameters, the two decision-models do not provide the same ranking between the three alternatives: according to expected utility, moving to West is the best alternative while, according to prospect theory, moving to a safe-neighbor country is the best option. Given the fact that we made our survey with individuals who have decided to leave their country to go to the West, we should predict decision-makers to choose this alternative. We find that EU make this prediction, but not CPT. Can we conclude EU to be a better predictor than CPT? The answer is no, and three reasons (at least) can be evoked: 1/ by definition, models are simplifications of reality, and their predictions are linked to the assumptions on which they are built. Here, in this first work, by instance we suppose decision-makers to enjoy utility through the perception of earnings (while many other things have an impact on human well-being, which are not especially correlated with the net earnings). 2/ predictions of models also depend on the specifications of parameters: here, for EU-values by instance, values are relatively close to each other, so that a little error in parameters estimation could lead to another ranking. 3/ The specification of parameters depends on the quality of answers in the survey. However, we surveyed people who are already in the West: it is possible their preferences (and especially their behavior towards risk) have changed between the decision to move and the moment where they answered the survey. However, what is of first importance is not only to be able to predict decision making at a given period and context, but it is also to know how decisions may change when preferences and/or the living context evolve. And this can be predicted by models.

So, starting from these values, we make a sensitivity analysis by studying the impact of a variation in some parameters, one by one (ceteris paribus). First, for a given context, we make a sensitivity analysis on the preference parameters. Then, we provide a sensitivity analysis based on context parameters.

6.4.2 Sensitivity analysis - preferences parameters

Impact of the degree of risk aversion

α / σ	V-EU (West)	V-EU (Safe)	V-EU (Origin)	V-PT (West)	V-PT (Safe)	V-PT (Origin)
0,01	1,112625694	1,11211584	1,11166194	-1,6925907	1,0768882	0
0,1	2,911623732	2,89401152	2,88222167	-3,4517106	2,0975207	0
0,2	8,508261876	8,37530267	8,30720174	-7,4737002	4,3995931	0
0,3	24,96603459	24,2382224	23,9431968	-15,653749	9,2282375	0
0,4	73,60571313	70,1456948	69,0096007	-30,90015	19,356419	0
0,5	218,1672173	203,002449	198,900967	-54,031756	40,60049	0
0,6	650,50725	587,491425	573,276675	-67,203137	85,160368	0
0,7	1952,383768	1700,20695	1652,31045	37,01267	178,62563	0
0,8	5901,748837	4920,4185	4762,32499	729,23596	374,67096	0
0,9	17977,33551	14239,7478	13726,0763	3845,0515	785,8801	0
1	55206,20848	41209,9942	39561,5945	16144,826	1648,3998	0
1,1	170965,5586	119262,198	114025,285	61735,651	3457,5526	0
1,2	534035,1584	345146,175	328646,146	224921,64	7252,2882	0
1,3	1682638,388	998857,006	947231,044	796920,03	15211,825	0
1,4	5347196,897	2890703,68	2730129,84	2775743,2	31907,117	0
1,5	17134414,95	8365729,75	7868839,38	9563805,2	66925,838	0
1,6	55342520,06	24210518,3	22679739,4	32720402	140378,33	0
1,7	180089949	70065518,7	65368036,2	111425743	294446,45	0
1,8	590095763,2	202770418	188405170	378273704	617607,53	0
1,9	1945803533	586819926	543025464	1,282E+09	1295444,6	0
2	6452839127	1698263626	1565119757	4,335E+09	2717221,8	0

Figure 1: Impact of risk aversion

Here, we start from the baseline scenario provided in the preceding subsection (with parameters provided in Tables 1 and 2), and we make numerical calculations of EU-values and CPT-values for different values of parameters relative to the concavity/convexity of the value function (α for EU-value, and σ for CPT-value).

First, we can note that the results provided in Figure 1 are in line with Points (i) and (ii) in Proposition 3: given our parameters, conditions (6.7) and (6.8) are both satisfied for $\sigma \geq 0.6834$ and, in Figure **??**, we observe that the CPT-value of West becomes positive for $\sigma \in [0.6; 0.7]$, and then increases in σ (in a way to become higher than the CPT-value of Safe for $\sigma \in [0.7; 0.8]$).

Note that the switching point in the ranking between West and Safe is made for $\sigma \in [0.7; 0.8]$, while our estimated value for σ is: 0.723. So, our estimated parameter is very close to the switching value (for which West is preferred to Safe). This calls for making relative the ranking provided by Table 3: the ranking of Safe as the best alternative under Prospect Theory is not very robust, and is "challenged" by the alternative West. Finally note that, given our context parameters, the ranking provided by Expected Theory does not change with the value of α: the preference for West is sufficiently robust.

Impact of the degree of loss aversion

Here, the result is straightforward since, because of the assumption considering as the reference point the situation to staying at home under conflict, only the perspective of a failure in obtaining asylum in West is considered as a negative perspective. So, only the CPT-value of West decreases in λ (other perspective are independent from λ). So, holding other parameters constant, Safe is preferred over West for λ higher than $[1.6; 1.7]$.

Note that if the reference point would be "staying at home in time of peace" (and earning y_{ON} each period), then the result would not be trivial because both failing in obtaining asylum and going to a Safe-neighbor country would be considered as negative perspectives. In that case, we should compare the relative evolution of both West and Safe with λ.

Impact of a variation in the weighting function (probability (mis)perception)

To better understand the relative evolutions of the different CPT-values with γ, we must first recall that West is a combination of two perspectives, a positive one (obtaining asylum in West) and a negative one (not obtaining asylum).

