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A Brief Overview of Neuroeconomics

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One of the foundational concepts in microeconomics is utility. Utility is the benefit received from a decision. When faced with a decision between multiple alternatives, a rational actor selects the option with the highest utility. Uncertainty makes the decision more nuanced; the expected utility of a decision is the payoff multiplied by the probability of receiving it, and the option with the highest expected utility is chosen. However, one of the principal challenges with this is that economists do not have a way to calculate utility in a meaningful way.

This is where an emerging field called neuroeconomics comes in. Neuroeconomics uses neuroscientific methods to collect quantitative data that can be used to test economic theories. In doing so, it can help economists test models and develop new ones. Finally, it can also shed light on the neural mechanisms behind certain economic processes. In this article, I will give a brief overview of the application of neuroeconomics to utility theory because it is foundational to microeconomics.

One of the first studies in neuroeconomics, by Platt and Glimcher (1999), ran a series of experiments with monkeys to test if the two variables involved in calculating expected utility - payoff and probability - were considered by the brain. Monkeys were shown dots on a screen, and their eye movement was tracked. The study had two experiments, the first of which was split into two parts . During this first experiment, a colored dot was shown followed by other dots. If the monkey followed the colored dot with its eyes, they got a squirt of juice; following the other dots meant no juice. In the first segment, they always got juice, but the quantity varied. In the second segment, the quantity was fixed, but the probability of receiving it varied.

They found that neuron activity was positively correlated with reward size and the probability of reward. However, the authors noticed that as the trials went on, the correlation got weaker. This indicated that the decision of which dot to follow in earlier trials were made under more uncertainty, suggesting that reward size and probability were both important variables in making decisions under uncertainty.

The second experiment gave monkeys a choice between two dots, which gave a different reward. Using the frequency of each choice, the authors estimated the value associated with each choice. They found that choice was associated with higher expected value. That is, the monkeys considered the expected value of following each dot before deciding which one to follow.

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An Interview with Professor Emma Riley

ADAM ALEY

The EUB is excited to greet the newest entry to the UW Economics Department, Professor Emma Riley. Coming from the United Kingdom, Professor Riley began studying economics at the age of 16, when popular books such as *Freakonomics* and *The Undercover Economist* drew her interest to the field. She soon thereafter found her niche in development economics during her second year as an undergraduate at the University of Cambridge. Following a two-year stint at A.T. Kearney as a Business Analyst, Professor Riley went on to earn her MPhil in Economics, with distinction, in 2015, and her PhD in Economics, both from the University of Oxford in 2019. She was awarded the Edgeworth Prize for Best Doctoral Thesis for her work entitled, *"Essays on Mobile Money Services, Microenterprises and Role Models in Developing Countries."* Her current research focuses on digital financial services, such as mobile money, microfinance, female entrepreneurship, and a variety of other engaging subjects utilizing randomized controlled trials (RCTs). During our interview with Professor Riley, we asked about her experience transitioning from the UK to the PNW, the influential rise of development economics over the past several years, and insights into her recent and current research.

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An Interview with Professor Emma Riley

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Q: What made you apply to the University of Washington for your professorship? What about the campus, or the Pacific Northwest in general, appeals to you?

A: I was keen to move to the USA to have access to the network of economists here, particularly for development economists on the west coast. UW appealed in particular because of professors like Rachel Heath, Alan Griffith and Fahad Khalil, doing work in development economics. Rachel Heath does work very close to my own, and I was excited about the opportunity of working with her. My husband had previously lived in the Pacific Northwest and described how beautiful it is. I like hiking and nature, so it's perfect for that. The climate also suited me very well, as the UK is extremely similar weather-wise.

Q: Development economics has become a prominent field of study over the last two decades, promoting a wide variety of research topics and experiments from economists like Abhijit Banerjee, Esther Duflo, Michael Kremer, etc. Can you explain how this research has become so popular in recent years, and why this branch of economics plays a considerable role in the future of economic analysis?

A: Development Economics has borrowed heavily from medicine in the use of RCTs. Development economists often use RCTs by embedding them into people's usual lives. They also operate studies on a large scale, trying the same or similar programmes across multiple countries. Because of this, development economics is able to make very strong causal claims about a topic, whether it's the impact of health on education, or barriers to saving. I think this want to make causal claims has become increasingly valued in the field of economics more generally. Saying that though, there are still plenty of skeptics of the general findings that we can take away from RCTs, and its application to macroeconomics is not so solid.

