Economic Rationality under Fear Induced Cognitive Load

Prajneya Kumar: 2019114011
Ihita Gangavarapu: 2021701007

Project report

1 Abstract

Emotions and rationality go hand in hand and it has been an area of research for decades. Research also focuses on the relationship between cognitive load inducing these emotions and its impact on the rationality of people. This report focuses on fear-induced cognitive load and its effect on the rationality of economic decisions. Experiments are conducted to study the behavior of our subjects based on fear induced through two scenarios: crime and natural disaster. Through the performance of the subjects in budget allocation tasks, inferences are made on their consistency and rationality of decisions. Our work refers to the research titled "Economic Rationality under Cognitive Load" for the study and makes minor modifications to the experiments.

Keywords: Cognitive load, rationality, fear, working memory, response times, budget allocation, risk

2 Introduction

A considerable amount of research has been conducted to understand the impact of burdening the subjects' working memory and their performance in various tasks. Deck, C. and S. Jahedi (2015) find that a higher cognitive load reduces performance in mathematical challenges and leads to impatience and risk-averse behavior. Andreas C Drichoutis et.al in the research titled "Economic Rationality under Cognitive Load," experiment with varying the cognitive load of the subjects through memorization tasks and making them perform a budget allocation task. The impact of the cognitive load on rationality and consistency is measured by mapping the results to a utility function. Our study is based on this work and is a slight modification of the cognitive load aspect of the experiment. Additionally, research indicates that emotions such as happiness, anxiety, regret, sorrow, and fear impact the rationality of decision-making in people. Fear as an emotion is not uncommon and plays a crucial role in economic decision-making as it may influence investments, markets, politics, and strategies. In" Fear and Economic Behavior," the author creates a transition of players from a neutral to a fearful state of mind. Their analysis focuses on the effect of fear on behavior through its impact on a player's risk aversion, thus indicating their economic behavior.

Our work combines fear's role in decision-making and cognitive load's impact on the rationality of decisions. In our work, cognitive load is induced through prompts shown to the subjects that instill a sense of fear in them and thus burden their working memory. With two different types of fears induced, namely: crime-induced and fear of natural disasters, a study is conducted to understand what affects the subjects' decisions.

3 Problem Statement

According to economic theory, a utility function helps explain rational consumer behavior. Previous studies have demonstrated that a persistent cognitive ability can capture some consistency of choices with economic rationality. The original paper investigates how a brief burden on participants' working memory can impact economic rationality. By having participants memorize a number while performing an induced budget allocation task, the authors exogenously change the cognitive load in two well-controlled laboratory trials. The authors find that while cognitive load has an adverse effect on reasoning tasks, there is no effect on the consistency of subjects' choices and risk preferences. They thus conclude that even while momentary working memory stress has negative impacts on reasoning tasks, economic rationality can be achieved when people

are subjected to it. We believe that there was no effect of cognitive load on economic rationality because the cognitive load was defined as exhausting the working memory with numbers. We try to induce cognitive load by exhausting the working memory with fear related to the problem statement and thus hypothesize that this load will have an adverse effect on the economic rationality of subjects.

4 Experiment Design

4.1 Definitions

We define the following terms before proceeding to our experiment design:

1. **Cognitive Load:** Cognitive load is defined as the amount of information that the working memory of the brain can hold or memory resources required to process information at a given period of time
2. **Fear:** Fear is an unpleasant often strong emotion caused by anticipation or awareness of threat or danger. It can be either physical, emotional, or psychological.
3. **Types of Fear:** We categorize fear into two types for the scope of this study:
   (a) **Crime-Induced Fear:** Fear induced in individuals through the possibility of being a victim of a crime. Levels of fear of crime within a community are caused by the level of criminal activity within that community.
   (b) **Fear of Natural Disasters:** Fear induced through the possibility of the occurrence of a natural disaster or falling a victim to it.

4.2 Variables

We only have one independent variable: **Cognitive Load due to fear**

We study the dependent variable: **Rational Choice**

4.3 Methodology

We try to replicate the task given in the original paper only by tweaking the cognitive load part. Instead of giving numbers to memorize, we present the participants with some contextual prompts. These prompts are cognitive load based assessments that consider two distinct categories of fear: crime-induced fear and fear due to natural disasters.

4.3.1 Hypothesis

Our hypothesis is that given a task that involves making economic decisions (such as the budget allocation task), people deviate from rational choice to other varying choices based on the type of fear/circumstance they face.

4.3.2 Phase Design

1. **Period 1:** Subjects are shown the prompt as described in the next subsection based on the type of fear they are being tested upon.
2. **Period 2:** Subjects have to complete a budget allocation task 4 times based on different budgets.