λ	V-PT (West)	V-PT (Safe)	V-PT (Origin)
1	423,4404319	211,805006	0
1,1	386,9527121	211,805006	0
1,2	350,4649922	211,805006	0
1,3	313,9772724	211,805006	0
1,4	277,4895525	211,805006	0
1,5	241,0018326	211,805006	0
1,6	204,5141128	211,805006	0
1,7	168,0263929	211,805006	0
1,8	131,538673	211,805006	0
1,9	95,05095318	211,805006	0
2	58,56323332	211,805006	0
2,1	22,07551345	211,805006	0
2,2	-14,41220641	211,805006	0
2,3	-50,89992627	211,805006	0
2,4	-87,38764614	211,805006	0
2,5	-123,875366	211,805006	0
2,6	-160,3630859	211,805006	0
2,7	-196,8508057	211,805006	0
2,8	-233,3385256	211,805006	0
2,9	-269,8262455	211,805006	0
3	-306,3139653	211,805006	0

Figure 2: Impact of loss aversion (CPT only)

γ	V-PT (West)	V-PT (Safe)	V-PT (Origin)
1	-13,66943111	211,805006	0
0,9	149,3920522	211,805006	0
0,8	356,4388918	211,805006	0
0,7	618,8787046	211,805006	0
0,6	951,0730269	211,805006	0
0,5	1371,102162	211,805006	0
0,4	1901,728066	211,805006	0
0,3	2571,606546	211,805006	0
0,2	3416,813335	211,805006	0
0,1	4482,765296	211,805006	0

Figure 3: Impact of probability weighting (CPT only)

If, when considering West, the positive perspective is associated with the lowest (objective) probability (i.e. if $p < 1 - p$), then a reduction in γ, which leads to a distortion of probabilities in a way to get them all equal to 1 (i.e. both p and $1 - p$ tend to 1 when $\gamma \to 0$), leads to an increase in the CPT-value of West. Is it sufficient for West to dominate Safe? Yes, if the "mean" earning associated with West (i.e. the mean of the earnings of both perspectives associated with West - getting and not getting asylum, the two earnings being similarly weighted) is higher than the earning associated with Safe.

In the opposite case, a misperception of probabilities can lead to a preference for Safe (over West) in the case where (i) $p > 0.5$ (because in this case, when considering West, a misperception / reduction in γ reduces the relative weight of the positive perspective, in a way that the CPT-value of West could decrease) and (ii) if the mean earning in West is lower than the earning in Safe[40].

[40] "mean" earning means, as in the preceding explanation, a mean of the two possible earnings: obtaining refugee status, and not obtaining it, both perspectives being similarly weighted. The "mean" earning associated with West could be lower than the earning associated with Safe since the alternative going to West is associated with the earning linked to refugee status, which is the highest one, and the earning from not obtaining asylum and being sent back at home, which is the lowest earning. The earning associated with Safe has an intermediate value, so that the case we are currently discussing is possible.

7 Conclusion

In conclusion, we find that Expected Utility Theory, though the standard model used in the literature, is not as well adapted to modelling refugee choices as Cumulative Prospect Theory. Our study provides evidence that refugees show loss aversion, probability distortion and utility concavity, compatible with Cumulative Prospect Theory.

Compared to other populations, refugees' utility functions are less marginally decreasing, they exhibit a lower loss aversion and are more objective when taking probabilities into account. Introducing a psychological primer implying the recollection of a fearful situation further reduces this probability distortion. The experimental results are robust to an embedding effect (deleting some of the lines of the Tanaka *et al.* (2010) framework).

We further propose a theoretical model of refugee migration adopting the insights from the experiments, based on Cumulative Prospect Theory. A numerical simulation including the socio-demographic characteristics observed in our sample shows that the model may provide better understanding of refugee migration. How to interpret these results? Returning to our initial questions, we can conclude that refugees evaluate gains, losses and probabilities differently to other populations. They prise gains more: migrating to a Western country with potentially very good perspectives is highly valued. Some types of losses carry a lower weight for them than for other populations.Finally, what about the perception of risks? According to UNHCR figures (which are admittedly inaccurate by nature), the probability of dying when crossing the Mediterranean in 2016 was 5000/305000, or 1.6%, so quite low. Refugees do not overestimate low probabilities as other populations, so this risk is not much exaggerated.

Which lessons can one take for policy making? First of all, refugees take their decisions differently from other populations. Our study suggests that policy makers cannot deduce refugees' choices from their own preferences. In practice, this means that coercive measures may have a smaller discouraging effect on refugees than on other populations. This is because refugees have lower loss aversion and value gains more highly. We can therefore predict a higher deflection effect when a migration path is closed. In order to evaluate the consequences of policies, and avoid unintended consequences, policy makers need to adopt appropriate models. We propose a model of refugee migration that incorporates the different components of risk preferences and could help policy makers to better understand forced migration and its determinants.

