

The Impact of COVID-19 Pandemic on Gold Price: From Ultra-Short-, Short- and Medium-Term Perspectives Respectively

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Abstract. As the coronavirus pandemic spreads, it is not just people's health is threatened, but the financial market as well. In particular, policies such as segregation, embargoes, etc. broke the relationship between supply and demand in the market and the depressed economy caused investors to lose confidence. The fear of infection during the COVID-19 pandemic led investors to favor the purchase of financial assets with safe-haven and hedging properties, such as gold. In this article, the daily, weekly, and monthly prices of gold per troy ounce in US Dollars from January 1, 2010, to February 24, 2022, were extracted and analyzed. Three ARIMA models were applied in the study to predict the gold prices based on the assumption of no pandemic exists. And comparing the fitted values with the actual ones. The study analyzes the impact of Covid-19 on gold price performance from three perspectives. An ultra-short-term analysis is from January 24 to February 6 based on the model built by the daily dataset. A short-term one from January 24 to March 8 according to the weekly constructed model. And a medium-term comparison from January 2020 to July 2020 with the monthly dataset. Additionally, the possible reasons to explain the result are provided to help different investors make decisions.

Keywords: Gold price, COVID-19.

1. Introduction

Due to the physical properties of gold as one of the densest metals and easy to store, gold has been a kind of currency in the financial market since ancient times. As a hard currency, gold is often used by investors as a safe-haven asset to hedge against the risks and uncertainties associated with other financial investment options. This is because the factors that negatively affect general stocks, bonds, and other financial assets are often good news for the price of gold, such as wars, high inflation expectations, a decline in the U.S. Dollar Index, and so on. Taking inflation as an example, the possibility of real returns being lower than expected can diminish the buying power of currencies and the value of investments [1]. As a result, investors, portfolio managers, and governments aim to effectively handle and safeguard against purchasing power risks [1]. In the long run, Covid-19 brings with it rising and fluctuating inflation rates. The daily inflation density peaks around June 1, 2020, at about 4.25 percent, while this value in January 2020 was approximately 3 percent [2]. According to a report from the World Gold Council in 2017, there is a correlation where a 1% increase in inflation leads to a 2.6% surge in gold demand [1]. This clearly demonstrates that gold can serve as a protective measure against the risk of losing purchasing power [1].

Because of new variant viruses, vaccine development, and policy development, the Covid-19 pandemic brought great uncertainty, and the resulting economic impact dramatically altered individuals' investment perceptions and behaviors. In 2020, the IMF assessed that the global economy experienced a contraction of 4.4%, which was described as the most severe decline since the Great Depression of the 1930s [3]. The significant economic downturn was leading to widespread disruptions and challenges across the world. However, an interesting result derived by Muhammad Shadab Iqbal and Lin Li is that people did not become more risk-averse as anticipated by the numerous uncertainties caused by Covid-19 [4]. Consequently, the future trajectory of gold prices remains uncertain. To address this uncertainty and offer pertinent guidance to investors and organizations, this article assesses the impact of the pandemic on gold prices from three different timeframes: ultra-short-, short-, and medium-term. By doing so, it aims to help investors and

organizations steer clear of irrational investments or strategies that may arise due to the unpredictable nature of the market.

The remainder of this paper is organized as follows: it begins by providing details about the data source and its stability. Next, it discusses the ARIMA models used in the analysis and presents a comprehensive examination of the results concerning the influence of Covid-19 on gold prices. Lastly, the final conclusion is briefly stated.

2. Research Design

2.1. Data Source

The study extracted daily, weekly, and monthly gold closing prices per troy ounce in US Dollars from January 1, 2010, to February 24, 2022, from World Gold Council. Gold, being considered a safe haven asset, experiences a price surge and holds the potential for a promising future due to the ongoing war between Russia and Ukraine [5]. Therefore, the rationale for halting data collection till February 24, 2022, in this research is to avoid the influence of the war on gold prices. Data processing is required to figure out the impact of Covid-19 throughout the world on gold price fluctuations in ultra-short, short, and medium periods respectively. The daily, weekly, and monthly gold prices are transformed by the formula $\ln(1 + \text{price})$. With this logarithmic scale, Stata was used to analyze the data and construct models for further exploration.