The survey can be found at: Form Link

4.3.3 Prompts

The following two prompts were used to induce fear of the respective types:

- Your new job requires you to relocate to a new city with your family. The new city is recently infamous for heinous crimes including late-night robbery and murder. One day you are returning home from a late night office meeting at 12.30 AM.

- The city is highly earthquake-prone and has had incidents of earthquake-based natural disasters in recent times.

Context

Your new job requires you to relocate to a new city with your family. The new city is recently infamous for heinous crimes including late night robbery and a murder. One day you are returning home from a late night office meeting at 12.30AM.

NEWS FLASH

NEWS FLASH

Late night crime spree by 3 men in Delhi, accused on the run

Context

You have to book a cab to return home. You are also very hungry so you want to buy food (You can even skip this and go to sleep hungry). The more amount you put in for your cab, the earlier it arrives. If you put in too less amount, it might even take the cab hours to arrive.

4.3.4 Budget Allocation Tasks

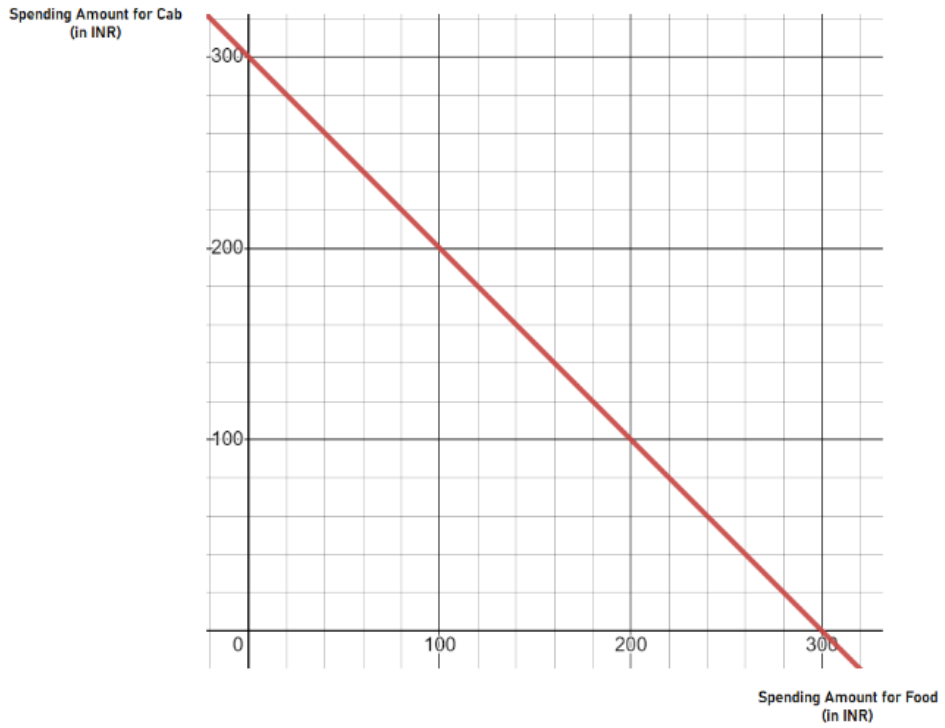
- Task-1

Your budget is Rs X. You have to book a cab to return home. You are also hungry so you want to buy food (You can even skip this and go to sleep hungry). The more amount you put in for your cab, the earlier it arrives. If you put in too less amount, it might even take the cab hours to arrive. How much money will you allocate to the cab and how much will you allocate for food?

- Task-2

Your budget is Rs X. You have to buy a property and a car in the new city. . The more amount you put in for your house property, the safer it is against earthquakes. How much money will you allocate to the property and how much will you allocate for a car?

Budget Line 1



Budget Line Description

The red line in the figure above denotes your budget. This means that if you spend Rs. 300 on Cabs, your cab will arrive immediately, but you won't have any money to spend on food. Or, if you spend Rs. 250 on Food, you will automatically spend Rs. 50 on the cab, but you will have to wait for your cab for hours.

How much money will you spend on the cab? (in INR) *

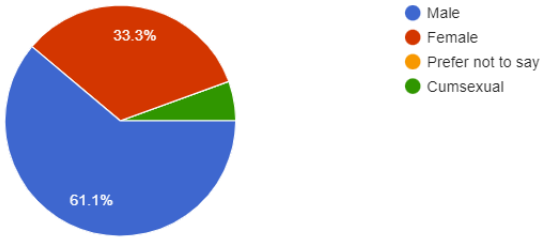
Please take a careful look at the graph above before answering the question.

Short answer text

4.3.5 Demographics of Subjects

The target age based demographics considered are young adults between 18 to 27 years of age.

Expected Sample Size: 30 participants. However, we were able to gather data from 18 participants only and make our analysis based on the same.