Table 1: Tables for TCN game

SERIES 1	Option A: 3 pink + 7 blue	Option B: 1 pink + 9 blue	Exp. payoff difference (A-B)
1	40 ecu if pink or 10 ecu if blue	68 ecu if pink or 5 ecu if blue	7.7
2	40 ecu if pink or 10 ecu if blue	75 ecu if pink or 5 ecu if blue	7
3	40 ecu if pink or 10 ecu if blue	83 ecu if pink or 5 ecu if blue	6.2
4	40 ecu if pink or 10 ecu if blue	93 ecu if pink or 5 ecu if blue	5.2
5	40 ecu if pink or 10 ecu if blue	106 ecu if pink or 5 ecu if blue	3.9
6	40 ecu if pink or 10 ecu if blue	125 ecu if pink or 5 ecu if blue	2
7	40 ecu if pink or 10 ecu if blue	150 ecu if pink or 5 ecu if blue	-0.5
8	40 ecu if pink or 10 ecu if blue	185 ecu if pink or 5 ecu if blue	-4
9	40 ecu if pink or 10 ecu if blue	220 ecu if pink or 5 ecu if blue	-7.5
10	40 ecu if pink or 10 ecu if blue	300 ecu if pink or 5 ecu if blue	-15.5
11	40 ecu if pink or 10 ecu if blue	400 ecu if pink or 5 ecu if blue	-25.5
12	40 ecu if pink or 10 ecu if blue	600 ecu if pink or 5 ecu if blue	-45.5
13	40 ecu if pink or 10 ecu if blue	1,000 ecu if pink or 5 ecu if blue	-85.5
14	40 ecu if pink or 10 ecu if blue	1,700 ecu if pink or 5 ecu if blue	-155.5
SERIES 2	**Option A: 9 pink + 1 blue**	**Option B: 7 pink + 3 blue**	**Exp. payoff difference (A-B)**
15	40 ecu if pink or 30 ecu if blue	54 ecu if pink or 5 ecu if blue	-0.3
16	40 ecu if pink or 30 ecu if blue	56 ecu if pink or 5 ecu if blue	-1.7
17	40 ecu if pink or 30 ecu if blue	58 ecu if pink or 5 ecu if blue	-3.1
18	40 ecu if pink or 30 ecu if blue	60 ecu if pink or 5 ecu if blue	-4.5
19	40 ecu if pink or 30 ecu if blue	62 ecu if pink or 5 ecu if blue	-5.9
20	40 ecu if pink or 30 ecu if blue	65 ecu if pink or 5 ecu if blue	-8
21	40 ecu if pink or 30 ecu if blue	68 ecu if pink or 5 ecu if blue	-10.1
22	40 ecu if pink or 30 ecu if blue	72 ecu if pink or 5 ecu if blue	-12.9
23	40 ecu if pink or 30 ecu if blue	77 ecu if pink or 5 ecu if blue	-16.4
24	40 ecu if pink or 30 ecu if blue	83 ecu if pink or 5 ecu if blue	-20.6
25	40 ecu if pink or 30 ecu if blue	90 ecu if pink or 5 ecu if blue	-25.5
26	40 ecu if pink or 30 ecu if blue	100 ecu if pink or 5 ecu if blue	-32.5
27	40 ecu if pink or 30 ecu if blue	110 ecu if pink or 5 ecu if blue	-39.5
28	40 ecu if pink or 30 ecu if blue	130 ecu if pink or 5 ecu if blue	-53.5
SERIES 3	**Option A: 5 pink + 5 blue**	**Option B: 5 pink + 5 blue**	
29	receive 25 ecu if pink or lose 4 ecu if blue	receive 30 ecu if pink or lose 21 ecu if blue	6
30	receive 4 ecu if pink or lose 4 ecu if blue	receive 30 ecu if pink or lose 21 ecu if blue	-4.5
31	receive 1 ecu if pink or lose 4 ecu if blue	receive 30 ecu if pink or lose 21 ecu if blue	-6
32	receive 1 ecu if pink or lose 4 ecu if blue	receive 30 ecu if pink or lose 16 ecu if blue	-8.5
33	receive 1 ecu if pink or lose 8 ecu if blue	receive 30 ecu if pink or lose 16 ecu if blue	-10.5
34	receive 1 ecu if pink or lose 8 ecu if blue	receive 30 ecu if pink or lose 14 ecu if blue	-11.5
35	receive 1 ecu if pink or lose 8 ecu if blue	receive 30 ecu if pink or lose 11 ecu if blue	-13

Notes: 10 ecu = 1 euro; Table adapted from Tanaka *et al.* (2010); baseline treatment DEL0ASC.

Table 2: Descriptive statistics of covariates

	Description	Mean value	Std. Dev.
Age	Age (in years)	33.63	9.80
Gender	Dummy if female	0.25	0.45
Married	Marital Status	0.53	0.50
Number of children	How many children do you have	1.51	1.94
Muslim	of muslim religion	0.83	0.37
Iraq	country of birth==Iraq	0.22	0.42
Syria	country of birth==Syria	0.56	0.50
Other Country	country of birth==other	0.32	0.46
Migration duration	year since flee the country	2.97	4.26
Primary	edu_level==Primary level	0.11	0.32
Secondary	edu_level==Secondary level	0.49	0.50
College (University)	edu_level==College or University	0.36	0.48
Other education	other education	0.02	0.14
In work	ever worked	0.51	0.50
No income	income_range== 0.0000	0.28	0.45
Income Range (less than 200)	income_range==less than 200 euros	0.05	0.22
Income Range (200-400)	income_range==200-400 euros	0.12	0.33
Income Range (400-600)	income_range==400-600 euros	0.20	0.40
Income Range (over 600)	income_range==over 600 euros	0.35	0.48
Nb. of obs.		206	

Table 3: Calculation of CPT parameters using the interval approach

			Baseline	
	Mean	Std. Err.	95% Conf. Int.	Wald test: parameter=1
sigma	0.708***	0.034	0.641,0.775	0.000***
lambda	2.109***	0.183	1.748,2.469	0.000***
gamma	0.923***	0.025	0.875,0.972	0.002***
Nb. of obs.	205			

