



Are We *All* Predictably Irrational? An Experimental Analysis

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Abstract

We examine the question of rationality, replicating two core experiments used to establish that people deviate from the rational actor model. Our analysis extends existing research to a developing country context. Based on our theoretical expectations, we test if respondents make decisions consistent with the rational actor framework. Experimental surveys were administered in Côte d’Ivoire and Ghana, two developing countries in West Africa, focusing on issues of risk aversion and framing. Findings indicate that respondents make decisions more consistent with the rational actor model than has been found in the developed world. Extending our analysis to test if the differences in responses are due to other demographic differences between the African samples and the United States, we replicated these experiments on a nationally representative analysis in the U.S., finding results primarily consistent with the seminal findings of irrationality. In the U.S. and Côte d’Ivoire, highly educated people make decisions that are less consistent with the rational model while low-income respondents make decisions more consistent with the rational model. The degree to which people are *irrational* thus is contextual, possibly western, and not nearly as universal as has been concluded.

Keywords Prospect theory · Rationality · Risk aversion · Anchoring bias · Africa

Introduction

Are we all predictably irrational? Since the seminal work of Tversky and Kahneman (1974, 1981, 1986, 1991) and other behavioral economists (Akerlof and Kranton 2000; Ariely 2010; Camerer 2003; Thaler 1980), the usefulness of models assuming rationality has been questioned, if not entirely dismissed in some cases (Green and Shapiro 1994; Sen 1977). However, the vast majority of the empirical work

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establishing consistently irrational behaviors has been conducted on populations in the West, dubbed WEIRD for Western, educated, industrialized, rich and democratic (Henrich et al. 2010). In their review of the psychology literature, Henrich et al. (2010) indicate that 68% of subjects were from the United States, 96% from the Western Industrialized world, with 80% of the Western sample being undergraduate students. If other populations behave differently than these groups, then the implications of the new models of behavior may not be as widely applicable as we thought.

There have been some forays examining deviations from the predictions based on the rational actor model across different populations, notably studies of the impact that poverty has on decision-making. While some studies establish ways in which poverty decreases cognitive ability through the additional stresses associated with living in poverty (Mani et al. 2013; Haushofer and Fehr 2014), others argue that the influence of poverty on decisions is related more to additional constraints and a constant presence of risk in the lives of the poor (Duflo 2006; Banerjee and Duflo 2007; Carvalho et al. 2016). There is a growing body of literature that establishes that the poor are less subject to some of the cognitive biases found by Tversky and Kahneman (Shah et al. 2015, 2018). Possible explanations for the differences in decision-making by the poor are that poverty may increase attention to costs, and/or it exposes one to more risk, which causes people to give more weight to current versus future outcomes.

To determine whether these predictable irrationalities are applicable in other parts of the world, we replicate some of the most important experiments conducted by Tversky and Kahneman (1981) in Côte d'Ivoire and Ghana, and compare these samples to those from Western populations. We find that respondents from Côte d'Ivoire and Ghana make decisions that are closer to the model of rationality than Westerners. Building on this key finding, we also examine the effects of individual characteristics on decision-making to determine whether there are systematic differences within these populations. Here, we find that most sub-groups, with some exceptions, make decisions that are relatively more consistent with the predictions of the rational model than has been found in prior research. Finally, to ascertain why the differences exist between the original results from 1981 and our data, we re-consider two of the original experiments in a nationally representative sample of American adults. This sample provides support for the 1981 results of systematic irrationality, with important exceptions, and helps to contrast our findings from West Africa that the rational actor model is most applicable in the developing world.

Our empirical results, in sum, suggest there is more merit to the rational choice paradigm than perhaps has been thought, and that existing studies concluding people are predictably irrational are overstated in a number of ways. This is an important finding with implications for several areas of academic scholarship. The rational actor model has served as the cornerstone assumption about the behavior of political actors, influencing research in political science on voter choice, foreign policy making, conflict, and international political economy amongst others (de Mesquita and Smith 2011; Mansfield et al. 2000; Powell 1991; Slantchev and Tarar 2011). Recent work has extended the paradigm to explicitly non-western contexts (Hollyer et al. 2015). Nevertheless, debates about its utility in political science have been especially spirited (de Mesquita and Morrow 1999; Walt 1999), with one enduring criticism

being the lack of empirical support that people behave as the model assumes, a point which even supporters acknowledge (Kahler 1998; Snidal 2002). In economics, as well, the core mainstream model assumes rationality, with applications to the law (Posner 2014) and even addiction (Becker et al. 1991). By addressing the empirical underpinnings of rational choice, we help fill an important gap in our understanding of rationality and show that the model might be most relevant for non-western populations.

Experiments Testing the Rational Model of Behavior

The experiments we perform in Côte d'Ivoire and Ghana relate to prospect theory, in which perceptions/responses are dependent upon some reference point. We focus on the following experiments because they concern attitudes towards risk and the value of money, given the literature on differences in cognitive ability and biases between the poor and middle/higher income individuals as described above.

Two Classic Experiments

The first deviation from rationality that we test is Tversky and Kahneman's (1981) S-shaped risk-aversion/risk loving preferences over different question frames. To test the rational model of consistent risk aversion, they asked respondents to choose between two options with the same expected value, with one expressed as a certain outcome and the other expressed as a gamble. Respondents were randomly assigned to the choice set framed either as a gain, in this case lives saved, or as a loss, in this example, framed as deaths. Their results indicated that when choices were framed as gains, respondents preferred the certain option, but when framed as a loss, respondents preferred the gamble, producing an S-shaped utility function. Expressed risk preferences are therefore sensitive to how the questions are framed.

The second form of cognitive bias we test is mental accounting bias. Tversky and Kahneman (1981) ask respondents their willingness to spend time to travel across town from one store to another in pursuit of a fixed dollar discount, with some respondents told that the discount is on a relatively low-price item and others that the discount is on a higher price item. A rational person should evaluate these two choices in the same way—either the fixed dollar amount is worth the time or it is not. However, respondents in Tversky and Kahneman's (1981) sample that were asked about the lower-price item were more likely to view the discount as worth the trouble than respondents considering a discount on the higher-price item.