4.3.6 Assumptions and exceptions

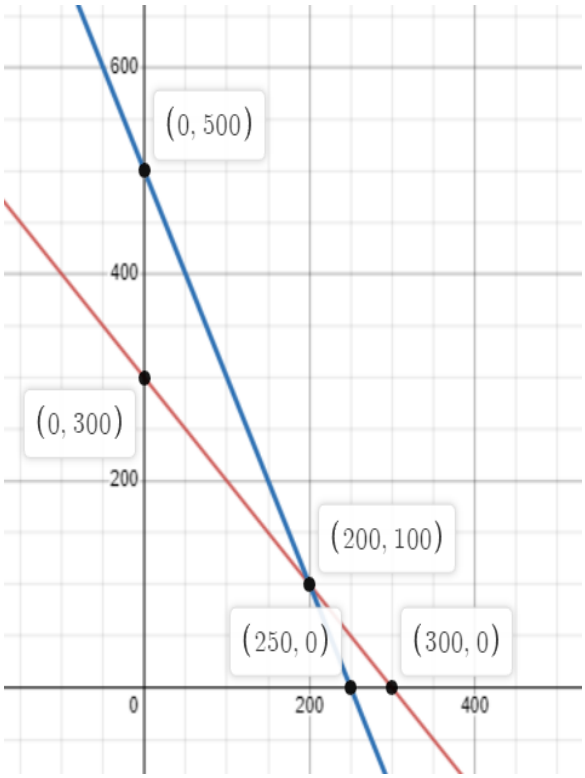
The emotion of fear can be interpreted differently by individuals from varied demographics. This work sticks to a single definition of fear and assumes the group to be homogeneous. Gender, professional background, income, religion, marital status etc were not considered for the analysis.

5 Results and Analysis

How do we know if the participants have made a rational decision or not? We change the value of X in the above Budget Allocation Task 4 times for each participant and try to map it to a utility function in accordance with GARP. We analyze our data by comparing each pair of budget lines once.

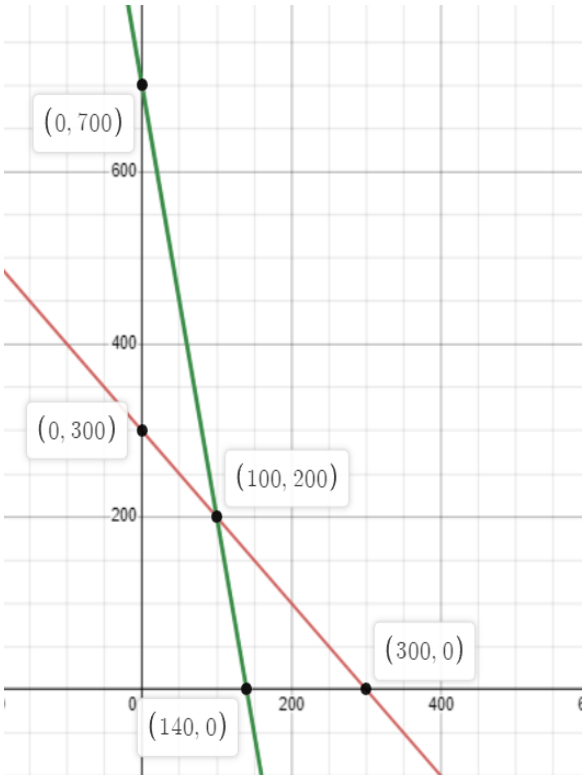
5.1 Crime Based Fear

5.1.1 Budget Lines 1 and 2



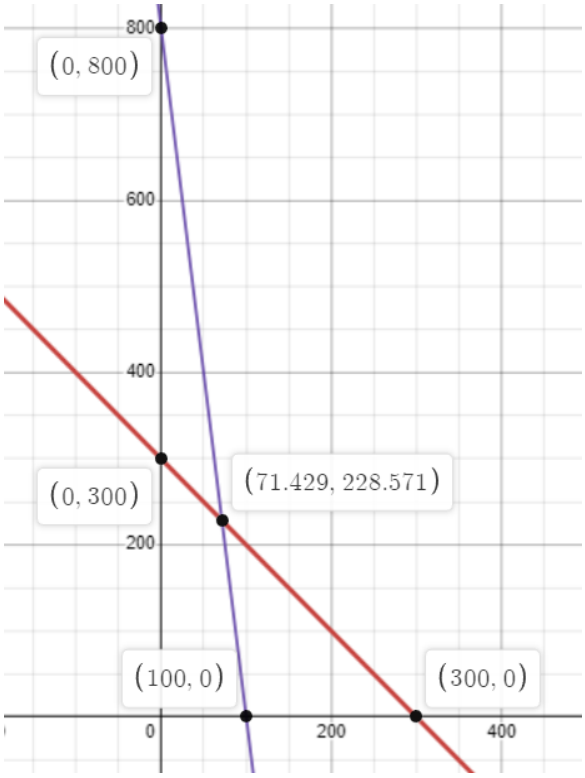
Here, participants will be said to be rational if they follow GARP, that is, across their responses, they choose to lie on either the higher triangle of the graph or the lower one. All participants made rational decisions in this case.