Q: Tell us a bit about your more recent paper: "Household response to an extreme shock: Evidence on the immediate impact of the Covid-19 lockdown on economic outcomes and well-being in rural Uganda." What does the study cover and how do households respond to this loss of income due to pandemic lockdowns?

A: This study descriptively analyses the impact of the Covid-19 pandemic on rural households in Uganda. When the pandemic hit, and Uganda went into one of the strictest lockdowns in the world, my coauthor and I decided to look at how the households had fared. We hired a team of local enumerators who phoned 1,300 residents in May 2020. We found that the lockdown had pushed already extremely poor households further into poverty. We find that income falls 60% between March 2020 and May 2020, from $100 a month to only $40 a month for a family of 5. This drop in income is mainly driven by falls in enterprise profits and labour income, as businesses are forced to close and demand for workers dries up. Households use up nearly 50% of their savings, going from on average $120 to only $60 saved. They also double their borrowing, from $40 to $80. We also see that household happiness falls 25%, from 4 out of a 10 point scale to only 3. Overall, the study highlights how severely already vulnerable households were affected by the strict covid-19 lockdown in Uganda, at a time when Uganda had only a handful of covid-19 cases.

During our interview, Professor Riley also recommended two books for students looking to break into the subject of development economics, both written by Banerjee and Duflo: *Poor Economics and Good Economics for Hard Times, which are micro and macro-oriented, respectively. Professor Riley currently teaches Econ 491 (Issues in Development Economics) for undergraduates and Econ 593 (Topics on the Microeconomics of Development) for graduate students. She hopes to teach a class on experimental economics in the future, incorporating topics like RCTs, lab experiments, and microfinance into the coursework. If you would like to contact Professor Riley, you can reach her at erileyg@uw.edu or you can learn more about her research at htttp://emmaalriley.wordpress.com/.*

Sources for information in this article can be provided upon request

Earthquake Insurance in Western Washington

YEAN KIM

There is an 84% chance of a magnitude 7.0 earthquake rocking western Washington within the next 50 years. Of note is that only ~14% of homeowners in western Washington state possess earthquake insurance. My arguments in this article are that this coverage is inadequate compared to the risk of an earthquake and its respective projected damage, that at least some of this inadequacy in coverage is derived from irrational behavior, and that we should implement a policy that seeks to counteract this irrationality and elevate insurance adoption rates to a more optimal level.

There are two main lenses through which we can view this market wide adoption rate of earthquake insurance among homeowners. The classical lens would argue that individuals are rationally making decisions regarding their earthquake insurance coverage status by weighing the risk and magnitude of earthquake damage against the costs and benefits of attaining earthquake insurance, and then deciding to take the profit maximizing action. However, there is data suggesting that purely rational thought is not the only factor at play when self-determining insurance coverage in this case.

One such piece of evidence is the discrepancy seen between Canadian and Washingtonian homeowner insurance rates. We are seeing an adoption rate of earthquake insurance in British Columbia, where the Canadian government has actively aimed to make the hazards of foregoing earthquake insurance more widely known, sitting at a level of ~60% of homeowners in a region with similar earthquake risk, socioeconomic factors, and earthquake insurance policy structure. Additionally, 40% of commercial structures in WA have earthquake insurance, although the risk of severe damage to commercial structures in the most likely earthquake scenarios is similar to that of residential. Evidence from reactions to past natural calamities also shows that insurance purchases spike immediately after a devastating flood or earthquake takes place, but slowly returns to pre-spike levels over time, even though the risk of said natural disaster occurring often stays constant.

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The brain area being studied was the lateral intraparietal area (LIP), which is responsible for turning sensory inputs into motor actions. This means that the expected value consideration occurred before signals were sent out to facilitate eye movement. This step by step process suggests that the neurons in the LIP went through the steps of calculating utility. A follow up study demonstrated this, showing that the LIP is the physiological utility function for eye movement; it calculates expected utility for each decision and sends out motor signals for the one with the highest utility. However, it should be noted that this does not preclude other areas of the brain from being the utility function for other processes.