2.2. Weak Stationarity Test: ADF

The first step before constructing the model is testing whether the data is stationary or not through Augmented Dickey–Fuller (ADF) Unit Root Test. According to the test result in Stata, the p-values in Table 1 for all daily, weekly, and monthly gold prices are large. It represents there is not enough evidence to reject that these variables have a unit root. In other words, the raw data is not stationary to build the model directly. Trying to take different orders of difference of the variables is needed and testing the unit root again until the dataset is stationary. In Table 1, all variables of the first-order difference and the second-order difference have p-values of 0, which are considered stationary datasets. However, for a better determination of the order of AR and MA in the following step, the second-order difference is chosen to use.

Table 1. Weak stationarity test

Variables	t-statistic	p-value
Raw		
Daily	-2.039	0.5799
Weekly	-2.087	0.5535
Monthly	-1.432	0.8513
1st order difference		
Daily	-36.526	0.0000
Weekly	-15.963	0.0000
Monthly	-9.060	0.0000
2nd order difference		
Daily	-63.190	0.0000
Weekly	-26.062	0.0000
Monthly	-15.087	0.0000

2.3. ARIMA Model

The ARIMA model is very similar to the ARMA model but with an additional order of difference, which is determined by 2 in all three models. And ARMA is combined with two sections, AR and MA. The general expression of $AR(p)$ is shown in equation (1). It estimates the future gold price by applying the past value from January 2010 to February 2022. Equation (2) displays the general

expression of MA(q), which forecasts using a white-noise error term. The lag order of AR(p) and MA(q) need to be derived by the graph of PACF and ACF respectively. Combining all these elements together, an ARIMA (p, d, q) model is built to do the following analysis.

$$x_t = \phi_0 + \phi_1 x_{t-1} + \dots + \phi_p x_{t-p} + a_t \quad (1)$$

$$x_t = c_0 + a_t - \theta_1 a_{t-1} - \dots - \theta_q a_{t-q} \quad (2)$$

2.3.1 ARIMA (p, d, q) for Daily Price

In Fig.1, for PACF, the part beyond the critical values decreases around 10. To avoid a large lag to make the model too complex, setting p equals 10 in this case. For ACF, the first part beyond the critical values is, demonstrating that MA(q) has order 1 and the value of q is equal to 1. Therefore, ARIMA (10, 2, 1) is constructed for the daily price in the logarithm.

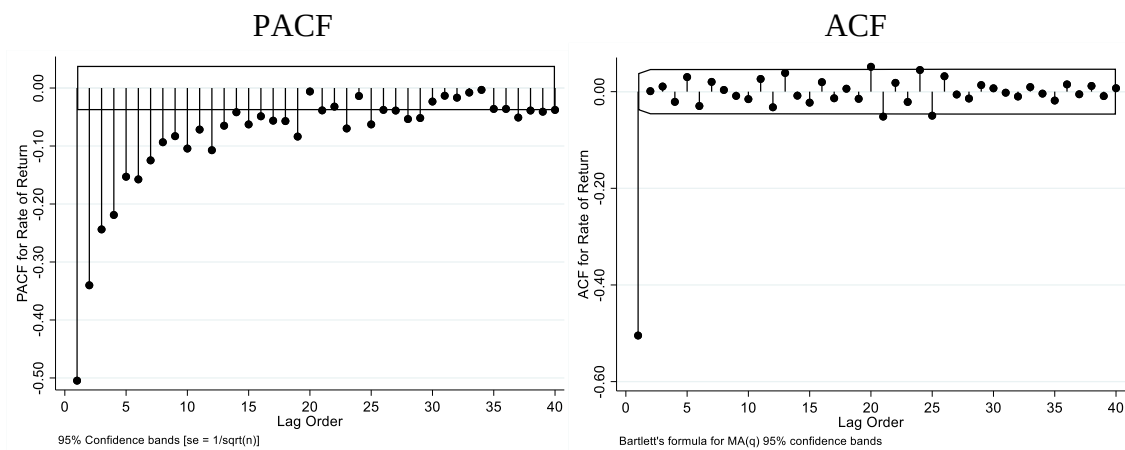


Figure 1. PACF and ACF for daily data

2.3.2 ARIMA (p, d, q) for Weekly Price

Similarly, in Fig.2, choosing p equals 7 is derived through PACF because after time lag 7, there exists a part inside the critical values. According to ACF, q equals 1 since the first part beyond the critical values is 1, and almost all the rest time lags are inside the 95% confidence bands. For the weekly gold price log-return series, the model used is ARIMA (7, 2, 1).