5.1.2 Budget Lines 1 and 3



Here, participants will be said to be rational if they follow GARP, that is, across their responses, they choose to lie on either the higher triangle of the graph or the lower one. All participants made rational decisions in this case.

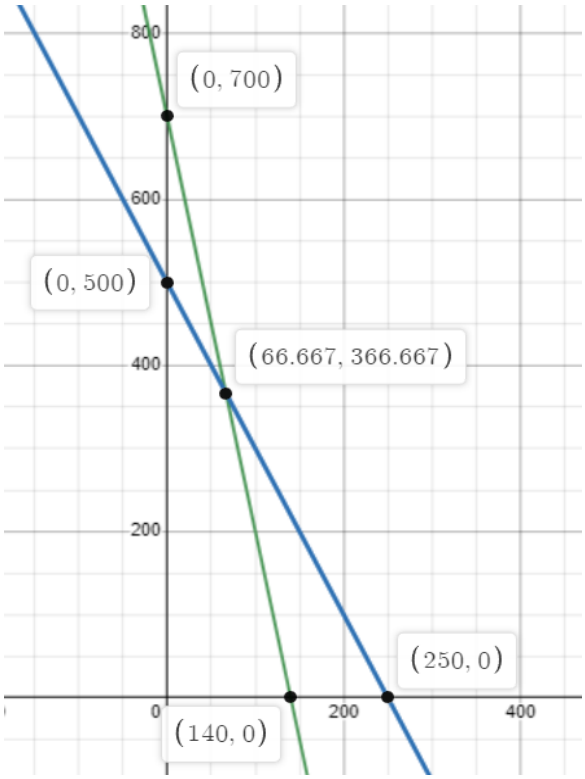
5.1.3 Budget Lines 1 and 4



Here, participants will be said to be rational if they follow GARP, that is, across their responses, they

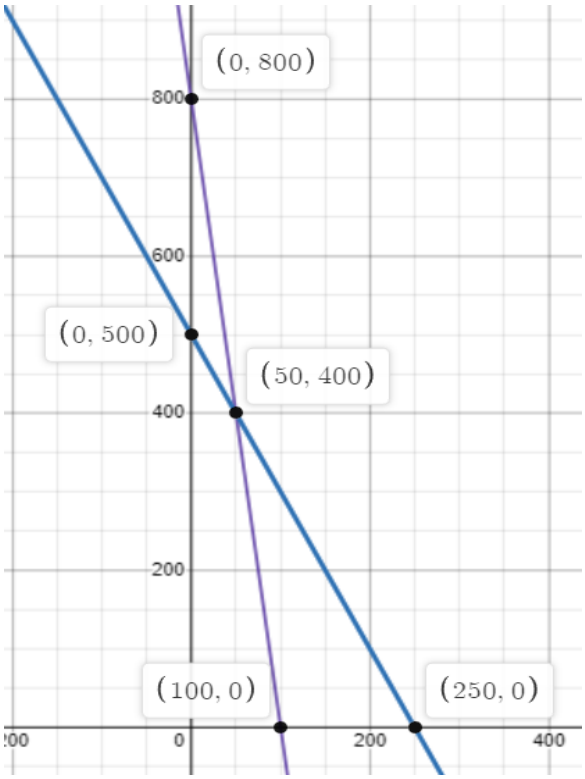
choose to lie on either the higher triangle of the graph or the lower one. 14 participants made rational decisions in this case, while 4 shifted towards irrationality.

5.1.4 Budget Lines 2 and 3



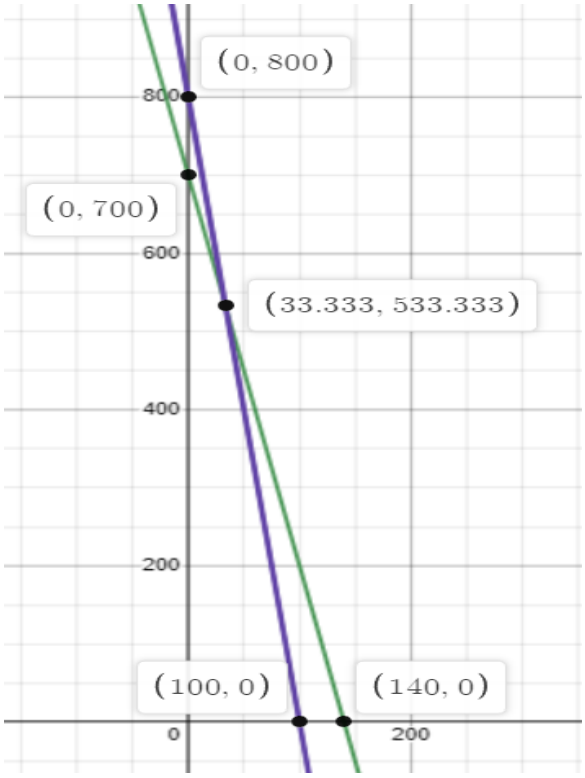
Here, participants will be said to be rational if they follow GARP, that is, across their responses, they choose to lie on either the higher triangle of the graph or the lower one. 17 participants made rational decisions in this case, while 1 shifted towards irrationality.