Cross-Cultural Findings

There is a small, but growing literature examining these and related questions in different cultural contexts. For example, Weber and Hsee (1998) find that Chinese respondents make riskier pricing decisions than Americans, but attribute these differences to different perceptions on the level of risk, rather than differences in risk

aversion across cultures. Vieider et al. (2012) find that comparing across countries risk tolerance is lower as average income rises, but within countries higher income individuals exhibit higher risk tolerance. They explain this paradox by arguing that risk attitudes at the national level are correlated with mechanisms to increase economic growth.

There are a few studies specific to African countries. Nsor-Ambala (2015) tests prospect theory on self-employed individuals in Ghana asking respondents about how hypothetical changes in tax rates under different framings of these changes influences compliance with tax law. They also measured respondents underlying ethical views and compared more ethical respondents to less ethical ones. Interestingly, the most ethical respondents were more responsive to the changes in tax rates and their framing, although at all levels they were still more compliant than unethical respondents. Harrison et al. (2010) compare samples from India, Uganda and Ethiopia and find that half the population matches expected utility theory, while the rest are consistent with prospect theory. Akay et al. (2012) find that Ethiopian farmers are more risk averse than Dutch and U.S. university students, but their rates of ambiguity aversion (i.e., being uncertain about the probabilities involved) were similar. Finally, Apicella et al. (2014) test for the endowment effect on a group of isolated hunter-gatherers and another group of the same tribe who have regular contact with outsiders through eco-tourism in Northern Tanzania. They find that the isolated group exhibits no endowment effect, while the group with more outside contact exhibits an endowment effect.

Yet, to the best of our knowledge, none of these studies have tested in a developing country context the core questions of consistency in risk preferences and mental accounting implied by the rational choice model. In this analysis, we test these core assumptions of the rational choice model in two West African countries providing an important extension to a literature that has not only played an important role in academic circles, but also one that has been extended to non-academic audiences as well (Ariely 2010). Our results indicate that context matters as to how closely people behave according to the claims of rationality.

Explaining Variations in Rationality: Why Development Context Matters

In the spirit of Shah et al. (2015, 2018), who have studied differences in the preferred choices of poor versus higher income populations in the developed world, we examine rationality in the developing world. We hypothesize that decision-making in developing countries is relatively consistent with the assumptions of the rational-actor model than decision-making in developed countries. To be clear, we are not proposing that some people are inherently more rational than others, but rather that structural conditions cause people to act more closely to the expectations of the rational choice model, consistent with evidence in Henrich et al. (2001) and Apicella et al. (2014). Others, not subject to the same structural conditions, are more likely to deviate from rational behavior.

In the developed world, structural conditions are typically less conducive to rational behavior than in the developing world. Most people living in developed countries today have access to various forms of insurance that serve to reduce the risk resulting from decisions that are not ultimately in one's best interest. Consumers often receive insurance through warranties or other guarantees of product quality helping to reduce the adverse consequences of not accurately weighing the costs and benefits at the time of purchase. Knowing they have insurance, consumers relax and are less calculating than they would be absent this insurance. Health insurance, for instance, insulates people from the full costs of their decisions causing them to deviate from rational behavior including not thinking at the margin and making decisions that are more risky (i.e., moral hazard). With warranties and other forms of insurance, consumers do not have to be as discerning as they otherwise would be without these guarantees. In contrast, across the developing world most people cannot make decisions in the same way because they lack access to formal insurance guarantees (Banerjee and Duflo 2007; Deaton 1997). The absence of these protections forces people to make decisions that are relatively calculating and ultimately rational.

In addition to the lack of formal insurance, the poor face more constant and pervasive risks in their lives than do those who are wealthier (Banerjee and Duflo 2007; Carvalho et al. 2016; Duflo 2006). Being poor leaves little margin for error thus causing the poor to be discerning. Losing a small amount of money because one has purchased something that does not work or does not last must be avoided for those living at the margin. In Africa, most people live at the margin, subsisting on less than a few dollars per day, necessitating that they avoid making decisions that are not in their best advantage. When one is poor, decisions that turn out to be mistakes are difficult, if not impossible, to recover from such that people must avoid them in the first place. To do so, one must be as calculating as possible when making decisions. Living closer to the margin thus forces people to make calculating decisions and act more in-line with the behavior of a rational actor. In contrast, it is easier for someone living further from the margin to recover from mistakes and thus they can relax the effort needed to avoid making suboptimal decisions. Being less calculating is a luxury afforded to those not living at the margin, since acting in a rational manner is time-consuming and difficult; poor people cannot afford the luxury of foregoing this cognitive effort.

This calculating behavior of the poor is true for everyday decision-making, like buying food at the market, but also for inherently more personal decisions such as where one lives. Despite facing many constraints, the poor carefully weigh costs and benefits of where to live and decide according to those calculations. The forced collectivization of peasants in Tanzania, known locally as *ujamaa*, is a good example of this calculating behavior. Early on in the process of collectivization, the peasants were asked to move to collective farms, but they resisted and did not voluntarily move. Already living close to the margin, most peasants knew that joining these farms would lead to more not less hardship, and so they fought the process ultimately causing then Tanzanian President Nyerere to force them to collectivize. Living at the margin, the peasants had no safety-net and thus had to carefully weigh the costs and benefits of collectivization, which they concluded not to be in their best

interest. Interestingly, it was those not living at the margin—party officials and community development officers—“who settled on to *ujamaa* villages like flies” (Meredith 2005, pp. 254–255). As this example shows, those facing the most risk are most likely to act in calculating ways because relatively they have the most to lose.

In addition to making decisions about where to live, the poor must be calculating in their decisions about family size. Across the developing world, relatively high fertility rates, often above replacement, reflect the high demand for children, which in Africa happens to be higher than in other regions of the world (Bongaarts and Casterline 2013). Decisions about family size are a function of practical concerns like providing for one’s security in old age. In the developing world, there is little money to save, and even if one has funds to save there are few institutions for the poor to deposit and grow their savings. Moreover, governments in the developing world are unstable, underfunded, and often predatory, and they provide little in the way of social security for people in their later years. In contrast, in the developed world opportunities to save for old age are relatively abundant and governments have a variety of programs to aid the elderly. To compensate for higher levels of risk in the developing world, people have more children who provide services and income for their parents (Banerjee and Duflo 2007). Due to other opportunities to save for retirement besides having children, the same decision about family size in the developed world is less constrained and less related to creating security for old age.¹ For many people in the developing world, then, the decision of having children is grounded in risk aversion, and having more children is very much a rational decision.