For Wald tests, the number displayed is the p-value.
* p<0.1, ** p<0.05, *** p<0.01

Table 4: Regression of **sigma** on several sets of covariates-Baseline

Covariate	(1) Coef.	Std. Err.	(2) Coef.	Std. Err.	(3) Coef.	Std. Err.	(4) Coef.	Std. Err.
Constant	0.708***	(0.034)	0.173	(0.283)	0.738***	(0.064)	0.223	(0.304)
Age (in years)			-0.002	(0.005)			-0.002	(0.005)
Female			-0.041	(0.101)			-0.049	(0.107)
Married			-0.025	(0.094)			-0.017	(0.092)
Number of Children			0.005	(0.028)			0.006	(0.029)
Muslim			-0.011	(0.098)			-0.017	(0.100)
Iraq			0.285**	(0.119)			0.279**	(0.120)
Syria			0.021	(0.100)			0.019	(0.100)
Years since flee the country			0.007	(0.007)			0.007	(0.007)
Primary education			0.327	(0.207)			0.323	(0.205)
Secondary education			0.366*	(0.198)			0.361*	(0.198)
College or University			0.406**	(0.204)			0.401**	(0.200)
Other Education			0.992***	(0.236)			0.997***	(0.235)
Ever Worked			0.219**	(0.090)			0.223**	(0.089)
No income			0.128	(0.117)			0.139	(0.118)
Income Range (less than 200)			0.102	(0.167)			0.097	(0.166)
Income Range (200-400)			-0.042	(0.129)			-0.052	(0.128)
Income Range (400-600)			0.020	(0.111)			0.029	(0.111)
2. Sad frame					-0.031	(0.081)	-0.043	(0.089)
3. Happy frame					-0.062	(0.095)	-0.100	(0.095)
Model R-squared	0.000		0.181		0.002		0.187	
Nb. of obs. /clusters	205/205		203/203		205/205		203/203	
Specific Wald tests on estimated coefficients (p-values)								
Constant=1	0.000							

*, ** and *** stand for significance at the 10, 5 and 1% level respectively.
Reference category for education is no education; for income ranges is income over 600 ; for country is other country.
For the Life Experience reference is Neutral Emotions
All monetary terms are in Euros.

Table 5: Regression of **lambda** on several sets of covariates - Baseline

Covariate	(1) Coef.	Std. Err.	(2) Coef.	Std. Err.	(3) Coef.	Std. Err.	(4) Coef.	Std. Err.
Constant	2.109***	(0.183)	2.244	(1.923)	1.880***	(0.337)	1.969	(2.004)
Age (in years)			0.076**	(0.030)			0.077**	(0.030)
Female			0.785	(0.556)			0.830	(0.581)
Married			0.427	(0.457)			0.409	(0.457)
Number of Children			-0.072	(0.167)			-0.082	(0.169)
Muslim			-0.534	(0.573)			-0.515	(0.592)
Iraq			-0.306	(0.657)			-0.296	(0.669)
Syria			-0.233	(0.528)			-0.238	(0.529)
Years since flee the country			-0.036	(0.045)			-0.036	(0.046)
Primary Education			-2.020	(1.569)			-1.974	(1.582)
Secondary Education			-1.822	(1.539)			-1.760	(1.548)
College or University			-2.004	(1.504)			-1.958	(1.517)
Other Education			-3.282**	(1.603)			-3.290**	(1.607)
Ever Worked			-0.325	(0.468)			-0.330	(0.465)
No Income			0.117	(0.731)			0.084	(0.719)
Income Range (less than 200)			-1.049	(0.646)			-1.036	(0.658)
Income Range (200-400)			-0.681	(0.604)			-0.637	(0.610)
Income Range (400-600)			-0.280	(0.561)			-0.322	(0.568)
2. Sad frame					0.242	(0.433)	0.240	(0.463)
3. Happy frame					0.446	(0.497)	0.333	(0.526)
Model R-squared	0.000		0.153		0.004		0.155	
Nb. of obs. /clusters	205/205		203/203		205/205		203/203	
Specific Wald tests on estimated coefficients (p-values)								
Constant=1	0.000							

*, ** and *** stand for significance at the 10, 5 and 1% level respectively.
Reference category for education is no education; for income ranges is income over 600; for country is other country.
For the Life Experience reference is Neutral Emotions
All monetary terms are in Euros.

Table 6: Regression of **gamma** on several sets of covariates - Baseline

Covariate	(1) Coef.	Std. Err.	(2) Coef.	Std. Err.	(3) Coef.	Std. Err.	(4) Coef.	Std. Err.
Constant	0.923***	(0.025)	1.116***	(0.248)	0.857***	(0.049)	1.016***	(0.254)
Age (in years)			-0.004	(0.003)			-0.003	(0.003)
Female			-0.010	(0.070)			0.007	(0.072)
Married			-0.049	(0.061)			-0.047	(0.061)
Number of Children			0.025	(0.018)			0.020	(0.018)
Muslim			0.037	(0.073)			0.041	(0.071)
Iraq			0.053	(0.084)			0.051	(0.084)
Syria			0.129*	(0.074)			0.122*	(0.074)
Year since flee the country			-0.000	(0.007)			0.000	(0.007)
Primary Education			-0.075	(0.200)			-0.052	(0.201)
Secondary Education			-0.164	(0.190)			-0.131	(0.191)
College or University			-0.137	(0.196)			-0.116	(0.195)
Other Education			-0.365*	(0.207)			-0.363*	(0.204)
Ever Worked			-0.117*	(0.060)			-0.112*	(0.061)
No Income			0.038	(0.090)			0.034	(0.090)
Income Range (less than 200)			-0.012	(0.114)			-0.012	(0.109)
Income Range (200-400)			0.028	(0.083)			0.041	(0.082)
Income Range (400-600)			0.037	(0.078)			0.023	(0.078)
2. Sad frame					0.112*	(0.061)	0.090	(0.064)
3. Happy frame					0.054	(0.067)	0.054	(0.067)
Model R-squared	0.000		0.127		0.018		0.136	
Nb. of obs. /clusters	205/205		203/203		205/205		203/203	
Specific Wald tests on estimated coefficients (p-values)								
Constant=1	0.000							

