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The Impact of Gold Returns, Bitcoin Returns, and Rising Food Price on Hedging Capability Against Education Costs in Indonesia

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Abstract: This study investigates the effectiveness of gold and Bitcoin as hedging instruments against the rising costs of education and food inflation in Indonesia. Using data from 2009 to 2024, the research employs descriptive and correlational quantitative methods, incorporating volatility analysis and hedging effectiveness models such as the Sharpe ratio and Value-at-Risk. Gold demonstrates stability and consistent performance as a hedge against inflation in education costs, while Bitcoin, despite its volatility, shows potential as a speculative alternative. Food price increases are shown to significantly impact education costs, and this study highlights the need for effective investment strategies to counteract these economic challenges. The findings contribute to a deeper understanding of gold and Bitcoin's roles in mitigating specific forms of inflation, particularly in critical sectors like education and food.

Keyword: Gold, Bitcoin, Inflation, Education Costs, Hedging, Food Prices

INTRODUCTION

A good education is needed to improve human resources in Indonesia; thus people can compete globally. The quality of education in Indonesia has also been concerning lately. This is due to several problems in the education system in Indonesia. Various educational problems are high education costs, low quality of education, education budget problems, and uneven education. The main problem of education in Indonesia is the high cost of education. Schools and universities, which were originally public services, shifted towards privatization of education which led to commercialization. The community spent high cost to receive education level start from Kindergarten (TK) to Higher Education (PT) which contributed to the phenomenon of high dropping out of school among Indonesian children (Afrah, 2023).

According to an article citing Badan Pusat Statistik (BPS) statistical data, education costs grow by 10% to 15% every year (Sarah, 2021). Education must be affordable and accessible to all levels of society, especially the poor (Idris, 2010). The cost of higher education does not only occur in public and private schools or colleges. For example, at the basic education level, even though the government has provided BOS funds to public elementary and junior high schools, most people in the lower middle class still feel that the funds are

insufficient to meet the cost of education, especially the basic operational costs that must be borne by parents and guardians of students (Ferdi, 2013).

Tuition fees are one of the components of instrumental input that is very important in the implementation of education (Dedi Supriadi, 2010). Tuition fees are the entire financial sacrifice incurred by consumers (parents of students or students) for the needs of their education from the beginning to the end of education. Whether it is registration fees and credits per semester, building construction donation costs, student welfare and facilities fund (DKFM) per semester, and other tuition fees which include the cost of developing and financing curricular and extra-curricular activities, equipment book fees, state exam fees, and other education fees used to support lectures (Lupiyoadi and Hamdani, 2012).

Investment comes from the word invest which means to plant, invest or plant money. Based on the Great Dictionary of the Indonesian Language (KBBI), investment is defined as investing money or capital in a company or project for the purpose of making a profit. Investment is the placement of a number of funds at this time with the aim of obtaining a number of profits in the future (Herlianto, 2008:1).

According to (Tandelilin, 2010: 3) investment is defined as a commitment of a certain amount of money or other resources that is made today in the hope of obtaining benefits in the future. Investment is a form of postponement of current consumption to obtain consumption in the future, where it contains an element of uncertainty risk so that compensation for the delay is needed (Martalena and Malinda, 2011: 1). Investment is an investment of a certain amount of funds at this time (*present time*) to get greater results (*higher benefit*) in the future (*in future*). Currently, there are various forms of investment that can be found, including real assets such as land, buildings and precious metal gold.

Gold is a precious metal as one of the most widely used real assets as an investment medium for investors because the value of gold is relatively always rising and more liquid. Another advantage of gold is that the price of gold is relatively flexible and follows the flow of inflation, which means that if inflation occurs high enough, the price of gold will increase following the inflation that occurs (Syafputri, 2012). Making gold as an investment instrument is a fairly interesting action because the price of the gold commodity, if expressed in rupiah, has been proven to always increase continuously. Investing in gold is also fairly minimal risk because the commodity is always in tune with the flow of the inflation rate so that if the inflation situation that occurs is very high, causing the price of the gold commodity to follow and also soar. This is the same when inflation decreases, the price of gold also falls. Gold prices generally tend to always increase and their value is not so significant if they decline (Salim, 2010).