5.1.5 Budget Lines 2 and 4



Here, participants will be said to be rational if they follow GARP, that is, across their responses, they choose to lie on either the higher triangle of the graph or the lower one. 14 participants made rational decisions in this case, while 4 shifted towards irrationality.

5.1.6 Budget Lines 3 and 4



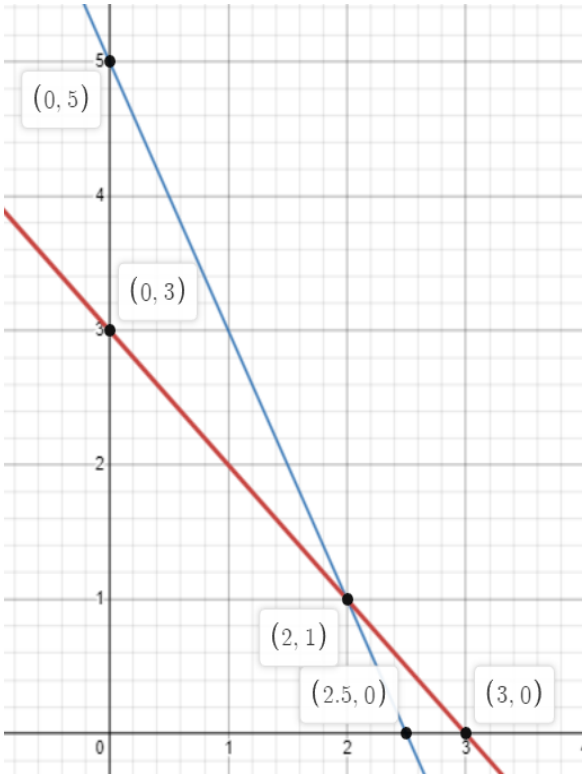
Here, participants will be said to be rational if they follow GARP, that is, across their responses, they

choose to lie on either the higher triangle of the graph or the lower one. All participants made rational decisions in this case.

By the given analysis of people's budget allocation across 4 different budget lines, we can say that crime-based fear **does not** affect rationality. Only 5 (total) participants out of 18 participants deviated from the rational path throughout the experiment.