*, ** and *** stand for significance at the 10, 5 and 1% level respectively.
Reference category for education is no education; for income ranges is income over 600; for country is other country.
For the Life Experience reference is Neutral Emotions
All monetary terms are in Euros.

Table 7: Mean Value test of the parameters with the other studies

Parameters	(1) Famers	(2) Students	(3) Refugees
sigma	0.504	0.666	0.708
lambda	3.523	2.607	2.108
gamma	0.671	0.639	0.923
Observations	107	382	205
Pairwise comparison			
sigma	Farmer vs Refugees	-0.167***	
sigma	Students vs Refugees	-0.041	
lambda	Farmer vs Refugees	1.414***	
lambda	Students vs Refugees	0.498*	
gamma	Farmer vs Refugees	-0.251***	
gamma	Students vs Refugees	-0.283***	

* p<0.1, ** p<0.05, *** p<0.01

Table 8: Calculation of CPT parameters using the interval approach for frame DEL0ASC

	Frame DEL0ASC			
	Mean	Std. Err.	95% Conf. Int.	Wald test: parameter=1
sigma	0.708***	0.034	0.641,0.775	0.000***
lambda	2.109***	0.183	1.748,2.469	0.000***
gamma	0.923***	0.025	0.875,0.972	0.002***
Nb. of obs.	205			

For Wald tests, the number displayed is the p-value.
* p<0.1, ** p<0.05, *** p<0.01
DEL0ASC-baseline framework

Table 9: Calculation of CPT parameters using the interval approach for frame DELLASC

	Frame DELLASC			
	Mean	Std. Err.	95% Conf. Int.	Wald test: parameter=1
sigma	0.675***	0.050	0.577,0.774	0.000***
lambda	2.552***	0.397	1.761,3.342	0.000***
gamma	0.981***	0.042	0.898,1.064	0.650***
Nb. of obs.	79			

For Wald tests, the number displayed is the p-value.
* p<0.1, ** p<0.05, *** p<0.01
DELLASC- Deleting the three last line of the series

Table 10: Calculation of CPT parameters using the interval approach for frame DELFASC

	Frame DELFASC			
	Mean	Std. Err.	95% Conf. Int.	Wald test: parameter=1
sigma	0.914***	0.052	0.811,1.018	0.102***
lambda	0.683***	0.149	0.385,0.980	0.037***
gamma	0.914***	0.042	0.830,0.998	0.045***
Nb. of obs.	71			

For Wald tests, the number displayed is the p-value.
* p<0.1, ** p<0.05, *** p<0.01
DELFASC- Deleting the three first line of the series

Table 11: Mean Value test of the parameters of different frames

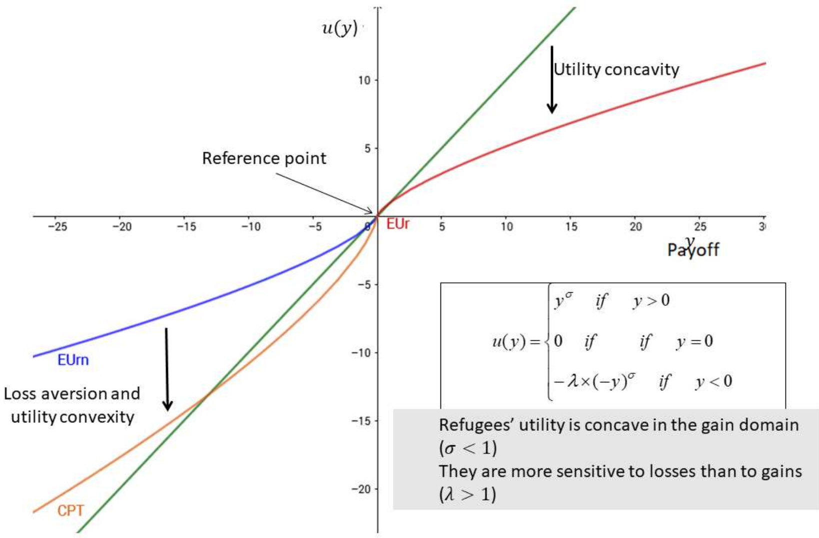
Parameters		(1) DEL0ASC	(2) DELLASC	(3) DEFASC
sigma		0.723	0.797	0.631
lambda		1.854	1.210	2.72
gamma		0.921	0.913	0.883
Pairwise comparison				
sigma	DEL0ASC vs DELLASC		0.141	
sigma	DEL0ASC vs DELFASC		0.704	
lambda	DEL0ASC vs DELLASC		0.005*	
lambda	DEL0ASC vs DELFASC		0.558	
gamma	DEL0ASC vs DELFASC		0.824	
gamma	DEL0ASC vs DELFASC		0.198	

