CHAPTER I INTRODUCTION

1.1.Background

The development of digital technology and distributed computing has driven significant transformations in the global financial system, one of which is through the emergence of cryptocurrencies as digital assets based on blockchain technology that is decentralized. Since its introduction by Nakamoto (2008), cryptocurrencies have developed not only as an alternative medium of exchange, but also as investment instruments with complex and dynamic risk characteristics [3]. In the past decade, the cryptocurrency market has shown rapid growth in terms of market capitalization, trading volume, and global investor participation, which makes it one of the digital finance segments with the highest level of uncertainty [5],[12].

As the adoption of cryptocurrencies as an investment asset increases, price volatility is becoming a key characteristic that distinguishes it from traditional financial instruments. Empirical studies show that cryptocurrencies have significantly higher volatility than conventional stocks, bonds, and commodities, and exhibit patterns of extreme fluctuations that are difficult to predict [4],[10]. This high volatility reflects market volatility and increases investors' risk exposure to sharp price movements in a short period of time.

In Indonesia, the growth in the number of cryptocurrency investors also shows a significant trend, especially among retail investors and the younger generation. Cryptocurrencies are becoming one of the most in-demand digital investment instruments, although most investors still have limited risk literacy and an understanding of volatility management [2]. This condition increases the potential for speculative and immeasurable investment decision-making, especially in markets with high volatility and sensitivity to global sentiment.

Cryptocurrency volatility is not only influenced by fundamental economic factors, but also by market sentiment dynamics, regulatory policies, blockchain technology innovations, and external events of a global nature. Recent research shows that crypto volatility is heterogeneous between assets and changes significantly over different time horizons, so a one-time scale approach is not able to comprehensively represent risk [8].

Recent literature emphasizes that cryptocurrency volatility is multi-scale, where short, medium, and long-term risks have different characteristics and are influenced by market mechanisms that are not always the same [17]. Investors with different investment horizons will face different levels of risk despite investing in the same asset. Therefore, volatility analysis that considers different timescales is important in managing the risk of digital asset investments.

In addition, distribution-based research shows that cryptocurrency returns often have asymmetrical distributions and contain significant tail risk, so average-based approaches are less representative for measuring extreme risk [19]. In this context, the quantitative approach is increasingly being used because it is able to capture risk dynamics at the extremes of the distribution, particularly in volatile market conditions.

A number of recent studies have developed multi-scale and quantitantile-based predictive models of volatility, such as the integration of cross-scale volatility components with time-varying quantitial spillovers [20] as well as quantity-based probabilistic forecasting approaches to cryptocurrency volatility [30]. Although these methods perform well in the context of prediction, most approaches are still complex, difficult to interpret, and less applicable to retail investors and decision support systems that require transparency.

On the other hand, systematic reviews and literature reviews show that most cryptocurrency volatility research still focuses on modeling and forecasting, while descriptive-quantitative and easy-to-implement approaches to investment risk classification are still relatively limited [31]. In fact, clear and data-driven risk classification is an important component of rational investment decision-making, especially for novice investors.

The selection of Bitcoin (BTC), and Ethereum (ETH), as the object of the study, was based on the difference in the volatility characteristics and market structure of the two assets. Bitcoin has the largest market capitalization and is often used as a benchmark for the overall condition of the cryptocurrency market [13]. Ethereum exhibits more dynamic volatility due to the intensive network activity and smart contract ecosystem, so these two assets represent two different but complementary characteristics of cryptocurrency risk [14].

Based on this exposure, a quantitative approach is needed that is not only able to measure volatility, but also classify the risk level of cryptocurrency investments in a systematic, transparent, and easily interpretable manner. The integration of the concept of multi-scale volatility with a quantitative approach offers a relevant framework for describing investment risks over different time horizons without relying on specific distribution assumptions [9].

This research aims to develop a volatility-based cryptocurrency investment risk classification framework by integrating multi-scale analysis and quantitil approaches. Different from predictive studies that are complex and black-box, this study emphasizes methodological transparency and ease of implementation as a risk decision support system. Thus, this research is expected to fill research gaps and make academic and practical contributions to digital asset risk management.

The urgency of this research is increasing along with the growth in the number of cryptocurrency investors, especially novice investors who are often exposed to high volatility risks without an adequate understanding of risk management [11]. Many novice investors make transactions based on market sentiment or short-term trends without understanding the level of volatility inherent in cryptocurrency assets. With the increasing number of cryptocurrency investors, especially retail investors and the younger generation, the need for an understanding of digital investment risks is becoming increasingly important. This condition can increase the potential for losses due to extreme price fluctuations. Therefore, a risk analysis approach is needed that is able to describe the level of market volatility in a systematic and easy-to-understand manner. This research aims to develop a volatility-based cryptocurrency investment risk classification framework that can be used as a risk mitigation tool for investors in understanding the dynamics of the cryptocurrency market. Thus, this research is expected to make an academic contribution to the development of digital asset risk assessment as well as a practical contribution in the form of a volatility-based risk classification framework that is easy to understand and can be used as a basis for more rational investment decision-making.

1.2. Problem Formulation

Based on the background that has been described, the formulation of the problem in this study is as follows:

1. What are the characteristics and differences of the volatility of Bitcoin and Ethereum cryptocurrencies over different time horizons based on the multi-scale volatility approach?
2. How do you apply the multi-scale volatility approach in measuring and comparing the risk levels of Bitcoin and Ethereum investments over the short, medium, and long term horizons?
3. How can the quantile method be used to classify and differentiate the risk levels of volatility-based Bitcoin and Ethereum investments in an objective and easily interpretable way?

1.3. Research Objectives

This research aims to:

1. Measure and analyze the volatility of Bitcoin and Ethereum cryptocurrencies over various time horizons using a multi-scale volatility approach.
2. Applying a multi-scale volatility approach to describe the risk characteristics of Bitcoin and Ethereum investments over short, medium, and long term horizons.
3. Classifying the risk levels of Bitcoin and Ethereum investments based on volatility using the quantitative method as an easy-to-interpret risk classification framework that can be used as a support for investment decision-making.

1.4. Research Benefits

The expected benefits of this study are as follows:

1. **Academic Benefits**

   Contributing to the development of digital asset risk analysis studies, particularly in the context of volatility and cryptocurrency risk classification.

2. **Practical Benefits**

   Provides an easy-to-understand cryptocurrency investment risk classification framework that can be used as a decision-making guide for novice investors.

1.5. Research Limitations

In order for the research to be more focused, the limitations of the problems in this study are as follows:

1. The study only analyzed two cryptocurrencies, namely Bitcoin (BTC), and Ethereum (ETH).
2. Investment risk is measured based on price volatility, without directly considering fundamental factors or market sentiment.
3. The research does not discuss price prediction or portfolio optimization, but rather focuses on the classification of investment risks.