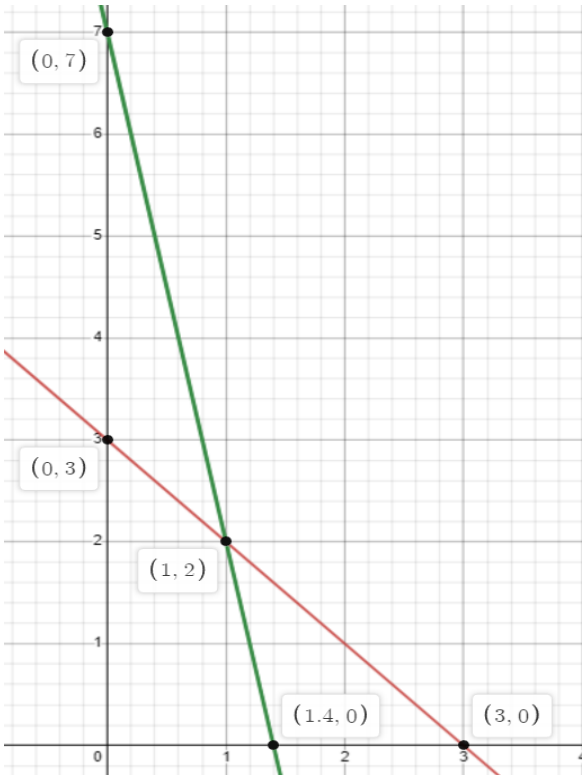
5.2 Natural Disaster-based Fear

5.2.1 Budget Lines 1 and 2



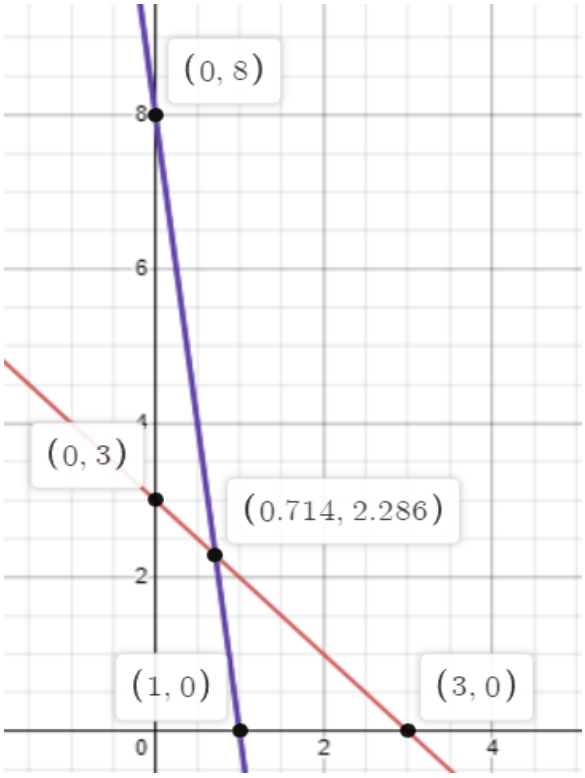
Here, participants will be said to be rational if they follow GARP, that is, across their responses, they choose to lie on either the higher triangle of the graph or the lower one. All participants made rational decisions in this case.

5.2.2 Budget Lines 1 and 3



Here, participants will be said to be rational if they follow GARP, that is, across their responses, they choose to lie on either the higher triangle of the graph or the lower one. 11 participants made rational decisions in this case, while 7 took an irrational choice.

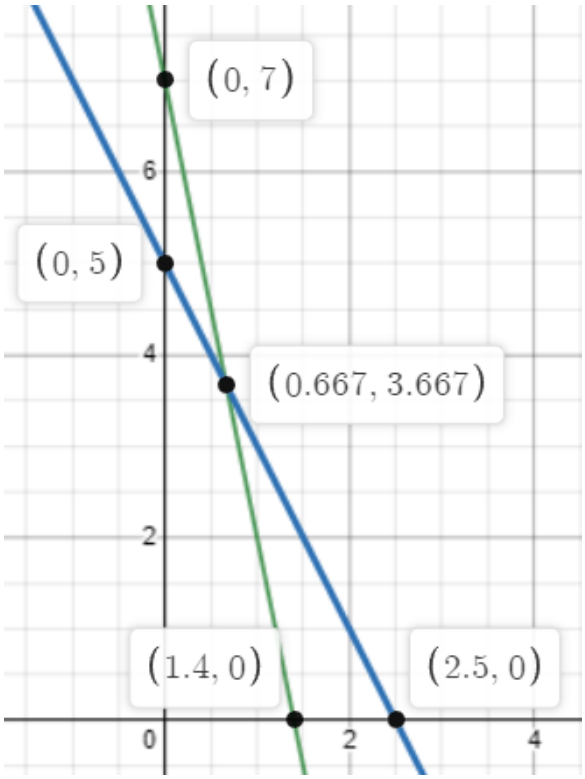
5.2.3 Budget Lines 1 and 4



Here, participants will be said to be rational if they follow GARP, that is, across their responses, they

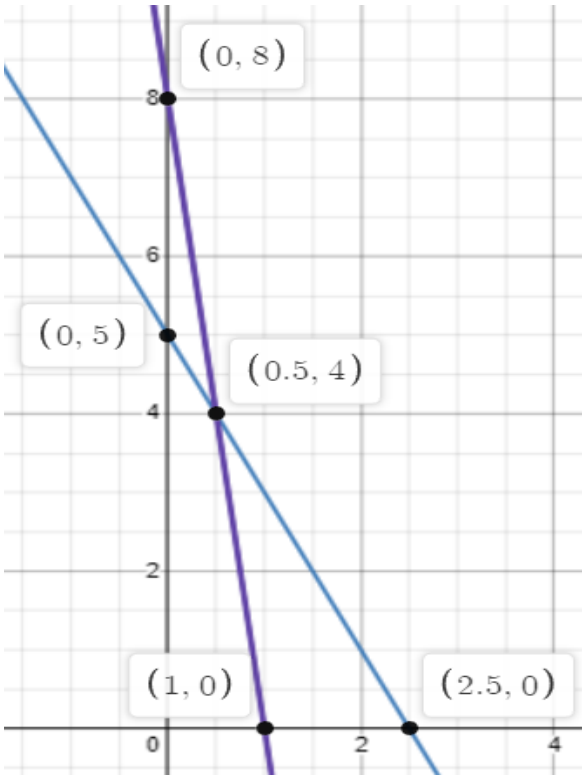
choose to lie on either the higher triangle of the graph or the lower one. 10 participants made rational decisions in this case, while 8 took an irrational choice.

