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The Asymmetric Effect of Covid-19 and Economic Policy Uncertainty on Financial Development of Iranian Economy: Quantile Regression Approach

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ABSTRACT

The Covid-19 pandemic has created uncertainty in various sectors of the national and global economy, including the financial sector. This disease has had a major impact on societies, causing health and financial crises and pushing economies to the brink of recession. This study focuses on the financial development of Iran during the Covid-19 pandemic and the effect of oil price, gold price and uncertainty of Iran's economic policies on the financial development of Iran's economy. In this study, the quantile regression approach was used to evaluate the daily data of the variables from 19 February 2020 to 10 September 2021. The empirical results of this study show that the increase in the number of registered Covid-19 patients has a positive effect on financial development, while the price of gold and the uncertainty of Iran's economic policies have a negative correlation with financial development. As for the economic policy uncertainty variable, it has a negative effect on Iran's financial development in the lower and middle quantiles, but a positive effect in the upper quantiles. The final result of this study is the confirmation of the existence of asymmetry in the impact of Covid-19 on Iran's financial development.

Keywords: Covid-19, Economic Policy Uncertainty, Financial Development, Iranian Economy.

1. Introduction

The Covid-19 pandemic spread rapidly around the world in late 2019, causing severe disruptions to global activities. Due to the threat the disease posed to people's lives, many countries imposed restrictions on public activities, such as quarantining global transport and aviation activities, which led to negative shocks entering the economy (Wu & Ma, 2021).

The Covid-19 pandemic precipitated a multifaceted global crisis, triggering a significant downturn in both consumption and investment across numerous nations. Beyond its immediate health ramifications, the outbreak instigated a precipitous decline in crude oil prices, reflecting diminished demand and heightened economic uncertainty. Commodity markets, already sensitive to the escalating spread of the virus, were further destabilized by unfavorable financial market indicators worldwide. This confluence of factors amplified volatility and introduced substantial uncertainty into the crude oil, gold, and silver markets, creating a challenging environment for producers, investors, and consumers alike, as documented by the United

States Energy Information Administration (2020) and the World Gold Council (2020).

The Covid-19 disease has had several negative impacts on financial development around the world. The quarantine to contain the disease has reduced direct income from production, deepened poverty, created negative supply shocks, disrupted the global supply chain and led to many job losses, pushing the economy to the brink of recession. The outbreak has sent stock markets on divergent paths, ultimately harming growth and financial stability. Investors and traders, unable to predict market disruptions and profitability, lost confidence in markets and financial instruments. Some international monetary Organizations and societies had already warned that the recent financial crises caused by the Covid-19 disease would be more severe and have serious long-term effects on the global economy (Jiang et al., 2021).

Financial markets in a closed economy such as Iran experience different conditions compared to the world's major financial markets. Since 1980, due to various sanctions, Iran has been under constant economic pressure and has subsequently experienced constant changes in economic policies, especially in the financial market, all of which have led to the creation of a shallow capital market, so that its financial markets do not have much relationship with other sectors of the economy and other financial markets of the world. The Iranian economy also faced a budget deficit due to the sanctions-induced recession and the recent Covid-19 pandemic due to the limited access to oil revenues after the imposition of sanctions, especially the sanctions imposed during the presidency of Donald Trump, which had a significant negative impact on the financial markets (Samadi et al., 2021).

In this study, the asymmetric effects of the Covid-19 outbreak and the uncertainty of the policy on financial development were examined in terms of the impact of global oil and gold prices. In this article, the approach of quantitative regression, parent test and Granger causality test was used to evaluate the daily data of variables from 19 February 2020 to 10 September 2021 for the Iranian economy.

