Effects of Dopamine and Loss Aversion on Financial Decisions

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Making decisions is a part of life. People do it everyday, but not everyone understands how or why they make certain decisions. Adults always need to consider certain circumstances and understand the effects of each choice they are given. Economists quantify the different components of financial decisions, such as weighing the benefits and losses of each choice, to better understand why people choose certain choices over others. Once they analyze the benefits and losses of each choice, they can evaluate them and choose the best one. However, there are many factors that affect how people evaluate the different choices they are given, causing their decisions in the end to change. Studying the brain and certain principles of economics can help us understand what factors affect decisions and why people make certain risky or safe decisions. The level of dopamine, a neurotransmitter associated with reward processing, can lead some people to consider the potential costs (or benefits) of their choices more strongly than others. By understanding the effect of these different factors in explaining people's financial decisions, people can improve their decision making and help prevent themselves from being affected by negative factors such as biases that lead people to make costly financial decisions.

One such bias is loss aversion, which is the tendency for losses to have a greater impact than gains. In order to understand why adults make better or worse financial decisions, we can study the ways dopamine affects financial decisions related to loss aversion. Previous research suggests brain regions that are rich in dopamine, such as the ventromedial prefrontal cortex and the striatum, are known to process the value of losses during financial choices, which in turn shape whether someone is more or less averse to taking financial risks. However, what remains unknown is whether loss aversion and dopamine responses jointly or uniquely impact whether adults make riskier decisions in the future and or respond more cautiously. To address this gap in the literature, the current paper will review research papers on neurofinance to understand how loss aversion versus dopamine affect adults' financial decisions. Knowledge of the different effects of loss aversion and dopamine will help people gain a deeper understanding of the factors that help versus hurt adults' financial decision making. People will be able to prevent themselves from making costly decisions affected by biases and make more logical and beneficial decisions in the future.

Loss Aversion

For centuries, economists have studied how we make decisions in the face of uncertainty. Economist perspective is beneficial because it breaks down decision making into different components, focusing mostly on the tradeoff between benefits and costs. Economics analyzes and teaches us about people's wants and needs and how they get them. Making decisions is part of this because it affects what wants and needs they prioritize and how much of them they get. Having knowledge of economics helps us better understand the logical analysis of adults when making financial decisions. This will help us follow logical thinking and make more efficient decisions in the future.

According to the principle of economics, people seek benefits and avoid losses. However, loss aversion, the tendency for losses to have a greater impact than gains, affects how much risk we take when making financial decisions. Loss aversion will cause adults more prone to

avoid making losses in the future. They will consciously or subconsciously make less rewarding yet safer decisions due to not wanting to lose. Even if they do not win, they are satisfied with what they have as long as their situation does not worsen. This is why many people like to make safer decisions even if they are not completely rational. Instead of choosing the decisions that have the highest ratio of gains to losses, they will tend to choose the decision with the one of the lowest risks.

Dopamine

Although economics can teach us about efficiency and loss aversion, it is not enough to understand adults' financial decision making. If you were to predict how adults would make financial decisions on pure logic there would be many ways such as using marginal cost and benefit to estimate the value of different choices. Then you would just have to predict the choice that has the best incentive. However, this is based on assuming that they will make completely rational decisions. People, especially adults, are affected by many different factors when it comes to making decisions.

In order to understand the neuroscience behind adults' financial decisions, there are few different ways. However, understanding which parts of the brain affect how dopamine affects an adults' financial decision is one of the best ways because the level of dopamine sensitivity in the brain can increase the importance we place on our losses through a few different ways. The two most important parts of the brain when it comes to being affected by dopamine are the Prefrontal Cortex and the Striatum (Rick 2010). The Prefrontal Cortex is in charge of focus, anticipation, self-control, and planning. Meanwhile, the Striatum is in charge of responses and movement.

Dopamine will make people feel euphoria and feel good about themselves. It would be similar to taking drugs. After being affected, they can get addicted and continue to take risks to achieve a greater reward and experience the release of dopamine again. Although they will still maintain a level of rationality, their financial decisions will still be somewhat riskier in pursuit of a greater reward.

However this is not always the case. The two types of decisions they choose depend on their personalities. Some people have a higher amount of self-control than others. Even if adults are affected by dopamine, they may not necessarily be addicted to it. This will allow them to make more efficient financial decisions by taking less rewarding yet safer decisions. But although self control can help reduce the effects of dopamine, it will still cause adults to make somewhat riskier financial decisions,

Effect of Dopamine and Loss Aversion on Risky vs. Safe Financial Decisions

Before having the knowledge of economics and neuroscience, adults are still affected by dopamine and loss. The result of their previous decisions will have a substantial impact on how they make their future decisions. However, the effects of loss aversion and dopamine on risky/safe financial decisions are mixed. Some studies show that people make riskier financial decisions when affected by dopamine and loss aversion, while other studies show that people make safer financial decisions when affected by dopamine and loss aversion.. In this next section, we review the literature on dopamine processing of potential losses and loss aversion

with the goal of understanding whether loss aversion is more strongly related to riskier or safer financial decisions overall.