Based on this discussion, we expect decision-making to be relatively consistent with the rational actor model in the typical developing country context than in developed countries. Given that people are poorer and life is more uncertain in the developing world, it is likely that respondents there will be more sensitive to risk. Thus, they may not exhibit the same cognitive biases around decisions involving risk as do people in higher income Western populations. Within countries, furthermore, it is likely that relatively poor people are likely to act in ways that are more rational than rich people. In the U.S., for example, we expect that lower income people make decisions in a more rational way compared to people of higher incomes. The following experiments test if there is empirical support for our primary expectations that decision-making is (i) relatively rational and (ii) more risk averse in the developing world than the developed world.

Personal characteristics will change the extent to which individuals are exposed to the conditions we outline above, and it is an empirical question about whether they affect the susceptibility to the framing biases established in the West. In our empirical analysis, we test whether income and education affect the degree to which respondents conform to the predictions of the rational actor model. The effect of income is related to the theoretical discussion outlined above. Like income, education also likely affects decision-making as people with more education are better

¹ Research finds that people have fewer children in democratic countries because the guarantees of social security are more credible than in authoritarian regimes (Przeworski et al. 2000).

equipped to deal with setbacks associated with risk than those with less education and education is correlated with higher incomes. In sum, we expect rational decision-making to be more likely in low-income countries, and amongst individuals it is more likely with the poor, least educated, and women.

Empirical Analysis

Sample

The data used in this analysis were collected between November 2017 and March 2018.² In Côte d'Ivoire, data were collected from November 20th to 25th 2017, and then following this initial collection a replication was conducted in neighboring Ghana from February 18th to the 21st of 2018. In Côte d'Ivoire, we sampled from four different communities including the country's largest city Abidjan, smaller cities of Bouna and Grand Bassam, and a fishing village outside of Bassam. In Abidjan, we obtained a cluster sample of one relatively high-income neighborhood, the Plateau, which is the primary business district, and one relatively lower income neighborhood (Marcory). In Bassam, we randomly sampled across four different sites. Moreover, we sampled in a relatively rural area and selected a fishing village outside of Bassam (Mondoukou) as well as Bonoua, a smaller town outside of Bassam. In Ghana, we sampled three sites in the greater Accra region including East-Lagon, La Paz, and Jamestown. In terms of income, East-Lagon is urban and relatively wealthier than the other two sites. La Paz is also urban and relatively middle-income while Jamestown is a fishing village and the poorest of all sites.

In choosing our sample sites and respondents, we followed a pre-determined multi-stage sampling process. In selecting sites, we first randomly selected clusters in sample communities, and within each cluster we chose respondents in both the morning and evening, and on the weekend. At each site, surveyors had a randomly assigned list of times ranging from 20 to 120 s that were used to determine the amount of time to move from one site to the next. Within each site, each surveyor moved in a random direction. After moving to a new site, a randomly generated list of 0's and 1's was used to determine if they asked a person to participate (= 1) or not participate (= 0). If the first number seen by a surveyor was a 1 then they would ask the first person they saw to participate and if that potential respondent agreed to do the survey then they would interview that person and then move to a new location according to the next randomly determined time and repeat the process. However, if the number was a 0, or the person declined to participate, then the next person was asked to participate if the following number in the list was 1 or skipped if the number was 0, and so forth. Response rates were over 95% in both Côte d'Ivoire and Ghana.

² Replication files available at <https://dataverse.harvard.edu/dataset.xhtml?persistentId=doi:10.7910/DVN/CVOTBI>.

Finally, we conducted a nationally representative survey of American adults. A nationally representative survey provides a point of comparison to our samples from West Africa, and to earlier studies which as noted have used highly selective samples either consisting of university students at two elite universities in Canada and the U.S., or a sample of doctors (Tversky and Kahneman 1981). In contrast, our sample of U.S. respondents is a nationally representative survey of 1000 U.S. adults, conducted by YouGov from March 19th to March 22nd 2018. The experiment was conducted with an original survey using a number of different means of selection (random-digit-dialing, direct mail, web advertising) with each respondent randomly invited to participate in the survey. Respondents were selected to be representative of the U.S. population based on gender, race, age, and education.³ The survey asked a number of questions including the two questions regarding the outbreak of a disease and decision to travel 20 min to save \$10.

Data collection in Africa was different than in the U.S., as the former used in-person surveys while the U.S. data was sampled using a variety of means. Across all three countries, the questions were the same and in all of the surveys we randomized the order of the possible responses for the disease outbreak so that respondents were not choosing the satisfying answer, which could be a problem if the certain option in the ‘save’ frame is presented first in order. To address this issue, we had two versions of each question with the order of the certain or probabilistic outcomes randomly appearing first and second in the two versions. For the second question, we had two versions, one in which the good in question was set at a high price and the other in which it was set at a low price.

We also altered the dollar amounts in the questions regarding the prices to account for inflation over time, choosing a \$10 discount relative to a \$250 jacket price and a \$30 shirt price in the United States. In the West African samples, we adjusted the values for the discount and the product prices to account for the local currencies and to reflect the lower average income in Côte d’Ivoire and Ghana relative to the United States. However, in all experiments, we kept the same ratio with respect to the differences in the high and low reference price and the hypothetical discount.

Sample Descriptions

Table 3, in the Appendix, provides frequency statistics for our samples from Côte d’Ivoire and Ghana and some population statistics for each country (Ghana Statistical Service 2018, Census Côte d’Ivoire 2018). For the most part, our sample demographics in both countries are close to the population statistics. One exception is with respect to the religious affiliation in Côte d’Ivoire. Fifty-six percent of our Ivorian sample is Christian and 38% is Muslim with the rest either animist or another affiliation. According to the census, 34% of Ivoirians are Christian and 43% are Muslim, though the size of the Christian population is disputed. In our case,

³ For more information on the methods used by Yougov see Twyman (2008).