Cryptocurrency It comes from a combination of 2 words, namely "cryptography" which means secret code, and "currency" which means currency. Bitcoin is one of the many cryptocurrencies that exist. Bitcoin was created with the aim of becoming an alternative to fiat currencies that in fact have purchasing power (*purchasing power*) Fiat currency, continues to decline year after year. However, in terms of prices, it will fluctuate greatly from time to time depending on how the market assesses that the point can rise sharply and can also fall sharply. Bitcoin to *cryptocurrency* The first then offers peer-to-peer transactions in which two or more people can transact in the world at a faster and cheaper cost compared to the traditional financial system. Bitcoin was launched in a whitepaper titled "Bitcoin: A Peer-to-Peer Electronic Cash System" (2008).

Since 2019 bitcoin has been declared legal by the Futures Exchange Supervisory Board, and through the Commodity Futures Trading Supervisory Agency of the Ministry of Trade (BAPPEBTI). The Head of BAPPEBTI said, there are 229 *cryptocurrency* which is legal in Indonesia, and Bitcoin is one of the *cryptocurrency* tradable. This recognition is stated in the Regulation of the Commodity Futures Trading Supervisory Agency Number 7 concerning the

Determination of the List of Tradable Crypto Assets. This regulation has been in effect since December 17, 2020.

The price of food commodities is greatly influenced by the stability of demand and supply distribution. Commodity prices often fluctuate due to several factors, namely, the production of staples experiencing crop failure due to weather, pest disturbances, and factors that will disrupt the development of basic commodity prices will interfere with the course of distribution. In Indonesia, the price of food commodities that often experience price fluctuations include rice, corn, soybeans, wheat flour, sugar, cooking oil, onions, chilies, eggs, meat and milk. Commodity price movements can be used as a *leading indicators* inflation. Inflation is defined as a general and continuous increase in prices. Some of the reasons are first, commodity prices are able to respond quickly to shocks that occur in the economy in general, such as increased demand (*aggregate demand shock*). Both commodity prices are also able to respond to non-economic shocks, such as floods, landslides and other natural disasters that hamper the distribution channels of these commodities. Bank Indonesia's ability to mitigate factors that play a role in the formation of inflation is a prerequisite for the success of inflation control efforts.

This study aims to analyze how investment return of Gold and Bitcoin as hedge against high inflation of education cost, comparing the return of Gold and Bitcoin in the context as hedge of education cost, and rising of food price as indicator of inflation, and indirect effect on high education cost.

METHOD

This study is a descriptive quantitative research with a correlational approach. This study aims to identify the relationship between the return on investment of gold and Bitcoin to the increase in food prices and education costs in Indonesia during the period 2009–2024.

The population for this study includes data on the prices of gold and Bitcoin, food inflation, and education costs in Indonesia from 2009 to 2024. The sample consists of time series data covering the prices of gold, Bitcoin, foodstuffs (such as rice, sugar, and cooking oil), and tuition fees at higher education institutions in Indonesia.

This study utilizes secondary data obtained from several reputable sources. Gold prices are retrieved from PT ANTAM Tbk. and GoldPrice.org, while Bitcoin price data are sourced from CoinMarketCap and INDODAX. Food inflation and education cost data are collected from the Central Statistics Agency (BPS) and Bank Indonesia reports. Tuition fee data are gathered from the Ministry of Education and Culture (Kemendikbud) and financial statements of public and private universities.

Data analysis is performed through descriptive analysis, correlation and regression tests using linear models, volatility analysis using the GARCH model, and hedging effectiveness analysis via the Sharpe ratio and Value-at-Risk (VaR) model. Data are initially processed using Microsoft Excel, while SPSS is employed for descriptive and regression analysis.