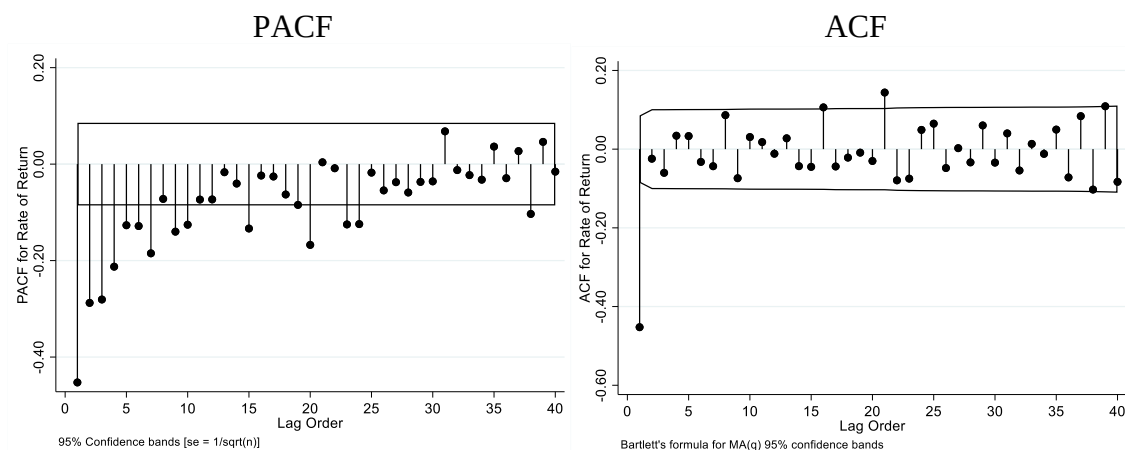


Figure 2. PACF and ACF for weekly data

2.3.3 ARIMA (p, d, q) for Monthly Price

By Fig.3, p is determined by 5 and q is determined by 1. From PACF, the majority is inside the 95% confidence bands after time lag 5. From ACF, the first part beyond the critical values is 1. The model built for the monthly price in logarithm is ARIMA (5, 2, 1).

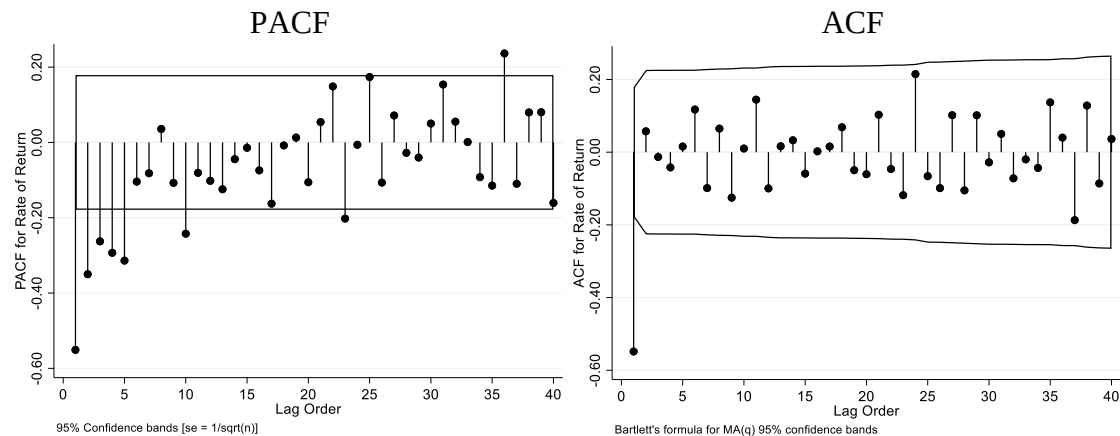


Figure 3. PACF and ACF for monthly data

2.4. Residual Test

After constructing three models, a residual test is used to test whether the residuals are white noise or not. In other words, a good model has uncorrelated residuals. As the last column of Table 2 shows, all models have very large p-values, which represents there is no sufficient evidence to reject that residuals are uncorrelated. Therefore, the models are appropriate.