2. Theoretical Foundations

Financial markets are the brains of the economic system and the main focus of economic decision making, and if these markets fail, the functioning of the entire economic system will be damaged (Huang and Wang, 2011). Most studies have shown the negative impact of the Covid-19 outbreak on various economic and financial sectors around the world (Dzigbede and Patak, 2020). The disease reduces financial market activity by destabilizing investor confidence (Ibn Muhammad et al., 2021, phan & Narayan, 2020, Topchu & Galal, 2020). In fact, in addition to its negative impact on health and hygiene, the disease is causing the world to face a sharp decline in financial development (Leach et al., 2021). Pak et al. (2020) provide detailed insights into how Covid-19 is reducing direct incomes and disrupting the microeconomic drivers needed to boost financial development. The stock market is very sensitive to bad health news and reacted to the death toll from the Covid-19 pandemic. Although the stock market initially reacted negatively in the early days of the pandemic, it stabilized and decreased in intensity over time, with the magnitude of the impact on financial markets varying over time (Ashraf, 2020). Not surprisingly, studies show that stock market volatility during the

Covid-19 pandemic exceeded that of previous similar pandemic crises, such as that caused by the Spanish flu (Baker et al., 2020).

On the other hand, oil as the main source of income for the Iranian economy, in addition to affecting other economic sectors of the country, provides a large part of the country's financial resources in various markets. The planning of economic growth and development in Iran is heavily dependent on oil revenues, and the realization or non-realization of projected oil revenues changes the path of development in various economic sectors, especially the financial sector of the economy. Of course, oil is sometimes referred to as a factor that accelerates the movement towards the path of development and sometimes as a factor that distances the Iranian economy from the path of growth and the emergence of political and social injustices (Behboudi et al., 2013). Investors are also looking for opportunities with minimal risk and a diversified portfolio of assets, including somewhat guaranteed financial instruments such as gold and precious stones, to maintain and increase the value of their wealth in different situations, and investing in gold in crisis and recession is safer than other investment options (Ciner et al., 2013). Gold is the best commodity that not only holds its value over time, but also yields more. Gold prices have a significant impact on inflation and other factors necessary for the development of the financial market (Shabir et al., 2020).

Policymakers and governing bodies are concerned about the financial crisis and economic challenges posed by the pandemic around the world during the Covid-19 pandemic. Since the ability of each country to control shocks and crises is determined by the quality of its sovereignty, the uncertainty of policy making in a country caused by the Covid-19 pandemic is a concern for government agencies and institutions, economic enterprises, business spaces and financial institutions (Kaufman et al., 2011). Identifying policy uncertainties caused by economic, political and social crises and shocks requires categorizing these uncertainties as well as the mechanisms of transferring their effects to other economic sectors, including the country's financial market. Given that the government budget in the Iranian economy has an important impact on other economic variables, especially monetary, banking and financial variables, due to its large dimensions, the severity of economic policy uncertainty affected by the budget and the mechanism of its impact on other economic sectors and caused by the Covid-19 pandemic crisis are examined.

3. Literature Review

The theoretical and empirical literature on the economic, social, environmental and health impacts of the Covid-19 pandemic grew rapidly during and after the pandemic (Ali et al., 2020). Many studies have been conducted by researchers to analyze the impact of the Covid-19 pandemic on issues such as the labor market (Baker et al., 2020), digital currencies (Conlon & McGee, 2020), the performance of the insurance industry (Babuna et al, 2020; Wang et al., 2020), the global economy (McKibbin & Fernando, 2020), economic uncertainty and geopolitical

risk (Sharif et al., 2020), liquidity and stock price fluctuations (Albulescu, 2021; Baig et al., 2021; Narayan et al., 2021). In the available literature, there are several studies on the relationship between the Covid-19 pandemic and commodity prices such as gold prices, oil prices and other factors such as financial market performance, financial institutions, insurance companies and investment firms. Often these studies confirm the negative impact of the Covid-19 outbreak on various economic and financial sectors of countries (Dzigbede & Pathak, 2020).

The impact of the Covid-19 pandemic on communities is unavoidable and is not limited to the health and hospital sectors, but also affects the activity of financial markets through investor distrust (Ibn-Mohammed et al., 2020; Phan & Narayan, 2020; Topcu & Gulal, 2020). Along with the health crisis caused by the Covid-19 pandemic, the world faced serious hurdles to financial expansion. Along with the health crisis, the world also experienced a sharp decline in financial development due to the pandemic (Leach et al., 2021). Pak et al. (2020) provide a detailed insight into how Covid-19-induced revenue losses and disruptions to the small stimulus needed to boost financial expansion. Fluctuations in oil prices and exchange rates due to the increase in Covid-19 infections caused severe fluctuations in stock prices in emerging markets (Topcu & Gulal, 2020). Ashraf (2020) compared the daily increase in Covid-19 cases to conclude that the stock market is very sensitive to news about people's health, but the severity of the impact on financial expansion over time and across countries was not the same.