RESULTS AND DISCUSSION

Gold investment returns

Investment is the allocation of capital into instruments that are expected to provide profits in the future. Modern portfolio theory (Markowitz, 1952) and *the Capital Asset Pricing Model* (CAPM) will be used as the theoretical foundation for analyzing the risks and returns of precious metals and Bitcoin. Precious metals such as gold and silver are often considered safe *haven* investments, especially in times of economic uncertainty and inflation (Baur & McDermott, 2010). The performance of precious metals is typically affected by factors such as political instability, global economic crises, and inflation. Precious metals tend to have a negative correlation with risky assets such as stocks when the market experiences high

volatility (Ghosh, et.all, 2004). Therefore, many investors use precious metals as *a hedge against inflation, including against rising food prices and education costs.*

Bitcoin investment return

Bitcoin, as the first *cryptocurrency*, has gained widespread attention as an investment instrument. Despite its high volatility, Bitcoin has shown potential as a hedge against inflation in several studies, especially in countries with unstable monetary policies. Bitcoin has unique characteristics as a decentralized asset and is often considered "*digital gold*". In the context of hedging, several studies show that Bitcoin can serve as a tool to fight inflation and fiat currency fluctuations (Bouri, 2017). However, the high volatility in the price of Bitcoin also creates uncertainty. However, more and more investors are starting to see Bitcoin as an alternative hedge against the decline in purchasing power due to inflation that has an impact on food and education costs (Cheah, 2017).

Increase in Education Costs in Indonesia

The cost of education, especially at the higher education level, continues to increase in Indonesia. The main causes of this increase in costs include inflation in the service sector, increased demand, operational costs of educational institutions, and government policies related to higher education (Baum, 2017). This study will use data from the Ministry of Education and Culture as well as financial reports of universities in Indonesia. Families and individuals are facing an increasing financial burden, and are therefore looking for investment instruments that can offset the increase. Precious metals and digital assets such as Bitcoin are often considered as instruments to overcome these gains through hedging strategies (Perna, 2006).

Rising Food Prices in Indonesia

Rising food prices are one of the main economic problems in Indonesia. Some of the factors that affect the increase in basic food prices include climate change, production costs, distribution costs, government policies, and global market dynamics (Abbot, 2011). This research refers to data from the Central Statistics Agency (BPS) related to the increase in basic food prices and annual inflation in Indonesia. Rising food prices have a direct impact on inflation, which can erode people's purchasing power. In the face of inflation driven by rising food prices, investors often look for assets that are able to maintain value or offer returns higher than the inflation rate (Headey & Fan, 2008).

Previous research

Table 1. Previous research related to the topic of investment returns on precious metals, Bitcoin and rising Food and Education Costs

No	Researchers	Research Title	Variables Studied	Research Results	Key Takeaways
1	Baur & McDermott (2010)	*Is gold a safe haven? International evidence*	Gold as a hedge, global market volatility	Gold has a negative correlation with risky assets during economic uncertainty and financial crises.	Gold is an effective hedge during the global economic crisis.
2	Ghosh et al. (2004)	*Gold as an inflation hedge?*	Gold, inflation, real yields	Gold is proven to protect wealth from inflation in the long run.	Gold is an asset that can be used as a hedge against inflation.
3	Bouri et al. (2017)	*On the hedge and safe haven properties of Bitcoin*	Bitcoin, volatility, diversification, inflation	Bitcoin can serve as a diversification and hedging tool during several periods of crisis.	Bitcoin has the characteristics of hedging, but with high volatility.

No	Researchers	Research Title	Variables Studied	Research Results	Key Takeaways
4	Cheah & Fry (2015)	*Speculative bubbles in Bitcoin markets?*	Bitcoin, speculation, market volatility	Bitcoin shows the existence of a high speculative bubble, with significant volatility.	Bitcoin has a high speculative risk, but it is still attractive as an investment.
5	Abbott et al. (2011)	*What's driving food prices in 2011?*	Food prices, inflation, global economic instability	Food prices have risen significantly due to global economic instability	The increase in food prices contributes to inflation which has an impact on people's purchasing power.
6	Klein et al. (2018)	*Bitcoin is not the New Gold – A comparison of volatility, correlation, and portfolio performance*	Bitcoin, gold, volatility, correlation, portfolio performance	Bitcoin has much higher volatility than gold and does not always act as a safe haven	Bitcoin and gold show significant differences as hedging instruments.
7	Baum et al. (2017)	*Trends in student aid 2017*	Tuition fees, inflation, financial ability	The cost of education continues to rise, creating a financial burden for many families.	The rise in education costs demands investment solutions to protect purchasing power.
8	Perna & Thomas (2006)	*A gap in affordability of higher education for minority students*	Tuition fees, inflation, education accessibility	Rising education costs lead to education accessibility gaps	Inflation in the cost of education affects people's economic ability in the long run.