5.2.4 Budget Lines 2 and 3



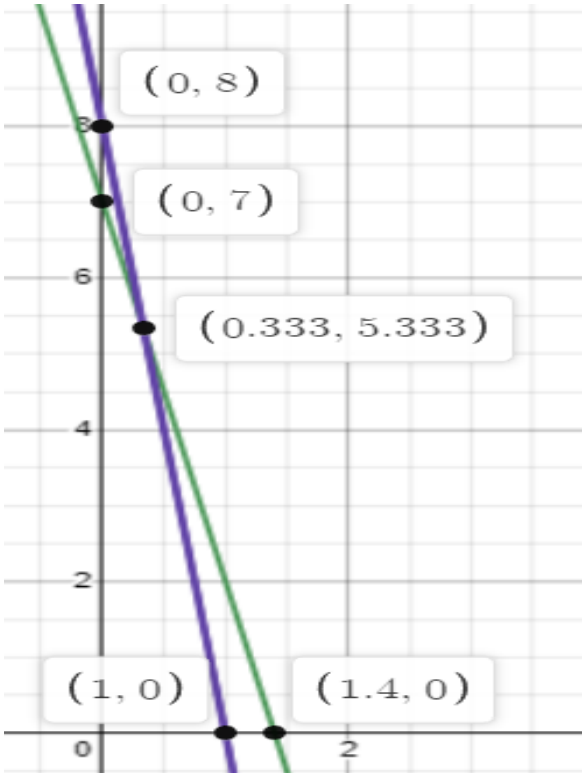
Here, participants will be said to be rational if they follow GARP, that is, across their responses, they choose to lie on either the higher triangle of the graph or the lower one. 14 participants made rational decisions in this case, while 4 took irrational choices.

5.2.5 Budget Lines 2 and 4



Here, participants will be said to be rational if they follow GARP, that is, across their responses, they choose to lie on either the higher triangle of the graph or the lower one. 7 participants made rational decisions in this case, while 11 took irrational choices.

5.2.6 Budget Lines 3 and 4

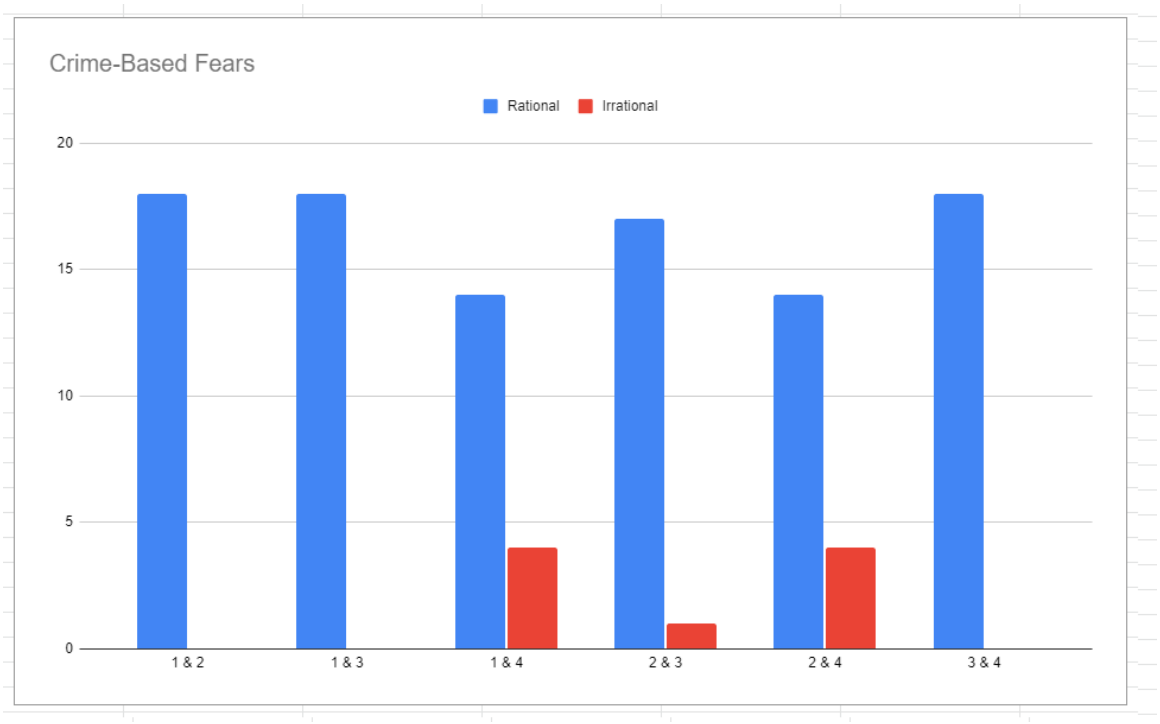


Here, participants will be said to be rational if they follow GARP, that is, across their responses, they