Hailu and Vural (2021) They concluded that the Covid-19 pandemic had a large negative impact on stock markets until the second quarter of 2020, but the impact diminished over time. Yang and Yang (2021) examined the impact of the Covid-19 pandemic on stock price volatility through economic policy uncertainty at the firm level. The researchers concluded that there was a significant increase in stock market volatility with a higher degree of sensitivity to economic policy uncertainty after the end of the pandemic was announced. Ahmed and Sarkodie (2021) examined the impact of the Covid-19 pandemic and economic policy uncertainty on stock price indices, with commodities (oil, natural gas, corn, soybeans, silver, gold, copper and steel yields) associated with the shocks from these two issues in two regimes of low and high stock volatility. In addition, Baker et al. (2020) confirmed that the volatility of recent pandemic stock markets has been greater by examining the impact of the Covid-19 pandemic on stock price fluctuations compared to previous infectious crises, including the Spanish flu outbreak.

Phan et al. (2021) examined the role of economic policy uncertainty on the expansion of financial markets in different countries. The researchers' findings showed that economic policy uncertainty has a negative and significant impact on financial stability. In addition, countries with weak financial systems and deficient financial market supervision experienced more volatility. Li and Zhong (2020) identified economic policy uncertainty as the most important factor in Chinese financial market volatility. Jiang et al. (2021) analyzed the short- and long-term effects of Covid-19, oil prices, gold prices and economic policy uncertainty on financial expansion in China. The results showed that the increase in the number of registered Covid-19 patients and economic policy

uncertainty had an unprecedented negative impact on financial expansion. Nguyen et al. (2020) study the impact of global economic policy uncertainty on the credit levels of domestic and international financial institutions. The study uses panel data from 22 countries for the period 2001-2015. The standard panel correction error and feasible generalized least squares tests are applied to measure the unbalanced data. The empirical study finds three main results. The highest economic policy uncertainty has a negative impact on bank credit growth. Decreasing policy uncertainty is favorable for credit growth. Moreover, emerging economies experience additional negative effects of policy uncertainty than developed economies. Hashmi et al. (2021) conclude that there is a significant cointegrated relationship between stock prices and the incidence of Covid-19. This cointegration is positive and weak at the upper quantiles, and has a strong negative effect at the lower quantiles. In their 2022 study, Li et al. sought to assess the empirical relationship between oil price, the global pandemic of 2020, and uncertainty based on stock market news. Their findings indicated that uncertainty exerts a significant negative influence on all stock index quantiles, whereas the impact of the pandemic is only discernible in the declining and stable conditions of the stock market. In a study published in 2023, Shirin-pour et al. investigated the asymmetric effects of exchange rate and oil price impulses on the performance of the Iranian stock market during the Covid-19 pandemic. Their findings revealed that these factors exert a significant influence on the performance of the stock market across different quantiles. The results of Ettayib's (2024) studies showed that the increase in the number of Covid-19 cases in the United States and the United Kingdom has increased the uncertainty of economic policy in the short and long term.

4. Data and Methodology

The purpose of this research is to investigate the asymmetric effect of the outbreak of Covid-19 disease on Iran's financial development through the side effects of economic policy uncertainty. Therefore, the financial development index was used as the dependent variable. In addition, daily reports of Covid-19 pandemic (COVID-19), oil price (OIL), gold price (GP) and economic policy uncertainty index (GPU) were used as explanatory variables. This research is considered to be objective, research and applied. Time series data between 30 February 2020 and 1 September 2021 have been used in this research. Covid-19 variable data from the World Health Organization, oil price variable data from the OPEC Organization, gold price variable data from the Ministry of Mining Industries and Trade portal, and financial development index and economic policy uncertainty from official documents published by the Central Bank of Iran and global development indicators.