Effect of Dopamine on Financial Decisions

There have been many studies done in order to test how dopaminergic brain systems are associated with financial decision making. One such study was done on dopaminergic drug effects on probability weighting during risky decision making (Ojala et al. 2018). The 22 normal participants were given a sulpiride pill, which blocked dopamine receptors in the brain. Then, "participants made a series of hypothetical decisions between a sure amount of money (either a gain or a loss) and a gamble (either a pure-gain or pure-loss gamble). In each series of decisions, the gamble was fixed and the sure amount was iteratively adjusted to converge toward a certainty equivalent corresponding to the sure amount that felt subjectively equivalent to the gamble. There were 10 series of decisions (i.e., 10 different gambles) in the gain domain and 10 series of decisions in the loss domain". The dopaminergic drugs made the participants overweight low probabilities and underweight high probabilities. This shows that blocking dopamine receptors diminished the distortion of winning probabilities.

Another study examined whether risky decision making predicts dopamine release. "Rats had 10 s to initiate a trial via food trough entry, which extinguished the food trough light and extended either 1 (free forced choice) or both levers (free choice). Requiring rats to enter the trough located between the levers prior to decision-making reduced the likelihood of an enduring side bias that affected decision-making. The two levers were classified as a safe lever, which resulted in a single food pellet, and a risky lever, which delivered three food pellets with the risk of an immediate 1 s foot shock. Shock probability escalated across blocks (0%, 25%, 50%, 75%, and 100%). Each block began with eight forced choice trials in which a single lever was extended, with four risky and four safe trials presented in pseudorandom order. These trials served to establish the new block/risk level. Forced choice trials were followed by 10 free choice trials, which offered choice between the safe and risky levers. Upon lever press and pellet delivery/shock, levers retracted and the food trough light illuminated. After food was collected or 10 s passed, the food trough and house lights were extinguished and an intertrial interval (ITI, 10 ± 4 s) preceded the next trial. Failure to initiate a trial or press a lever within 10 s of instrumental activation resulted in the trial being marked as an omission and proceeding to the ITI" (Freels et al. 2020). Through this study, they found that there was a correlation between risky behavior and dopamine released in rats. The rats chose more risky levels when they were affected by increased amounts of dopamine. Overall, these studies help support the opinion that dopamine causes people to make more risky financial decisions, in part because some people show biases in valuing low probability gambles more than high probability gambles.

Effect of Loss Aversion on Financial Decisions

There have also been many studies to test how loss aversion affects the brain. One such study was done on the neural basis of loss aversion in decision making under risk (Tom et al. 2007). In the study, participants were given the choice to accept a 50/50 chance of either gaining or losing a certain amount of money. They were asked to "indicate one of four responses to each gamble (strongly accept, weakly accept, weakly reject, and strongly reject). In order to allow for separate estimates of neural responses to gains and losses, the sizes of the

potential gain and loss were manipulated independently, with gains ranging from $10 to $40 (in increments of $2) and losses ranging from $5 to $20 (in increments of $1)". The ratio of loss response to gain response was taken as loss aversion. The results showed that the median of loss aversion was 1.93. This means that the participants were resistant to 50/50 chances unless the reward was almost twice as much as the gain. However, they were unable to find why this happened until they finally noticed that brain regions including the striatum, VMPFC, ventral ACC, and medial OFC showed decreasing activity as the size of the potential loss increased. This helped us understand that the more activation in these brain regions, the more loss averse people were.

Another study looks at how Amygdala-prefrontal connectivity modulates loss aversion bias in anxious individuals (Xu et al. 2020). 56 healthy people were chosen to test the effects of loss aversion on decision making. "In this paradigm, participants were asked to make decisions of whether to gamble. The gamble in each trial was composed of one of 16 potential gains ranging from +¥20 to +¥50 (displayed in green), and one of 16 potential losses ranging from -¥20 to -¥50 (displayed in red), both varied in an increment of ¥2". "λ of HA was significantly higher than in LA (t *(43)* = 1.80, p = 0.04; indicating greater loss aversion". This study also showed that loss aversion caused the participants to make safer decisions. Overall, these two studies help support the opinion that loss aversion causes people to make less risky financial decisions, in part because neural sensitivity in reward processing regions decreases in the context of more losses.

Conclusion

Overall, both dopamine and loss aversion are two big factors that affect adults' financial decisions. Dopamine can cause adults to make riskier decisions for higher rewards in order to experience the feeling of euphoria caused by dopamine, whereas loss aversion can cause adults to make safer decisions for lower rewards in order to avoid losing. Both dopamine and loss aversion cause adults to make less rational financial decisions. Our analysis of the economics and neuroscience literature suggests that dopamine leads adults to make more risky financial decisions, while loss aversion makes adults tend to make fewer risky financial decisions. These results are important because by having more knowledge of neuroscience and economics and understanding how dopamine and loss aversion affect the financial decisions of adults, people can prevent themselves from being affected by other factors and biases and make more efficient financial decisions in the future.

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