Table 2. Residual test

Model	Portmanteau (Q) statistic	Prob > chi2
Daily ARIMA (10, 2, 1)	30.4774	0.8615
Weekly ARIMA (7, 2, 1)	36.9766	0.6071
Monthly ARIMA (5, 2, 1)	32.9683	0.7769

3. Results

Using three models to get fitted values after January 2020 which is the time when Covid-19 was exposed. Since these fitted values are in logarithms, recalculating the original numbers is needed before making the comparisons. Taking the exponential of the fitted values and minus by one to get the estimated gold price. Then comparing them and the actual values to explore whether Covid-19 has a significant impact on gold prices in ultra-short-, short-, and medium-term perspectives.

3.1. Ultra-Short-Term Impact

Fig.4 shows the trends of the actual daily gold price and the fitted value predicted from ARIMA (10, 2, 1) respectively. The fitted values are predicted based on the assumption without Covid-19 so the difference between the two lines is the influence of Covid-19 on gold prices from an ultra-short-term perspective. From Fig.4, two lines are roughly in the same direction and the distance between them is small except the fitted line has a slower response on the gold price. Therefore, Covid-19 only has little impact on gold prices in the ultra-short term.

The outbreak of Covid-19 has not yet reached the world on a large scale in February 2020 is one of the possible reasons to explain. The Covid-19 health crisis was first detected in China in January 2020. However, until March 11, 2020, the World Health Organization officially declared the contagious infectious disease as a global pandemic [6]. Many countries didn't start taking a series of actions to prevent the spread of Covid-19 until then, such as lockdowns, which is what caused the panic. Based on information from the RavenPack website, the panic index for the Coronavirus reached its peak at 9.21 on March 30, 2020. This value signifies that 9.21 percent of all global news was focused on discussing the Covid-19 pandemic on that particular date [7]. So in the ultra-short term after the outbreak of Covid-19, the impact on the gold price was not significant as it had a time lag of spreading the rest of the world and causing panic. Although the emergence of Covid-19 does

make an increasing demand for gold and thus making the price of gold higher, the panic in China alone was not enough to give a large effect on a surge in gold trading [8].

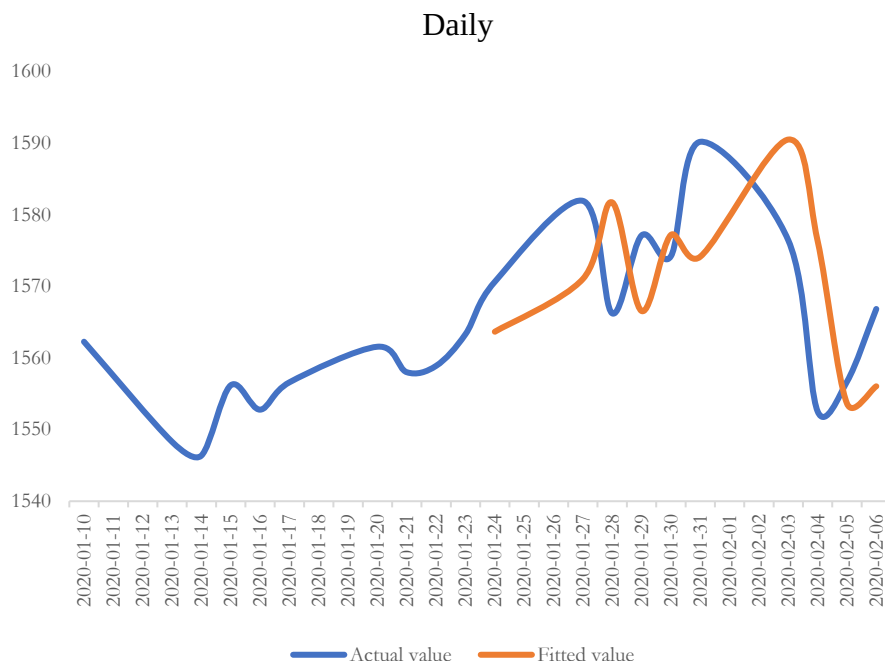


Figure 4. Actual and fitted value, daily

3.2. Short-Term Impact

The predicted and actual weekly gold price trends are represented in Fig.5. It is like the result of daily price in which the fitted values have a similar trend but a slower response. However, the hysteresis and the difference become a little bit larger relative to that of the ultra-short-term.