To investigate the asymmetric relationship between the set of research variables, the quantile regression approach was used. The quantile regression approach was introduced by Koenker and Bassett (1978) and has gradually become a comprehensive method for the statistical analysis of linear and non-linear models in various fields. The reason for using quantile regression is to estimate the conditional mean with other quantiles of the explanatory variable, while ordinary least squares regression is fitted to the conditional mean. In fact, it can also be said that the most important application of quantile regression is

to identify the shape of the distribution of the dependent variable of the model at different levels of the explanatory variable, which is done by fitting multiple regression models to a data set for different quantiles. The basis of quantile regression is based on the multi-conditional function, where a set of absolute values of the error is minimized in asymmetric forms. The estimation of parameters in quantile regression is based on a symmetric and asymmetric loss function and is calculated similarly to the estimation of parameters in least squares regression (Kazerooni et al., 2017).

The quantile regression approach has advantages over linear approaches in three ways: first, it allows for location asymmetry, since the coefficients can be conditional on the location of the dependent variable within the conditional distribution. Second, this approach examines long-run equilibrium effects with short-run aspects of the conditional distribution of variables defined in general quantiles. Finally, many studies use autoregressive distribution lag model (ARDL) and Johansen's linear cointegration tests to show only short-run cointegration parameters with the time variable, and simultaneously consider his quantile regression approach for both the long-run and the short-run with respect to different quantiles. Moreover, the use of the quantile regression model has another advantage over other linear models, such as the nonlinear autoregressive distribution lag model (NRDL), which treats nonlinearity as an exogenous process (Godil et al., 2020).

The specification of the model used in this study, inspired by the work of Chu et al. (2015), is in the form of relation (1):

$$QFD_{2t} = \mu(\tau) + \sum_{i=1}^{a} \varphi_i(\tau)\ FD_{2t-i} + \sum_{i=0}^{b} \gamma_i(\tau)\ COVID19_{t-i} + \sum_{i=0}^{c} \omega_i(\tau)\ OIL_{t-i} \sum_{i=0}^{d} \theta_i(\tau)\ GP_{t-i} + \sum_{i=0}^{e} \psi_i(\tau) GPU_{t-i} + \varepsilon_t(\tau) \quad (1)$$

where $\varepsilon t(\tau) = FD_{2t} - QFD_{2t}$ and $0 < \tau < 1$ denotes the quotient. Taking into account the possibility of expected serial correlation, relation (1) is defined as relation (2):

$$Q\Delta FD_{2t} = \mu + \rho FD_{2t-1} + \partial_{COVID19} COVID19_{t-1} + \partial_{OIL} OIL_{t-1} + \partial_{GP} GP_{t-1} + \partial_{GPU} GPU_{t-1} + \sum_{i=1}^{a-1} \varphi_i \Delta FD_{2t-1} + \sum_{i=0}^{b-1} \gamma_i \Delta COVID19 + \sum_{i=0}^{c-1} \omega_i \Delta OIL + \sum_{i=0}^{d-1} \theta_i \Delta GP_{t-1} + \sum_{i=0}^{e-1} \psi_i \Delta GPU_{t-1} + \varepsilon_t(\tau) \quad (2)$$

However, the quantitative error correction model is defined as equation (3) in the quantile regression approach:

$$Q\Delta FD_{2t} = \mu(\tau) + \rho(\tau)(FD_{2t-1} - \beta_{COVID19}(\tau) COVID19_{t-1} - \beta_{OIL}(\tau) OIL_{t-1} - \beta_{GP}(\tau) GP_{t-1}\ \beta_{TTI}(\tau) GPU_{t-1}) + \sum_{i=1}^{a-1} \varphi_i \Delta FD_{2t-1} + \sum_{i=0}^{b-1} \gamma_i \Delta COVID19 + \sum_{i=0}^{c-1} \omega_i \Delta OIL + \sum_{i=0}^{d-1} \theta_i \Delta GP_{t-1} + \sum_{i=0}^{e-1} \psi_i \Delta GPU_{t-1} + \varepsilon_t(\tau) \quad (3)$$