Table 1 Questions for Experiment 1

Version 1	Version 2
<p>Imagine that Ghana/Côte d’Ivoire is preparing for the outbreak of a rare disease, which is expected to kill 600 people. Two alternative programs to combat the disease have been proposed.</p> <p>Assume that the exact scientific estimates of the programs are as follows:</p> <p>If program A is adopted, 200 people will be saved</p> <p>If program B is adopted there is 1/3 probability that 600 people will be saved and a 2/3 probability that no people will be saved</p> <p>Which of these two programs would you choose? A or B?</p>	<p>Imagine that Ghana/Côte d’Ivoire is preparing for the outbreak of a rare disease, which is expected to kill 600 people. Two alternative programs to combat the disease have been proposed.</p> <p>Assume that the exact scientific estimates of the programs are as follows:</p> <p>If program C is adopted, 400 people will die</p> <p>If program D is adopted there is 1/3 probability that nobody will die and a 2/3 probability that 600 people will die</p> <p>Which of these two programs would you choose? C or D?</p>

the oversampling of Christians is because our locations were in the South where there are more Christians, and because our question on religion asked respondents to choose the religion they most closely identify with.

Empirical Results

Question 1: Does Framing Matter for Risk Preferences?

Our first question about rationality has to do with risk framing. Table 1, below, presents the questions as they were asked to respondents (English in Ghana and French in Côte d’Ivoire).

As we discussed, prior research such as Tversky and Kahneman (1981) finds discrepancies in preferences due to whether the questions are framed with losses or gains, thus suggesting inconsistencies in preferences for risk biased by the framing of the question. When the question is framed as saving lives, Tversky and Kahneman (1981) find that 72% of their respondents choose the certain outcome rather than the probabilistic choice. However, when the framing changes to the loss/death version, although the outcome remains the same in terms of lives saved and lost, the percent choosing the certain outcome drops to 22%. In the first case, the majority decision is risk averse, but in the second case the majority decision is risk taking, representing an almost complete reversal in preferences based on the frame presented. The change, as they note, represents a profound shift from risk aversion to risk taking and thus contradictory attitudes about risks involving gains versus losses, which are inconsistent with the rational actor model.

The results from our analysis testing the framing effect are presented in Fig. 1. Here, we present the percentage of respondents choosing the certain outcome when the question is framed as ‘lives saved’ and when it is framed as ‘deaths’. In Fig. 1, the left side shows the results when the question is framed in terms of lives saved for all three countries, with the horizontal line placed at 72% to compare with Tversky and Kahneman’s (1981) original finding. Figure 1 shows that 71% of respondents in Côte d’Ivoire and 66% of respondents in Ghana choose the certain response, while

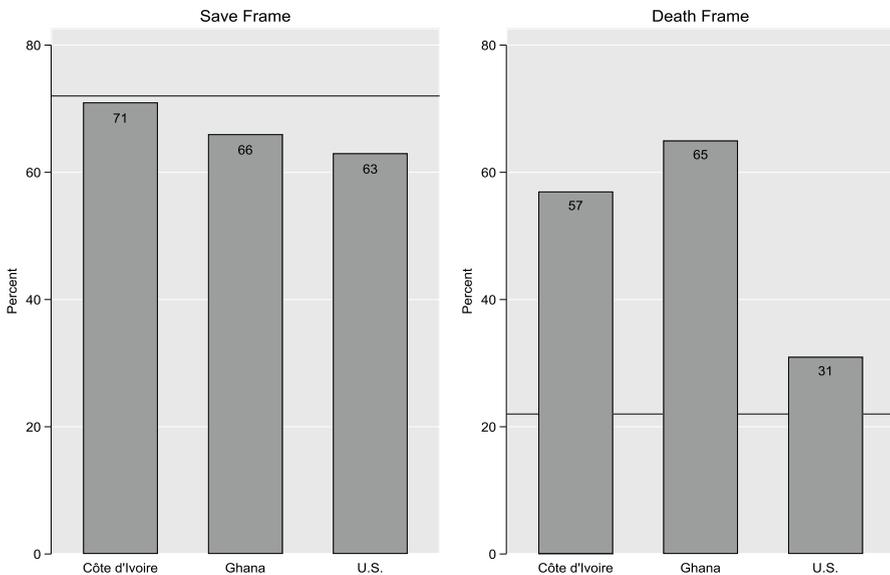


Fig. 1 Percent preferring the certain option over the gamble by frame

in the U.S. 63% choose the certain response, which is nine percentage points lower than what Tversky and Kahneman (1981) found, although still representing a majority of respondents.

In the right panel of Fig. 1, when the question is framed in terms of death, a majority of respondents in Côte d'Ivoire and Ghana still choose the certain (risk averse) response, 57% and 65% respectively, while only 31% choose the certain response in the U.S. under the death frame. In our two African samples, we do not find the almost complete reversal in risk preferences that Tversky and Kahneman (1981) found, but we do find similar reversals in preferences by the treatment in our nationally representative U.S. sample. Critically, then, respondents in the developing country context were much more consistent and less prone to be affected by the framing effect than found by Tversky and Kahneman (1981).

The unadjusted results thus show that in Côte d'Ivoire and Ghana respondents are largely risk averse when the question is framed in terms of saving people and they remain primarily risk averse even when the certain choice is framed in terms of deaths. As a result, and similar to Henrich, Heine and Norenzayan (2010) and Apicella et al. (2014), it seems that the external validity of Tversky and Kahneman (1981) and other such studies is questionable at least for developing countries like

Table 2 Questions for Experiment 2

Version 1	Version 2
Imagine that you are about to buy a cell phone for 775 GHS and a shirt for 85 GHS. The seller tells you that the shirt you want to buy is on sale for 45 GHS at the other store, 20 min away. Would you go to the other store?	Imagine that you are about to buy a cell phone for 85 GHS and a shirt for 775 GHS. The seller tells you that the shirt you want to buy is on sale for 735 GHS at the other store, 20 min away. Would you go to the other store?

