

# Chapter 7

## Economic Decision Making, Emotion, and Prefrontal Cortex

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### ABSTRACT

*How diverse regions of the brain are coordinated to produce objective-directed decision is the essence of neuroeconomics. Indeed, the latter is a formal framework to describe the involvement of numerous brain regions including frontal, cingulate, parietal cortex, and striatum in economic and financial decision-making process. The purpose of this chapter is to explain the relationship between economic decision making and emotion on one hand, and the relationship between economic decision making and prefrontal cortex on the other hand.*

### INTRODUCTION

Understanding and explaining human decision-making process is approached differently in economics and neuroscience. For instance, traditional economic theory explains behaviour primarily through theoretical foundations such as utility, preferences, and axioms. On the other side, neuroscience considers the physiological aspects and somatic variables that affect decision-making. In recent years, neuroeconomics has emerged as a multidisciplinary research area that integrates knowledge from neuroscience, psychology, and economics to better understand economic decision-making and to specify more accurate models of choice and decision. Multiple options always characterize decisional situations by multiple options, each carrying potential rewards, risks and related outcome probabilities.

Therefore, real life decision making requires the ability to make decisions effectively. The purpose of the chapter is to explain the relationship between economic decision making and emotion on one hand, and the relationship between economic decision making and prefrontal cortex on the other hand. In particular, based on a brief literature review, we aim to present the role of psychological factors, especially emotions, in economic decision making and presenting cortex regions involved in financial decision making. We essentially focus on physiological and neuroimaging aspects of economic and financial decision making. The chapter is organized as follows. Section 1 focuses on economic decision making and emotion. Section 2 covers economic decision making and the prefrontal cortex. Section 3 provides directions for future works as suggested in the literature. Section 3 presents the Conclusion.

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## Economic Decision Making and Emotion

Classical and neoclassical economics states that decisions are made based on valuable information and cost-benefit analysis. In particular, the main purpose in making a decision is to maximize the gains or outcome expected value expressed as a linear multiplicative relationship between probability and utility. Basically, classical economic theory assumes that all agents are aggregating and weighing information accurately and consistently. However, in real life problems, individuals have not been found to make decisions following a normative model (Beach & Lipshitz, 1993). In addition, human decision making process is affected by heuristics, biases, and framing effects (Tversky & Kahneman, 1974). More importantly, it involves psychological factors; especially emotions (Bechara et al., 2000; Bechara et al., 2002). Therefore, classical economic theory fails to explain human behaviour and decision-making.

Several psychological biases have been proposed in economic literature to explain economic decision making process including theory of beliefs (Barberis & Thaler, 2003), belief perseverance (Barberis & Thaler, 2003; Rabin, 1998), confirmatory bias (Rabin, 1998), overconfidence (Barberis & Thaler, 2003), optimism (Barberis & Thaler, 2003), representativeness (Barberis & Thaler, 2003; Kahneman, 2003), prototype heuristics (Kahneman, 2003), law of small numbers (Rabin, 1998), conservatism (Barberis & Thaler, 2003), anchoring and adjustment (Barberis & Thaler, 2003; Kahneman, 2003; Rabin, 1998), and availability biases (Barberis & Thaler, 2003; Kahneman, 2003). They are described in Table 1.

However, the most studied factor is emotion. Indeed, According to Somatic Marker Hypothesis (Bechara et al., 2000; Bechara et al., 2002), decision-making is a process guided by emotions. It provides a neuroanatomical and cognitive framework for decision-making and suggests that the process of decision-making depends on neural substrates that regulate homeostasis, emotion, and feeling. In order to investigate decision making process in neuroeconomics, a series of brain imaging modalities are used to record electrical activity and metabolic activity of the human brain including electroencephalograph (EEG), transcranial magnetic stimulation (TMS), functional magnetic resonance imaging (fMRI), and positron emission tomography (PET). These modalities help understanding and explaining neurobiological mechanisms of the decisional process (Pradeep, 2010). Indeed, at anatomical level, neuronal activation

*Table 1. Biases in financial decision making*

Biases	Description
Theory of beliefs	How agents form their expectations in the market
Belief perseverance	People form their own hypotheses and are likely to less attentive to information which contradicts their hypotheses
Confirmatory bias	People are influenced by initial judgements. They tend to use information to affirm their initial hypotheses
Overconfidence	Estimated quantities or probabilities are affected by overconfidence
Optimism	People's unrealistic positive view about themselves
Representativeness	People tend to determine something by the characteristics of the group or class to which it belongs.
Prototype heuristics	Broader view of the representativeness heuristic
Law of small numbers	People exaggerate the behaviour of small samples
Conservatism	Hesitation of many investors to act on new information
Anchoring and adjustment	Values are estimated similar to the initial values of uncertain quantities
Anchoring and adjustment	Probability of an event is estimated based on memories and personal experiences

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