In this study, the delta method, defined as equation (4), was used to test the combined short-term effect of the previous and existing FD on the existing FD:

$$\Phi_i = \sum_{i=1}^{a-1} \varphi_j \quad (4)$$

While the cumulative short-term effect of previous and current levels of COVID-19, OIL, GP, GPU are defined by relationships (5), (6), (7) and (8) respectively:

$$\gamma_i = \sum_{i=1}^{b-1} \gamma_j \quad (5)$$

$$\omega_i = \sum_{i=1}^{c-1} \omega_j \quad (6)$$

$$\theta_i = \sum_{i=1}^{d-1} \theta_j \quad (7)$$

$$\Psi_i = \sum_{i=1}^{e-1} \Psi_j \quad (8)$$

The coefficients associated with the long-term effect for Covid-19, oil price, gold price and economic policy uncertainty are calculated as βCOVID19* = -βcovid19 / ρ, βOIL* = -βoil / ρ, βGP* = -βgp / ρ and βGPU* = -βgpu / ρ.

The error correction coefficient must be negative and significant. To determine the asymmetric effect of the variables of COVID-19, OIL, GP and GPU on FD in the short and long term, the Wald test was used, where the null hypothesis is H0 = ρ*(0.05) = ρ*(0.1) = ... = ρ* (0.95).

5. Data Analysis and Discussion

5.1. Descriptive Statistics

Before analyzing the data, it is necessary to organize and summarize the data in an understandable way. Therefore, descriptive statistics will reveal the hidden points of the data. Descriptive statistics will help the research process. Descriptive indicators for the variables of Covid-19, oil price, gold price, economic policy uncertainty and financial development are reviewed in Table (1).

In relation to the use of the quantile regression approach, the most important indicator is the absence of a normal distribution and the presence of skewness in the variables. If the skewness coefficient is negative, it means that the distribution is skewed to the right, and if the skewness coefficient is positive, it means that the distribution is skewed to the left. Obviously, the higher the absolute value of the skewness coefficient, the more the society differs from the symmetric distribution in terms of skewness. Skewness is one of the appropriate parameters for comparing the dispersion of the community distribution with the normal distribution. Those distributions that have more dispersion than the normal distribution, or the distribution curve is shorter than the normal distribution curve, have negative skewness, and if the distribution curve is longer than the normal distribution curve, it has positive skewness. All variables have non-normal skewness and elongation, but the highest skewness is related to the variable of COVID-19 with a value of 1.2982 and the lowest skewness is related to the variable of FD with a value of -1.8172. Also, the highest value of dispersion is related to the FD variable with a value of 8.0397 and the lowest value of dispersion is related to the GPU with a value of 1.6524. These results show that it is appropriate to use the quantile regression approach for these variables with non-normal distribution. This problem is clearly seen in the results of the Jarque-bera test. As it can be seen, for the variable of financial development of Iran, the value of the probability of the test is smaller than the number corresponding to the significance condition of 0.05% and it can be concluded that the null hypothesis that the distribution of the variable is normal has been rejected.

Table 1: Descriptive statistics of model variables

Variable	Mean	Median,	Maximum	Minimum	Standard Deviation	Deviation	Skewness	Jarque-Bera statistics
COVID-19	190.57	143.50	694.00	15.00	143.77	1.2982	4.0716	184.08
OIL	50.31	49.22	76.01	12.22	16.20	-0.2666	2.1849	22.17
GP	1803.13	1803.31	2110.36	1474.25	101.53	-0.3837	3.4168	17.82
GPU	0.3359	0.3307	0.5380	0.1682	0.1233	0.3234	1.6524	52.23
FD	2674.81	2744.05	3527.33	320.91	584.66	-1.8172	8.0397	902.47

Source: Research calculations

5.2. Unit Root Tests

Time series are some of the most important statistical data used in empirical analysis. In research, it has always been assumed that the time series is stationary, and if this state does not exist, the conventional statistical tests based on f, t and chi-square and similar tests are doubted. On the other hand, if the time series variables are not stationary, a problem called spurious regression can occur. In such regressions, although there may be no meaningful relationship between the model variables, the coefficient of determination or detection (R^2) obtained may be very high, leading the researcher to draw erroneous conclusions about the degree of relationship between the variables. therefore, it is necessary to first examine the stationarity of the time series in the model.