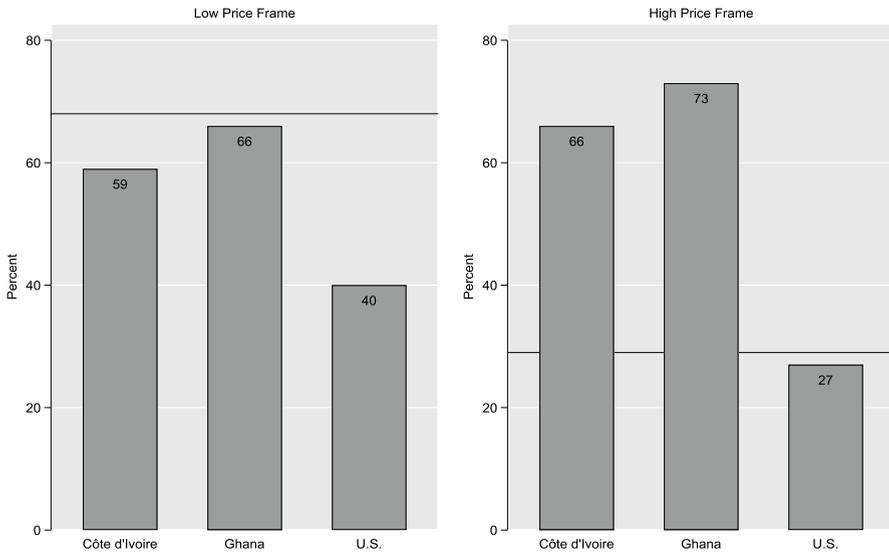


Fig. 2 Percent choosing to save money by frame

Côte d’Ivoire and Ghana.⁴ Building on these results, we next turn to the results from our second experiment.

Question 2: Does A Reference Point Affect Value of Money Versus Time?

In the second question, we consider the framing of a choice compared to high and low reference points. Specifically, in this case, we replicate a question from Tversky and Kahneman (1981) in which people are asked if they would drive 20 min to save

⁴ Respondents in both African countries do not show a large reversal in risk preferences across save and death frames, but it is important to note that there is a relatively larger reversal of preferences when the frame changes from gains to loss in Côte d’Ivoire (14 percentage points) than in Ghana (only one percentage point). Even in developing countries there is likely to be variation on the degree to which people conform or deviate from the rational model’s predictions. Some of this variation might be due to factors that we can explain and some of it might be due to sampling.

\$10 dollars varying if the price of the good is high versus low. The questions as presented in Ghana are shown in Table 2.

When the price of the good is low, Tversky and Kahneman (1981) find that 68% respond that they would travel 20 min to save \$10, but when the price is high only 29% say they would travel 20 min for \$10, or for a difference of almost 40 percentage points. This suggests, as they note, that the value of money is incompatible with the standard analysis of rational consumer behavior.

Once again, however, our results for Côte d'Ivoire and Ghana do not match Tversky and Kahneman's (1981) original findings. As shown in Fig. 2, we find that 59% of respondents in Côte d'Ivoire said they would travel 20 min to save money if the price of the good was low while 66% said yes for the high-priced item. Similarly, 66% of Ghanaians said they would travel 20 min to save money if the price of the good was low and 73% for the high-priced item. Compared to Tversky and Kahneman's (1981), as indicated by the horizontal lines in Fig. 2, we find a much greater willingness to pursue the discount regardless of the pricing frame. This is evidence that our sample of African respondents are relatively more consistent with rational choice theory than found in earlier research.⁵ Importantly, the gap between those willing to travel for the discount when the price is high versus low is very small compared to what has been found in earlier studies. Finally, strikingly, the respondents are more (not less) willing to travel for a discount on a high-priced item—the opposite decision relative to U.S. respondents.⁶

Estimating the Effect of Income

In this part of the analysis, we estimate the size of the framing effect across the three countries focusing on understanding the effect of income controlling for other demographic characteristics. Recall, we argue that the poor are more likely to be rational since they are more vulnerable to mistakes in decision-making. To further test this claim, we consider a series of bivariate logistic regressions in which the dependent variable is either (i) a certain response to the first question or (ii) an affirmative decision to save money in the second question. In the first case, our treatment is whether the certain option (the risk averse option) is framed in terms of saved lives rather than deaths, which is randomized across

⁵ While there was some evidence of a framing effect for Côte d'Ivoire in the gain/loss experiment (see Fig. 1), the responses related to framing do not differ in this high/low price anchoring experiment. One possible explanation is that the gain/loss experiment is set in the context of a disease outbreak, and Côte d'Ivoire experienced a dengue outbreak in 2017 (World Health Organization 2019a), while it has been several years since there was a disease outbreak in Ghana (World Health Organization 2019b). Deviations from rationality are more common in heightened emotional states, so perhaps the disease context was more emotionally triggering in Côte d'Ivoire than in Ghana, where the shopping decision was not.

⁶ Notably, in our sample of U.S. adults the responses are not entirely consistent with those found by Tversky and Kahneman (1981). For the low price frame, U.S. respondents choose to save money 40% of the time, much lower than the 68% choosing to save money in Tversky and Kahneman's (1981) original analysis. However, with the high price frame, respondents in our U.S. sample choose to save money at 27%, which is close to the original finding of 29%.

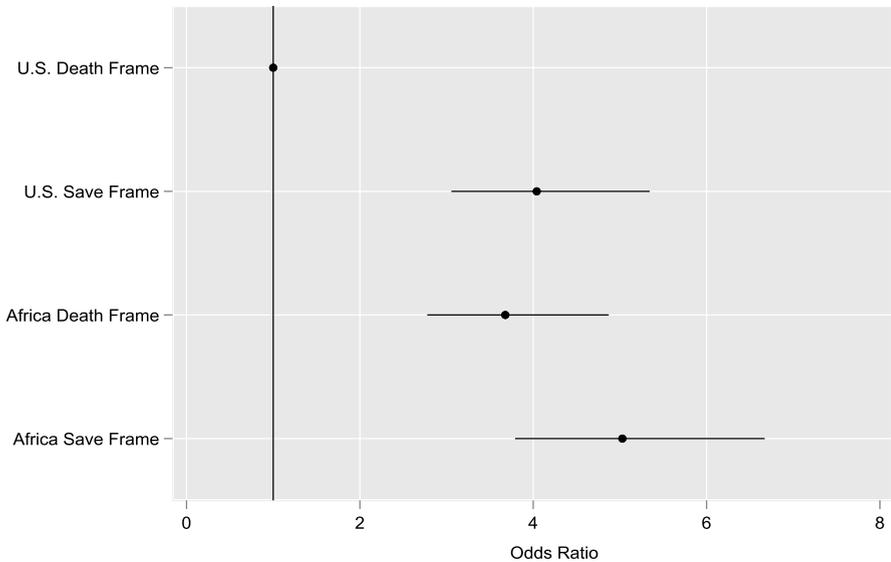


Fig. 3 Effect of policy treatment, developing vs. developed

respondents. For the second question, the treatment whether the discount is references to a high or low priced item.