Figure 5. Actual and fitted value, weekly

3.3. Medium-Term Impact

From the monthly data of the gold price in Fig.5, Covid-19 has a relatively large influence as there is a large difference between the movements of the two lines. Especially after June 2020, the blue line has a clear tendency to suddenly surge, while the predicted orange line has a smooth growth trend. Also, the yearly percentage of difference is calculated to better visualize this difference in terms of quantitative indicators. This value is 9.43%, which represents a relatively large discrepancy, nearly

10%. This suggests that Covid-19 has a positive impact on the price of gold which pushes up the gold price.

As the spread of Covid-19 around the world brought more and more death and panic, countries had to take measures to control the outbreak, such as borders being closed and cities being quarantined. Not only health problems but the medium-term effects of the pandemic are gradually reflected in the financial markets. A series of control policies led to a decrease in the trade of goods and commodities among countries, resulting in a slowdown of economic activity [6]. Under these circumstances, the surplus of resources in the market caused a decline in commodity prices, which subsequently triggered an unprecedented collapse of commodity markets, leading to a state of economic stagnation [6]. Gold becomes a more favorable choice for investors at this time as the increasing number of coronavirus-related news induces fear, and bullish sentiment toward gold, driving its value [9]. Investors expanded their investments in gold during this period to hedge against losses from other financial assets, leading to a rise in the demand and trading volume of gold, which pushed up the price of gold [10].



Figure 6. Actual and fitted value, monthly

4. Discussion

In comparison to other studies, this paper focuses on how Covid-19 impacts only the gold price at different times, whereas existing articles discuss the Covid-19 affects the correlation between the gold price and other financial assets, such as stocks, oil, Bitcoin, and so on. The other literature only focuses on examining the overall gold price trend and does not analyze it separately in the ultra-short, short, and medium term. Their conclusions are more macro and are related to other investment options to give suggestions on portfolio designing. However, one similarity between us in processing the data is that many authors adopted methodology or related transformations such as log return, Augmented Dickey–Fuller (ADF) Unit Root Test.

Through this paper, investors could pay more attention to deciding the percentage of gold in portfolios and whether to use it as a hedging asset during the pandemic because Covid-19 does have a large impact on gold prices from a medium-term perspective and is trending upwards. The analysis of the three different types of periods can help investors with different needs to make decisions. For those who want to invest in gold for the short term, Covid-19 did not have a significant impact on the price of gold, so their decisions will not change much. On the other hand, those who want to invest in gold for a medium term, need to consider the influence of Covid-19 more carefully. What's more, the universal access to vaccines, they need to pay close attention to the changing situation of the global epidemic and the latest policies. The gold market needs time to react to these changes and will

not be too volatile in the short term, so investors need to plan the time spot of gold trading to respond to these changes.

5. Conclusion

Gold has historically been considered a safe-haven asset, and during times of economic uncertainty, investors often turn to gold as a hedge against market volatility and inflation. The COVID-19 pandemic brought widespread economic disruptions and uncertainty which made the gold price fluctuates.

The objective of this study is to look into how the coronavirus pandemic correlates to the gold market in terms of the price of gold from three perspectives. ARIMA models are introduced for this purpose to assess and predict gold prices without Covid-19, with ACF and PACF to determine the order. The study leads to a conclusion after conducting an empirical investigation.

Finally, this article demonstrates that Covid-19 does not cause a large impact and volatility in gold prices in the short-term period following an outbreak due to the lack of market response and the lag in the spread of the disease. However, from a long-term perspective, the gold price received a larger impact. Based on the lack of investor confidence and panic about the economic outlook, the gold price had a good performance compared with the forecasts without the pandemic.

However, there are some limitations to this paper. While the study focuses on the impact of the COVID-19 pandemic on gold prices, it may not consider other external factors that could influence gold prices during the same period. Various geopolitical events, changes in monetary policies, and global economic conditions could also play a role in shaping gold prices although the influence of the Russia-Ukraine war is moved. The study only examines the correlation between the COVID-19 pandemic and gold prices but may not establish a causal relationship.

A multivariate analysis can be conducted in future research which includes various macroeconomic and financial market indicators to help better isolate the specific impact of the COVID-19 pandemic on gold prices. Also, making a comparison with other safe-haven assets during the same period to help investors seeking to diversify their portfolios, like silver, treasury bonds, or cryptocurrencies.

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