Table (2): The results of the generalized Dickey Fuller unit root test

Variable		COVID-19	OIL	GP	GPU	FD
with constant component with trend	statistics	-4.800	-3.38	-3.00	-3.01	-4.00
	p-value	0.032	0.046	0.032	0.035	0.022
with constant component with not trend	statistics	-3.98	-3.55	-3.44	-3.11	-4.10
	p-value	0.041	0.041	0.039	0.038	0.01

Source: Research Results

Table (2) reports the results of the generalized Dickey-Fuller test of the model variables for the existence of a unit root. The results of the Dickey-Fuller test show that all variables in this study are at least 90% counteracted.

5.3. Heterogeneity and Autocorrelation Variance tests

One of the classical assumptions is that the variance of the sets of the disturbance components is the same in different periods; in other words, E(ui2) = σ2 and i i= 1, 2, ..., n. Since the variance of the disturbance component is equal to the variance of the dependent variable, the problem of variance heterogeneity is related to the non-uniformity of the variance of the dependent variable in different periods. For the variance heterogeneity test, White's variance heterogeneity test was used in this research. The null hypothesis of this test implies equality of variances.

Another classical assumption based on OLS estimation was the non-correlation of the residuals of different time periods; in other words, E(ui, uj) = 0 and i = j. Violation of this assumption creates a problem called autocorrelation. The "LM serial autocorrelation test" was used to test for the existence of autocorrelation between the perturbation sets. The LM test for the dependent variable FD was calculated with intervals of one to two.

As can be seen in Table (3), the probability of significance is zero, which means that this statistic is less than the 1% significance level, so the null hypothesis is rejected and the model is faced with variance heterogeneity. Also, the probability of significance in the autocorrelation test in interval 2 for the dependent variable is greater than 0.05%; therefore, the desired estimated model does not have serial autocorrelation.

5.4. Model Estimation

Quantile regression was used to estimate the model and find out the strength and direction of the relationship between the explanatory and dependent variables in different quantiles of the dependent variable. In this method, the model will have different results for the estimated coefficients in different quantiles. Thus, the influence of the explanatory variables on the dependent variable in different quantiles is calculated and compared.

The results of the model estimation using the quantile regression approach are presented in Table (4).

The results of table (4) show that in the lower deciles of financial development index, i.e. 0.1 and 0.2 deciles, there is a positive and significant relationship between deaths caused by Covid-19 and financial development, but in the third decile, there is no relationship between these two variables because the coefficients are not significant. In the middle 5th and 6th deciles, Covid-19 deaths have a negative effect on Iran's financial development. However, in deciles 0.7, 0.8 and 0.9, the distribution of conditions is completely different. In these deciles, there is no relationship between Covid-19 deaths and financial development. For the economic policy uncertainty variables, the oil price and the gold price, the results were different in the quantiles. There were positive relationships in some quantiles and negative relationships in others. In the first and third deciles, there is a significant relationship between economic policy uncertainty and Iran's financial development, with the difference that the

relationship is positive in the first decade and negative in the third decade. In the middle deciles of 0.4 to 0.7, the effect of economic policy uncertainty variable on financial development is negative, but in the deciles of

Table (3): The results of the heterogeneity variance and serial autocorrelation tests

Test		LM statistics	p-value
White's Variance Heterogeneity		10.31	0.0000
LM Serial Autocorrelation	First order	1.0312	0.0000
	Second order	0.0495	0.2442

Source: Research Results

Table (4): results of model estimation with quantile regression

Quantile of FD	C	Covid-19	OIL	GOLD	GPD
0.1	-1.8136	3.4271	11.1601	2.7502	2.0339
0.2	0.5491	2.5328	12.5113	0.9581	0.0906
0.3	4.1422	0.8996	15.2412	-1.8180	-3.5392
0.4	4.2013	-0.0107	13.9846	-2.2980	-3.6724
0.5	6.5192	-2.0896	12.9459	-4.4687	-5.7918
0.6	7.7781	-2.7964	09.7768	-5.7833	-5.0394
0.7	18.380	-0.0319	10.3467	-12.159	-2.6254
0.8	12.519	0.1622	05.4296	-7.3946	2.3132
0.9	10.535	0.8980	03.5834	-5.5245	5.9626

Source: Research Results

0.8 and 0.9, this variable has a positive effect on Iran's financial development.

Therefore, according to the obtained results, the research hypothesis that there is an asymmetry in the relationship between Covid-19 and financial development in Iran's economy during the study period is confirmed.