The data used in this section are pooled including all variables that were available in all three countries. Each regression focuses on the effect of the treatment and its interaction with income adjusted for the respondent’s gender, education, political ideology, and age. To measure the effect of income, we analyze it at the macro and micro levels. In terms of the macro-level we divide the countries into developed (U.S.) and developing (Côte d’Ivoire and Ghana) while at the micro-level we divide individual respondents into four income levels (poor, middle, upper-middle, and rich).

Results from a logistic regression in which we interact the country-level income with the treatment for the first question (save or death frame) are reported in Fig. 3. Odds ratios are shown on the horizontal axis. In this case, the U.S. dummy with the death frame is the reference category. In comparison to this reference, the odds ratio for the interaction term for the U.S. and the save frame is 4.04, indicating that U.S. respondents are much more likely to choose a certain response (approximately 300% more) than U.S. respondents treated with the death frame. For African respondents, the odds ratio is 3.68 if they are treated with the death frame and 5.03 if they are treated with the save frame. Compared to U.S. respondents treated with the death frame, the chances that Africans choose the certain response are greater regardless of the experimental condition, but it is relatively stronger under the save frame. However, the 95% confidence intervals, as shown in Fig. 3, overlap for the two African cases and the point estimates indicate there is no statistically significant reversal within the African group.

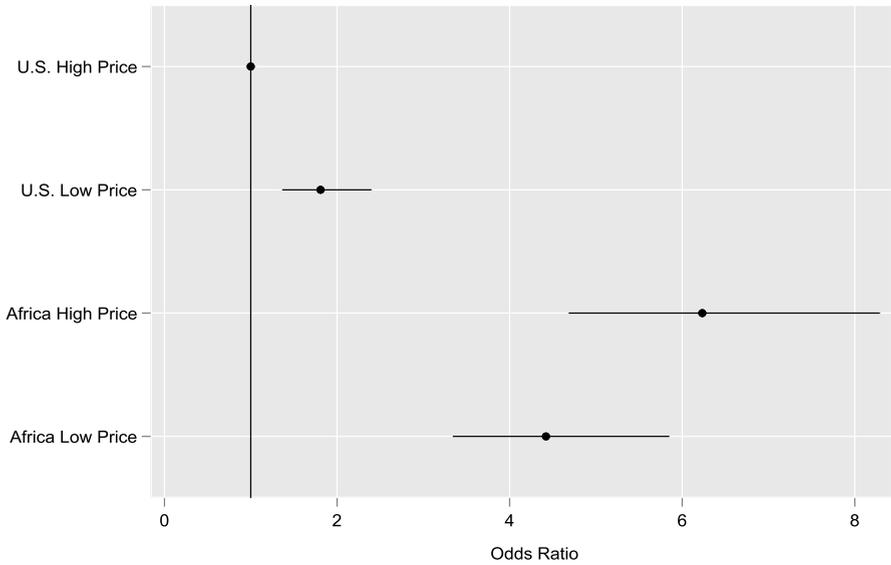


Fig. 4 Effect of price treatment, developing vs. developed

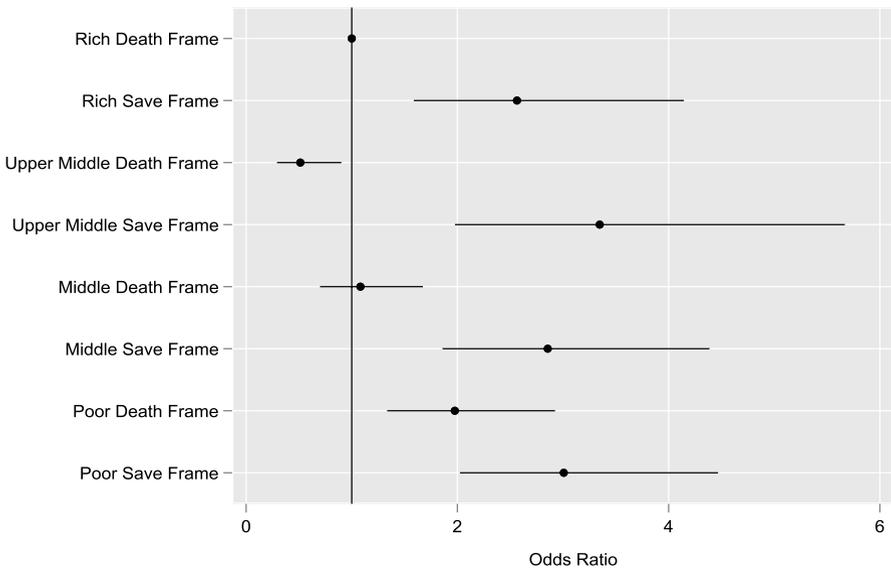


Fig. 5 Effect of policy treatment, by income level

Using the same aggregate level of analysis for the second question shows similar results. When the U.S. high-price is the reference category, Fig. 4 shows that American respondents are more likely to choose to save money when they are treated with the low price (odds ratio = 1.81). In comparison to U.S. respondents, respondents in