The research gaps that emerge are as follows:

1. There is no specific focus on rising food prices and education costs as a specific form of inflation. Most research is still focused on general inflation or stock market volatility.
2. The analysis is limited to comparing gold and Bitcoin to the stock and bond markets without considering the impact of sectors such as food and education that are relevant to people's needs.
3. The lack of exploration of Bitcoin in the education and food inflation sectors, where the high volatility and characteristics of Bitcoin as a speculative asset have not been examined in this context.
4. Long-term research on gold as a hedge against education or food inflation has not been deepened, although gold has proven to be an effective hedge in general.

The statistical research gap listed in the table below provides an overview of previous research, and shows that there is a gap for further research that focuses more on the influence of gold and Bitcoin on inflation in the food and education **sectors**, which are currently still underserved by the academic literature.

Table 2. The statistical research gap on gold, Bitcoin, rising food and education costs

No	Aspects Studied	Number of Journals Discussed (n = 5)	Percentage (%)	Research Gap
1	Gold as a hedge against general inflation	5	100%	There is no specific focus on rising food prices and education costs. Research is still limited to general inflation.
2	Bitcoin as a hedge or diversification tool against the stock and bond markets	4	80%	There has been no research that specifically examines Bitcoin as a hedge against inflation in the food/education sector.
3	Analysis of gold as a safe haven during economic uncertainty	3	60%	There was no discussion about the education and food sectors in the context of specific inflation.
4	Comparison of gold and Bitcoin as a hedging instrument against the stock market	3	60%	The research still focuses on the stock market, not addressing specific inflation sectors such as food and education.
5	The effect of gold on inflation in the food sector	0	0%	There is no study that specifically discusses gold as a hedge against rising food prices.
6	Bitcoin's influence on inflation in the food sector	0	0%	There has been no research that focuses on Bitcoin as a hedge against rising food prices.

No	Aspects Studied	Number of Journals Discussed (n = 5)	Percentage (%)	Research Gap
7	The influence of gold on the increase in education costs	0	0%	There is no journal that discusses gold as a hedge against rising education costs.
8	Bitcoin's influence on rising education costs	0	0%	No journal specifically examines Bitcoin in the context of education cost inflation.

- 100% of the journals reviewed discussed gold as a hedge against general inflation, but 0% focused on specific inflation in the food or education sectors.
- 80% of journals discuss Bitcoin in the context of the stock and bond markets, but none focus on the food or education sectors as a specific form of inflation.
- No journal (0%) specifically discusses Bitcoin and gold as a hedge against rising food prices and education costs.

Influence between variables

A. The Effect of Gold return on Food Increases

Gold, have long been recognized as an effective hedge against inflation. When food prices rise due to various factors such as supply disruptions, climate change, or rising energy prices, people's purchasing power is eroded. Precious metals yields are often positive during periods of high inflation, including rising food prices, as investors turn to gold as a safe haven asset to hedge their assets from currency depreciation and commodity price fluctuations (Baur, 2010).

Gold has a strong correlation with inflation, especially in commodities that have experienced sharp increases, including food. This happens because gold is not directly affected by the increase in the price of basic commodities, but is influenced by overall inflation expectations that drive demand for precious metals (Gosh, 2004).

B. The Effect of Precious Metal Yields on the Increase in Education Costs

Capie (2995) stated that the increase in education costs is also closely related to inflation, especially in the service sector and infrastructure spending. As with food prices, precious metals can be used as a hedge against rising education costs because gold tends to maintain its value over the long term and shows good performance when inflation occurs. Families who set aside funds in gold can hedge their wealth from rising education costs that often outpace the general rate of inflation. By storing assets in the form of precious metals, investors can protect their purchasing power when the cost of education increases, providing better financial stability to face large expenses in the future (Lucey, 2015).