For the mean tests, the number displayed is the p-value.
* p<0.1, ** p<0.05, *** p<0.01

Table 12: Comparison of features of models

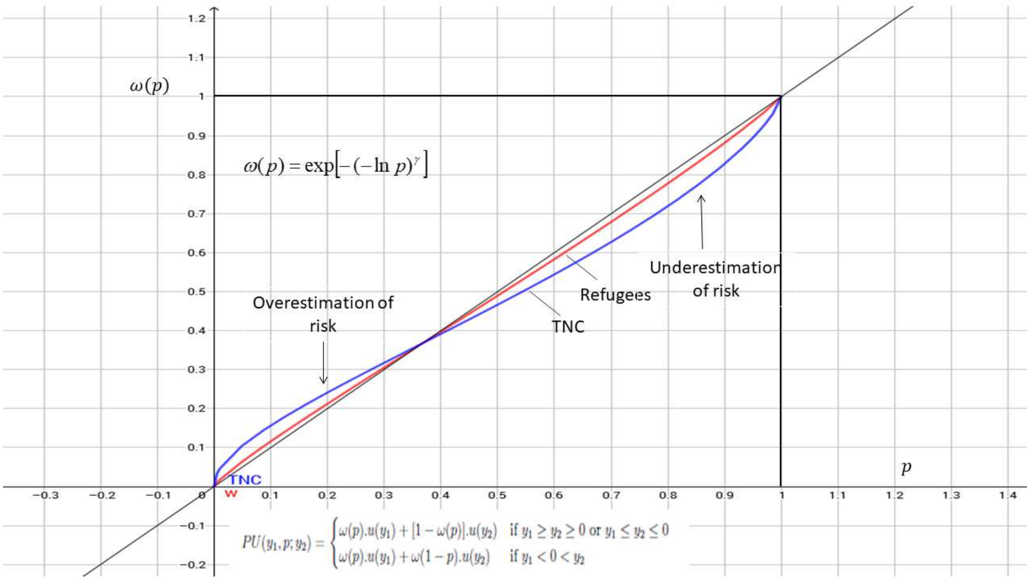
	Czaika (2009)	Djajić (2014)	Schaeffer (2010)
Country of origin (CO), migrant characteristics			
Economic factors	income, self-reliance	wage	✓
Non-economic factors	threat	threat, network	✓
Threat	level	level	level, credibility
Skill level	-	✓	-
Initial assets	-	✓	✓
Credit available	-	✓	-
A & C	-	-	✓
Retaliation	-	-	✓
Migration			
Illegal immigration	-	✓	economic
Country of first asylum	✓	✓	-
Success migration	-	✓	✓
Choice of Western destination	-	-	✓
Destination country policy			
Aid	✓	-	-
Probability refugee status	✓	-	✓
Costs of flight	✓	✓	✓
Amnesty/legal status	-	✓	-
Probability of expulsion	$= 1$ if rejection	-	$= 1$ if rejection
Set-up			
Time	✓	✓	-
Dynamic framework	Temporary stay	Back to CO	Back to CO

Figure 4: CPT Utility Curvature and Loss Aversion



Source: Author's Elaboration.

Figure 5: CPT Probability Distortions



Source: Author's Elaboration.