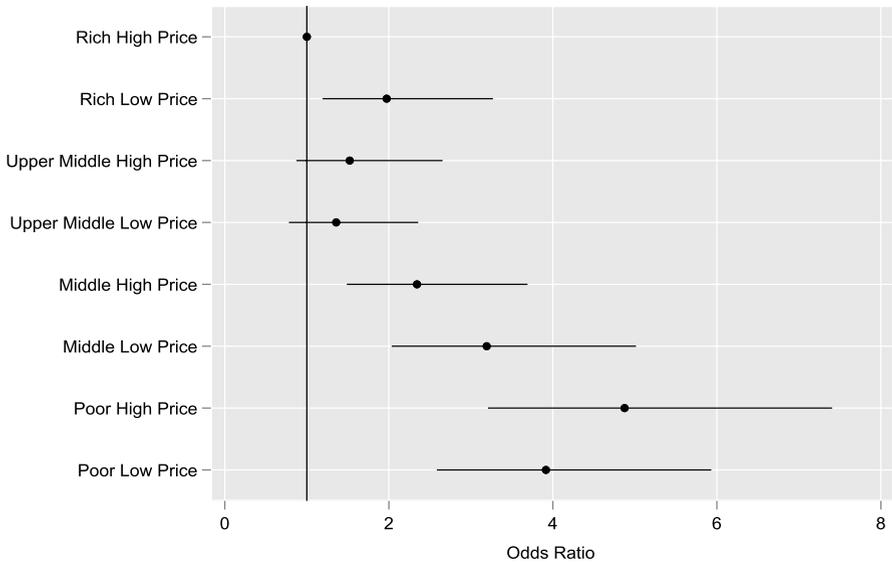


Fig. 6 Effect of price treatment, by income level

Africa are much more likely to choose to save money for both high and low-price treatments. Interestingly, the odds ratio decreases slightly yet remains greater than one for Africans treated with the low-price treatment. For the African cases of high and low-price treatments the confidence intervals overlap as well. Compared to respondents in the developed country sample treated with the high-price, respondents in the lower income developing countries are for both treatments more likely to choose to save money.

Building on these macro-level considerations, we now look at the effects of the treatments by individual income levels. Figure 5 shows the interaction of the treatments save or death with the respondent’s income category. Since we are most interested in comparing the responses of the poorest respondents we use rich respondents with the death frame as the reference category. When rich respondents are treated with the save frame they are more likely to choose the certain response compared to when they are treated with the death frame. For upper-middle income respondents there is a reversal in the odds ratio from less than one to greater than one moving from death to save frame. For the middle income respondents there is a change from an odds ratio that is not statistically significant under the death frame to one that is greater than one and significant under the save frame. Finally, for the poorest respondents the odds ratio is greater than one in both cases and the 95% confidence intervals overlap. Compared to rich respondents treated with the death frame, poor respondents are more likely to choose the certain choice, and they are not responsive to the treatment frame.

Figure 6 reports the results for the treatment of price by income level. In this case, the reference category is rich respondents treated with the high price. Only the rich respondents are responsive to the treatment frame. The upper-middle income

respondents have similar propensities in choosing to travel for the discount as the rich, but are not responsive to the reference price. As income decreases to the middle and poor categories, the willingness to spend the travel time for the discount increases; at the same time, the responsiveness to the treatment frame decreases. Moving to lower levels of income is thus associated with more consistent decision-making. Finally, for the poorest respondents we see that they are more likely to choose to save money compared to rich respondents treated with the high price and interestingly while there is no reversal the odds ratio actually decreases a little for poor respondents treated with the low price compared to those treated with the high price.

Reconsidering Earlier Findings

An important question emerges from our findings in Côte d'Ivoire and Ghana; why are the results so different as compared with analyses such as Tversky and Kahneman (1981) and others? One possible answer is that earlier studies have relied on samples that are not generalizable to other parts of the world. Given their limited external validity, it is quite surprising, in our estimation, the degree of influence these studies have had on views of rationality. Already our data have shown that there is serious doubt to conclude that these findings apply in two sub-Saharan African countries. In this section, we further analyze the U.S. data to better understand why the findings are different than our African samples.

Looking back at Fig. 1, we can see that for the question on the policy choice for disease prevention that respondents in the U.S. choose the certain outcome policy when framed as 'save' 63% of the time, but when the same outcome is framed in terms of 'deaths' the choice falls over 30 percentage points to 31%. As we noted, this indicates a reversal similar to what Tversky and Kahneman (1981) originally found. This result is important because it extends their work to a nationally representative sample, which as far as we know has yet to be done, thus suggesting support for their original findings and further establishing a difference in how people are thinking about these types of questions in the U.S. compared to our African samples.

One important point regarding the external validity of our results is that we field our U.S. sample on-line while the African samples we fielded in person on paper. The difference in methods could be driving the differences we have found, although given the questions we are asking which are not of a sensitive nature we think this is a low likelihood. Nevertheless, one could argue that those doing the survey in person paid more attention than those on the internet and this is why the responses are consistent with rational choice models in the samples from the developing countries compared to the U.S. sample. To this point, we note that early round of experiments were conducted prior to the internet, and while the exact methods are not reported it is noted that respondents were given a "form" when they participated in the experiment (Tversky and Kahneman 1981) suggesting that these studies were done in person as well. In the original paper, Tversky and Kahneman (1981, p. 453) specifically note that they used "data obtained from students...who answered brief questions in

a classroom setting”. Comparing our results from the U.S. using the internet with those from the earlier studies done in the classroom shows a remarkable level of consistency across methods of administering the surveys, suggesting they are stable across different methods of fielding the data. We believe this is an important point and shows that the type of method used to ask these questions probably does not affect responses. While we cannot be entirely certain that our results are not driven by the variation in methods used to ask the questions, we do think it is unlikely that this difference is responsible for all of the variation across the sample sites.

We can see further if the differences in responses across contexts are due to variations in the educational attainment by comparing a subsample of respondents that is similar to the sample of medical doctors used in earlier research. In our U.S. sample we do not have the type of employment for each respondent, but we do have their level of education, which we can use to create a comparison group that is similar to the 1981 sample of doctors. Doctors have post-graduate degrees and when we consider our restricted sample of respondents with post-graduate degrees we find the reversal matches almost exactly what was originally found of 50 percentage points. While 76% preferred the certain outcome when the question was framed as save, only 24% chose that outcome when framed in terms of death. Thus, the original finding might be not only conditional to developed countries, but furthermore to the most educated people in these places.