A second study by Heldmann (2009) combined neuroscientific and empirical economic methods. Traditionally, economists used lottery games or the bisection method to derive individual utility functions. In a lottery, a certainty equivalence is produced. This is the point where someone is indifferent to a sure payoff now, and a higher, but uncertain future payoff. In the bisection method, individuals are given a choice between two payoffs, and they give the quantitative difference in utility between the payoffs. The data gathered from these methods is used to calculate a utility function.

In the brain, the study measured event related potentials. These are electrical signals, and when a decision error is made, it sharply declines. This is called error-related negativity (ERN). ERNs can be used to derive a subjective value of a potential payoff. This study predicted that we would observe ERNs in the lottery method because a decision was made, whereas they would not be observed in the bisection method because there was no decision. If this is the case, then it suggests that there are different neural mechanisms underlying both of these methods.

Data supported this hypothesis. ERNs were observed for the lottery and the utility function was found to be concave, meaning it represented some level of risk aversion. The bisection method had little to no ERN activity, meaning there was no perception of risk associated with the description provided. However the utility functions were found to be mostly the same, having no statistically significant differences. The authors postulate the implications of this: the bisection method captures utility of money and the lottery combines utility and risk (probability). Therefore, if the bisection method is performed first, the utility function derived can be fed as an input into the lottery method, while the probability of winning is varied experimentally. This will allow future studies to calculate utility empirically and tease apart both components.

In summary, neuroeconomics represents an expanding and innovative interdisciplinary field. By using neuroscientific methods to record brain activity, it can shed light on utility theory and decision making, cooperation, and other behavioral processes. This will allow economic theories to be tested and validated empirically, and provide empirical backing for new and improved theoretical models.

Sources for information in this article can be provided upon request

Earthquake Insurance in Western Washington

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These pieces of evidence all lend credence to the suggestion that this earthquake insurance adoption rate is not the optimized coalition of all market individuals rational, cost benefit analysis. Instead, I am proposing that the resulting earthquake insurance adoption rate is inadequate, and that the decision to acquire earthquake insurance as a process is at least somewhat influenced by underlying irrational, behavioral issues. If we believe that this issue stems from some branch of behavioral economics, then we should craft a policy rooted in behavioral economics to promote the adoption of a more optimal level of household earthquake coverage.

I believe that a simple two-part policy could solve a portion of this overall suboptimal coverage rate while still remaining relatively uncontroversial and un-intrusive. The first part of this policy would be to ensure that earthquake insurance is bundled in by default with home-insurance. This subtle change of making an individual take the action to opt out of an option has shown great effect on the adoption rate of said option when compared against the scenario where the individual would have to take the action to opt in. Weighed against a rate of 85% of households maintaining home insurance, this could have a significant positive impact on the rate of earthquake insurance adoption, while still allowing for the same freedoms in the choice of earthquake insurance attainment.

The second portion of this policy would be of a more educational nature. This section of the policy would focus on ensuring that the individual is well informed on both the likelihood of an earthquake occurring as well as the potential cost in damages an earthquake may cause. This section would also aim to correct the erroneous line of thought held by many Washingtonians that the government would cover earthquake damage.

As the Washington state government has not imposed any significant policies in regards to earthquakes within the past 30 years, I believe that this proposed policy would be a great first step in ensuring that the citizens of Washington state are prepared as best as possible for the likely event of an earthquake in our region.

Sources for information in this article can be provided upon request

UPCOMING EVENTS:

Spring Quarter Events: In Spring Quarter the EUB will be hosting various events, such as the quarterly Paul Heyne seminar. Keep an eye out for them in your email.

Economics Tutoring: The EUB offers free tutoring every weekday at various times every quarter! Check the schedule on the EUB website to see tutoring times. If you need help with an upper level class, however, make sure you check the website to see which tutor can help.

Contribute to the Economizer: The Economizer will be seeking guest writers for our Spring Quarter issue. Interested writers should check their emails from the department in early Spring quarter for submission instructions.

Apply for the EUB: Applications for the 2022-23 Economics Undergraduate Board will open up next quarter. Submit your credentials to be considered for next year's EUB team, helping to improve the educational experience of students in the Economics Department.

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