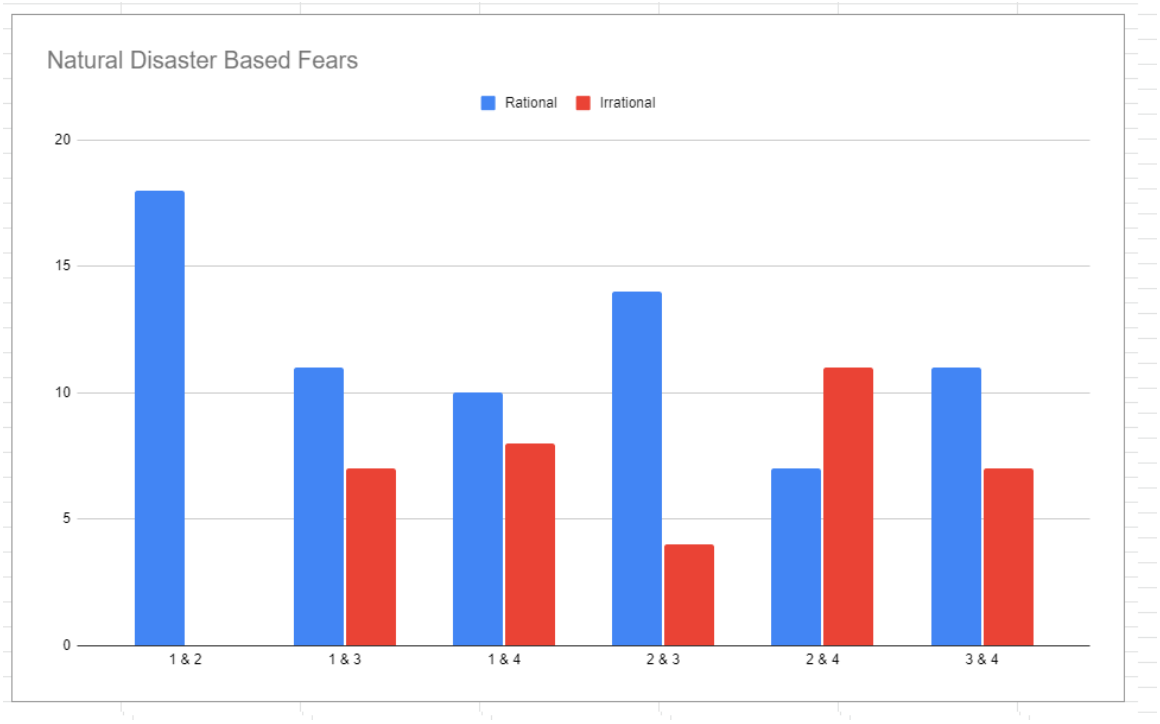
choose to lie on either the higher triangle of the graph or the lower one. 11 participants made rational decisions in this case, while 7 took irrational choices.

By the given analysis of people's budget allocation across 4 different budget lines, we can say that natural disaster-based fear **does** affect rationality. A significant majority of the 18 participants deviated from the rational path throughout the experiment. To sum up, we see that crime-based fear does not affect economic rationality. However, natural-disaster-based fear affects economic rationality. It is quite possible that we get deeper insights into increasing the sample size. The following graph sums up our results:

For crime-based fears:



For disaster-based fears:



6 Future work

In the future the work can be expanded by considering a large heterogeneous group for the study. Further, fears induced by other factors/scenarios such as faith, religion can be analysed. Additionally, analysis considering parameters such as area of residence, employment status, marital status will help understand the relationship between fear, cognitive load and economic rationality more realistically.

7 References

1. Andreas C Drichoutis, Rodolfo M Nayga, Jr., Economic Rationality under Cognitive Load, The Economic Journal, Volume 130, Issue 632, November 2020, Pages 2382–2409. https://doi.org/10.1093/ej/ueaa052

2. Deck, C. and S. Jahedi (2015). The effect of cognitive load on economic decision making: A survey and new experiments. European Economic Review 78, 97–119.

3. Elster, Jon. "Rationality and the Emotions." The Economic Journal, vol. 106, no. 438, 1996, pp. 1386–97. JSTOR, https://doi.org/10.2307/2235530. Accessed 25 Nov. 2022.

4. Bandelj, N. Emotions in economic action and interaction. Theor Soc 38, 347–366 (2009). https://doi.org/10.1007/s11186-009-9088-2

5. Lina Andersson, Fear and Economic Behavior,Department of Economics, University of Gothenburg

*****