If it is indeed education that is driving differences in the rationality of decision-making, then we should see similar behavior in our two African countries. In Côte d’Ivoire, 40% of our sample has less than a high school education and we see no evidence of a reversal among these as 64% of them prefer the certain outcome when the question is framed in terms of saving lives compared to 61% under the death frame. Among the respondents in Côte d’Ivoire with a university degree or greater we do find a reversal in preferences across the frames, as 69% of the most educated choose the certain outcome under the saving lives frame relative to 46% under the choice framed as deaths. Likewise, in Ghana, 38% of respondents have less than a high-school education and amongst these respondents 71% in the save frame group choose the risk averse option compared to 62% in the death frame group, resulting in a difference of only eight percentage points. In considering those with the highest education in Ghana, we do not find evidence of a reversal, however. In terms of education, it thus appears that the most rational respondents are those in both African countries with the lowest levels of education.

In terms of the second question, giving time to save money, we find modest evidence consistent with earlier findings, though with important deviations. Recall that in the original analysis, when the price of the calculator is low 68% of respondents claim they would travel 20 min to save \$10, but when the discount is on the higher priced item 29% say they would travel 20 min for \$10, or a difference of almost 40 percentage points. In our representative sample of U.S. adults, as noted, we do not find the same magnitude of change across the reference points. Looking back at Fig. 2, when the price is low about 40% would travel to save money, but when the price is high only 27% say they would travel to save money. While the direction of change is consistent with their findings, the degree of change, here 12 percentage points, is much smaller than the 40 percentage point difference found by

Tversky and Kahneman (1981). One reason this might be the case is because their sample consists of relatively educated people from elite universities who tend to be of higher means than others. We thus analyzed if education was a driving factor behind these results. When the price of the reference good is low, 42% of our lowest educated respondents in the U.S. (i.e., less than high school) say they would save money for the travel time, compared to 28% when the price of the reference good is high. In contrast, amongst the most educated respondents (i.e., those with a graduate degree), 32% say they would travel when the price is low, but only 17% would do so when the price is high. In Côte d'Ivoire, the least educated respondents choose to save money 65% when the price is low and 66% when the price is high while the most educated respondents make the same choices at 48% and 72% respectively. Less educated respondents in Côte d'Ivoire are more rational than are those respondents with more education. Lastly, in Ghana the least educated choose to save money 79% when the price is low and 58% when the price is high while the most educated choose this 65% and 86% respectively. When it comes to decision-making regarding price, relatively less educated people make decisions more in-line with the rational actor model compared to people of higher incomes.⁷

Conclusion

The notion that people are predictably irrational is not supported by our data collected from two West African countries and the United States. Our findings suggest decision-making that is more consistent with the rational actor model than found by earlier studies in the developed world. Conclusions that people are not rational in their decision-making or that they are predictably irrational have been based on samples that are limited in a number of ways. The problem seems to be widespread. The popular book *Predictably Irrational* begins with findings from an experiment of 100 graduate students from MIT's elite business school showing that respondents do not make consistent decisions when confronted with different menus of magazine subscriptions (Ariely 2010). The results are interesting, but given our findings we would highlight the limitations of a sample of business school students at an exclusive university. This brings up an important point, whether scholars have been cognizant of it or not, namely that earlier results indicating *irrational* type behavior from the U.S. and other western countries have been more or less automatically extended to the rest of the world. This thinking seems to be deeply biased in the sense that if people in western, relatively developed countries do not act in a manner consistent with rationality then no one else logically could be doing the same. Yet, our data and findings indicate the flawed nature of this generalization.

Importantly, we find in a nationally representative data set of American adults support for earlier studies as our findings show that respondents from the U.S. were irrational in their decision-making. Even our data from the U.S., however,

⁷ Recall in both Côte d'Ivoire and Ghana, the decision to save money is over 58% with a slight lower willingness to save money when the price is low rather than high.

indicates amongst certain segments of the population that some people act in a manner more closely aligned to the rational choice model while others deviate further from it. Lower income people in our sample of U.S. adults seem to be making decisions more closely aligned with the rational choice model than are high income people in these two replications of classic experiments. This suggests an important point about how we interpret the rational choice paradigm, namely that context matters even in the U.S. In some settings when people are conditioned by certain factors, as with poverty, they appear to make decisions more closely aligned with what the model assumes about how people act. Thus, it might be better to think less about if people are rational or not, and more about the conditions that push people to act in ways that are consistent with rationality and those that push them to make decisions in ways that deviate from classic rationality.

Future research can continue to examine differences in rationality and deviations from the model across the developing world as well as within countries like the U.S. and those in Europe. We think it is essential that not only is empirical testing of models of decision-making extended to the developing world, where less has been done in the first place, but given the limited external validity of prior research we think it is also essential that future research tests these questions with samples that are more representative of the populations they seek to understand.

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Compliance with Ethical Standards

Informed Consent Informed consent was obtained from all individual participants included in the study and the study protocol was approved by the Bucknell University Institutional Review Board.

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Appendix

See Table 3.

Table 3 Summary statistics for respondents

	Côte d'Ivoire			Ghana		
	Frequency/mean	Percent	Population	Frequency/mean	Percent	Population
Gender						
Male	423	52.94	52%	400	50.00	49%
Female	376	47.06	48%	400	50.00	51%
Fertility		4.07	4.06		3.83	3.13
Number of children						
Less than two	573	71.63		596	74.50	
Two or more	227	28.38		204	25.50	
Age group						
Less than 20	47	5.88		30	3.75	
20–29	348	43.50		440	55.00	
30–39	220	27.50		202	25.25	
40+	185	23.13		128	16.00	
Education						
Elementary or less	322	40.25	44%*	302	37.75	43%
High school	298	37.25		331	41.38	
More than high school	180	22.50		167	20.88	
Owns Home						
No	720	90.68		642	80.25	
Yes	74	9.32		158	19.75	
Political Views						
Conservative	295	37.58		388	48.50	
Moderate	253	32.23		221	27.63	
Liberal	237	30.19		191	23.88	
Religion						
Christian	448	56	34%	632	79.00	71%
Other	352	44	43% Muslim	168	21.00	17%
Survey site (Côte d'Ivoire)						
Abidjan	200	25	Survey site (Ghana)			
Bassam	342	42.75	Jamestown	200	25.00	
Bonoua	157	19.63	East Lagon	300	37.50	
Mondukou	101	12.63	Lapaz	300	37.50	

We calculate the fertility rate in our samples for women over 44 years of age

*This is the percent of the population that is literate. Sources for population data are Ivorian Census, Ghana Statistical Service, and UNESCO

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