Figure 6: Distribution of the Estimated Parameters

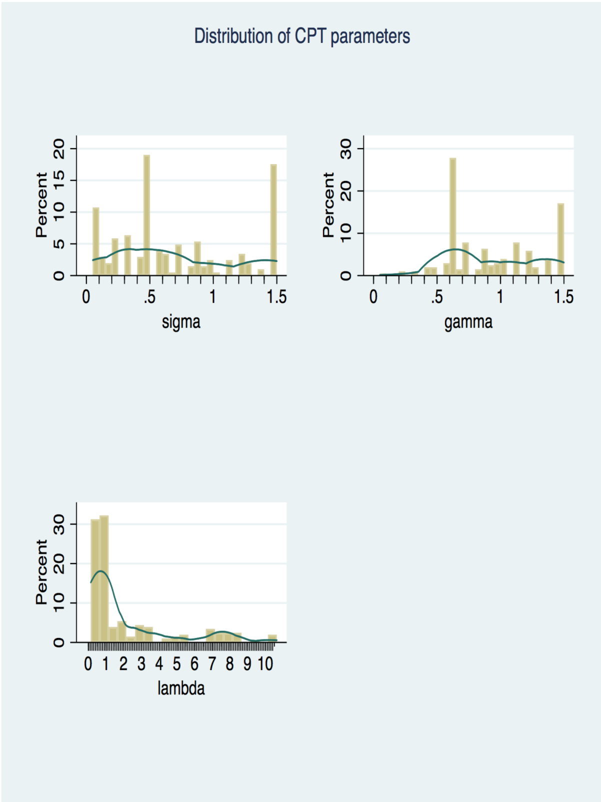


Figure 7: Distribution of the payments

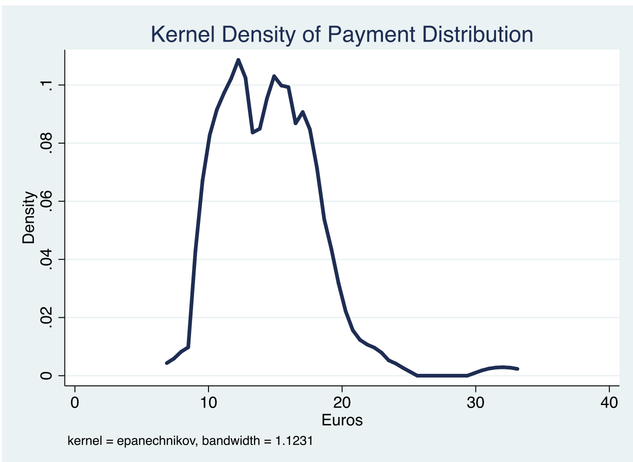


Figure 8: Comparison of Parameters Values

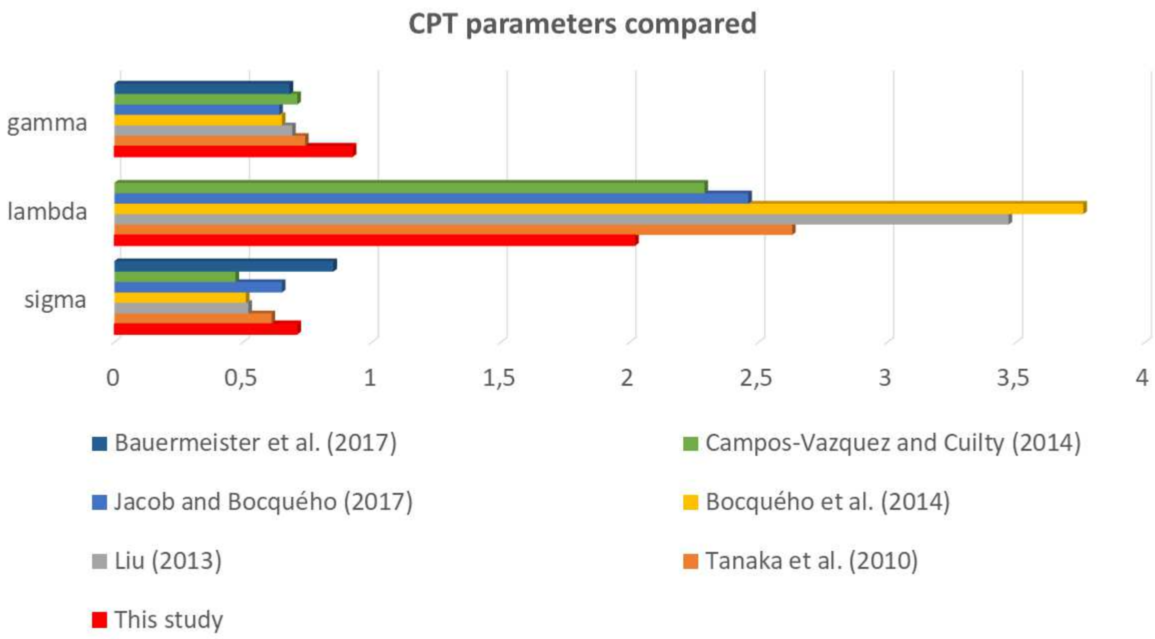
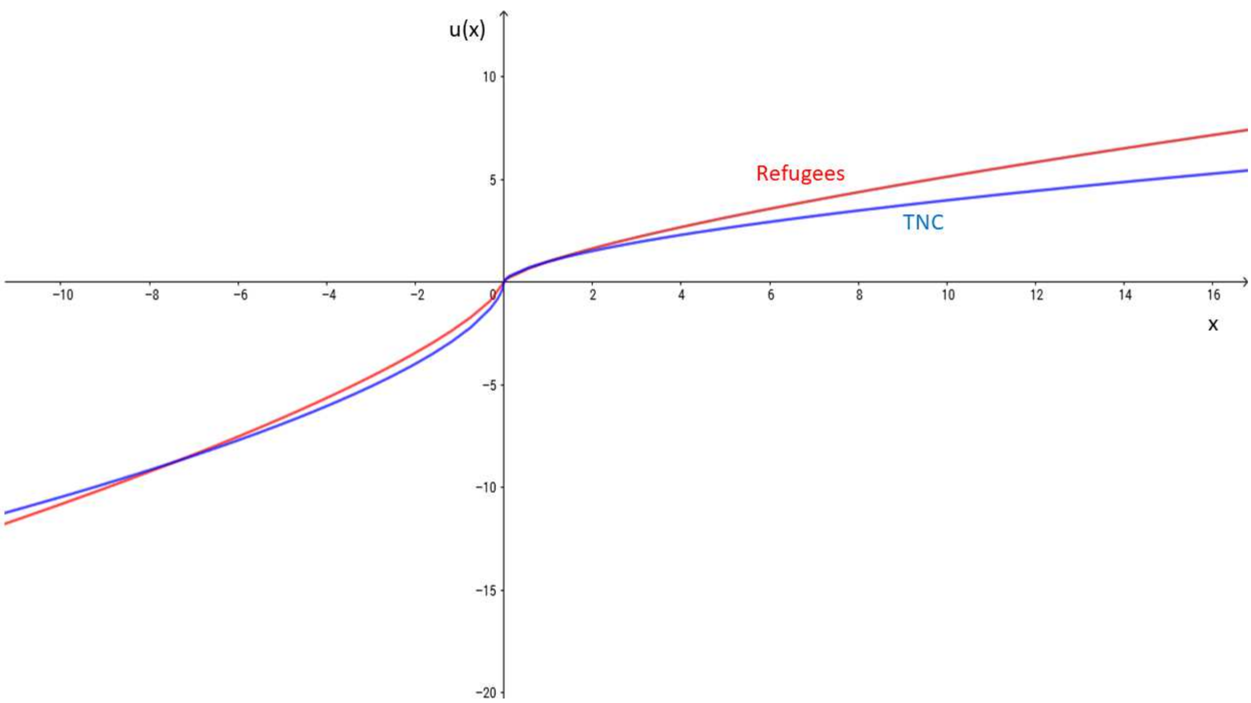