C. The Effect of Bitcoin Yields on the Increase in Food Stocks

Bitcoin as a digital asset is just starting to attract attention as a hedging tool, mainly due to its decentralized nature and limited supply. During periods of inflation or rising food prices, some investors choose Bitcoin as an alternative asset to protect their wealth. Bouri (2917) states that in some cases, Bitcoin shows a negative correlation with traditional assets, so it can serve as a portfolio diversification. However, Bitcoin's extremely high volatility makes it less predictable as a short-term hedge against rising food prices. Bitcoin price fluctuations can be very extreme, so while they have the potential to provide high returns, the risks are also great (Cheaeh, 2015).

D. The Effect of Bitcoin Yields on the Increase in Education Costs

Bitcoin can be used as a speculative asset and an alternative to hedge against rising education costs. Bitcoin's unaffected nature of fiat currency inflation makes it attractive to

investors who want to protect assets from declining purchasing power. However, Bitcoin is more suitable for investors who have a high risk tolerance, given its extreme price fluctuations (Klein, 2018). Bitcoin's yield in the long run can be significant, and some people invest in Bitcoin as a form of preparation for future big expenses, including education costs. However, Bitcoin's price volatility makes it riskier than the more stable precious metal and has long been recognized as a hedging instrument (Corbert, 2018).

Conceptual framework

Based on the formulation of the problem, systematic literature review, and discussion of relevant research, the conceptual framework below is obtained

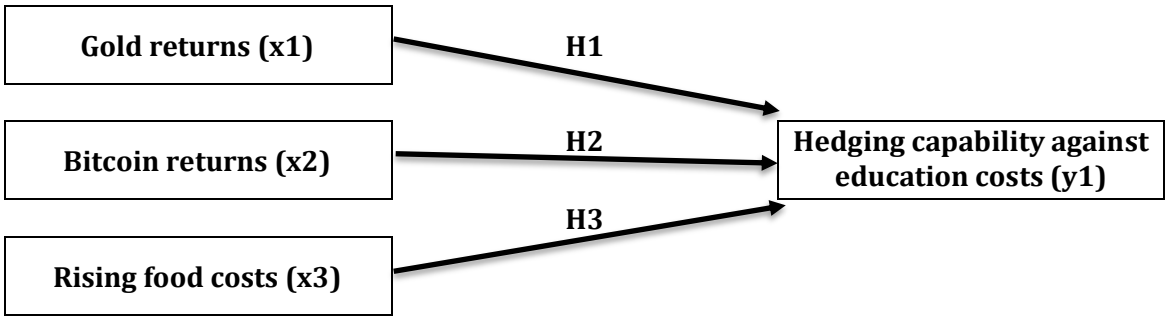

Figure 1. Conceptual Framework

Based on Figure 1. explained the conceptual framework identifies relationship between gold returns, Bitcoin returns, and food prices increases concerning their effectiveness against rising education costs in Indonesia

- Gold returns (x1) are assumed to have a negative correlation with rising education costs, reflecting its traditional role as a hedge during inflationary periods. Golds suggesting can be used to hedge against inflation caused by education price increases (Capie 2005, Baur 2010, Bouri 2017).
- Bitcoin returns are assumed to have an influence on education costs, but with more uncertainty and volatility than Gold. Bitcoin is hypothesized to influence education cost, representing a modern, high-risk hedging alternative. While there is a potential for high returns, the risks are also significant (Ghoosh 2004, Klein 2018).
- Rising food costs have a negative effect on hedging capability against education costs. An indirect contributor to inflationary pressure on educational costs, highlighting the interconnectedness of food and education costs.

CONCLUSION

The study concludes that gold remains a reliable hedge against rising education costs due to its stability and inflation-resilient. Bitcoin, while offering high returns, requires cautious consideration given its volatility. Rising food prices indirectly amplify education costs, emphasizing the interconnected nature of inflationary pressures. Effective investment strategies leveraging both traditional (gold) and modern (Bitcoin) instruments are essential to mitigate these economic challenges. This research underscores the importance of tailored financial tools to address inflation in critical sectors like education and food.

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