Figure 9: Comparison of the Utility function between TNC and our Study



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Equations

Proof of Proposition 1

Point (ii):

A VNM-DM prefers trying to leave to West instead of going to a safe-neighbor country iff:

$$V_{EU}(West) > V_{EU}(Safe)$$
$$\Rightarrow p(y_W^T - C^{Te})^{\alpha} + (1-p)(y_S^T - C^{Te})^{\alpha} > (y_S^T)^{\alpha}$$

Because $(y_S^T - C^{Te}) < (y_S^T)$, if we pose $(y_S^T - C^{Te}) = 0$ we make more difficult to be satisfied the condition for West to be preferred to Safe. So consider:

$$p(y_W^T - C^{Te})^{\alpha} > (y_S^T)^{\alpha}$$

as a sufficient (but not necessary) condition for West to be preferred to Safe. We have:

$$p(y_W^T - C^{Te})^{\alpha} > (y_S^T)^{\alpha}$$
$$\Rightarrow ln(p) + \alpha ln(y_W^T - C^{Te}) > \alpha ln(y_S^T)$$

After manipulations we obtain Point (ii).

Q.E.D

Proof of Proposition **??**

Point (i)

A PT-DM prefers trying to leave to West instead of going to a safe-neighbor country iff:

$$V_{PT}(West) > V_{PT}(Safe)$$
$$\Longrightarrow \omega(p)((y_W^T - C^{Te}) - y_{OC}^T)^{\sigma} + \omega(1-p)(-\lambda)(-((y_{OC}^T - C^{Te}) - y_{OC}^T))^{\sigma}$$
$$> (y_S^T - y_{OC}^T)^{\sigma} \tag{.1}$$

If we pose $(-\lambda)(-(y_S^T - y_{OC}^T))^{\sigma} = 0$ (i.e. we normalize the positive perspective of going to a safe-neighbor country to 0), then condition (.1) becomes more easy to be satisfied: satisfying this new condition is necessary but not sufficient to satisfy condition (.1). This new condition is:

$$\omega(p)((y_W^T - C^{Te}) - y_{OC}^T)^{\sigma} > \omega(1-p)\lambda(-((y_{OC}^T - C^{Te}) - y_{OC}^T))^{\sigma}$$

This is equivalent to:

$$ln(\omega(p)) + \sigma ln((y_W^T - C^{Te}) - y_{OC}^T) > ln(\omega(1-p)) + ln(\lambda) + \sigma ln(-((y_{OC}^T - C^{Te}) - y_{OC}^T)) \tag{.2}$$

After some manipulations we obtain the condition in Point (i).

Point (ii):

Consider again condition (.1), and pose again $(y_S^T - y_{OC}^T)^{\sigma} = 0$ in a way to obtain a necessary (but not sufficient) condition for West to be preferred over Safe. Again we have:

$$\omega(p)((y_W^T - C^{Te}) - y_{OC}^T)^\sigma > \omega(1-p)\lambda(-((y_{OC}^T - C^{Te}) - y_{OC}^T))^\sigma$$
$$\Longrightarrow \left[\frac{(y_W^T - C^{Te}) - y_{OC}^T}{-((y_{OC}^T - C^{Te}) - y_{OC}^T)}\right]^\sigma > \frac{\omega(1-p)\lambda}{\omega(p)}$$

If this condition is satisfied for a given value of σ, then any increase in σ reinforces this condition. Note that $\frac{(y_W^T - C^{Te}) - y_{OC}^T}{-((y_{OC}^T - C^{Te}) - y_{OC}^T)}$ is higher than 1 since $y_W^T > y_{OC}^T$. Note also that if $\omega(p) = \omega(1-p)$ (this is the case for $\gamma \longrightarrow 0$) and $\lambda = 1$, then this condition is more easily satisfied. This is Point (ii).

Point (iii): Consider condition (.1). We can see that λ is only associated with the negative perspective to not getting asylum in West. It is easy to see that an increase in λ reduces the value of $V_{PT}(West)$ and does not alter the value of $V_{PT}(Safe)$, so as to get what it is stated in Point (iii).

Point (iv):
When we differentiate the PT-value of West (equation (**??**)) with respect to γ we have:

$$\frac{\partial V_{PT}(West)}{\partial \gamma} = -ln(1/p).exp(-\gamma ln(1/p)).((y_W^T - C^{Te}) - y_{OC}^T)^\sigma \tag{.3}$$
$$+ - ln(1/(1-p)).exp(-\gamma ln(1/(1-p))).(-\lambda).(-((y_{OC}^T - C^{Te}) - y_{OC}^T))^\sigma$$

Note that: if $p < 0.5$, then $|-ln(1/p).exp(-\gamma ln(1/p))| > |-ln(1/(1-p)).exp(-\gamma ln(1/(1-p)))|$. As a result: if $|(y_W^T - C^{Te}) - y_{OC}^T| > |-((y_{OC}^T - C^{Te}) - y_{OC}^T)|$, and if $\lambda \rightarrow 1$, then $\frac{\partial V_{PT}(West)}{\partial \gamma} < 0$: a stronger misperception of probabilities increases the value of West.
Q.E.D