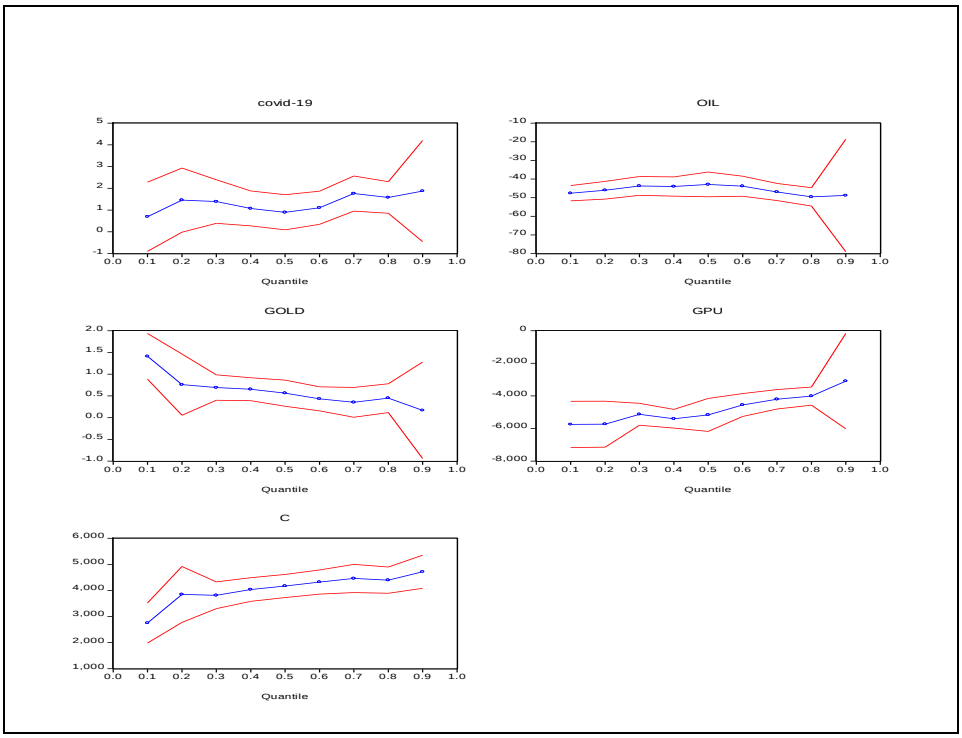
5.5. Structural Stability Tests

The structural stability tests of the cumulative residual and the squared cumulative lag reflect the stability of the estimated coefficients over the period under consideration. If the graph of the cumulative residual lies between two lines with a 95% confidence interval, the null hypothesis of no structural failure is accepted, otherwise the existence of structural failure is accepted.

The lines of estimated quantile regression coefficients for the variables of Covid-19, oil price, gold price and economic policy uncertainty together with their 95%

confidence intervals are shown in the figures below:

Figure (1): Results of structural stability tests



Source: Research Results

The results of the structural stability tests in Figure 1 show that the cumulative residual plot is between the upper and lower bounds, so the null hypothesis of no structural failure is accepted. These results imply that there have been no systematic changes in the regression coefficients, but there is a deviation from stability of the coefficients.

5.6. Quantile Model Asymmetry Test

Through the Wald test, the asymmetric effect of Covid-19, oil price, gold price and economic policy uncertainty on Iran's financial development has been examined and the results are reported in Table (5).

According to the values of the calculated probabilities between the different quantiles, the null hypothesis of the existence of symmetry in the estimated coefficients has been rejected with regard to the variable of Covid-19 and the financial development index, but the null hypothesis has been rejected with regard to the variables of oil price, gold price and economic policy uncertainty. It is not rejected.

6. Conclusion

This study investigates the asymmetric effect of Covid-19, oil price, gold price and economic policy uncertainty on Iran's financial development from 19 February 2020 to 10 September 2021. These data were analyzed daily using quantile regression approach. In this research, firstly, the stationarity of financial development variables, Covid-19, oil price, gold price and economic policy uncertainty was investigated using the generalized Dickey-Fuller test and it was found that all variables are at a stationary level. In the next step, the Granger causality test was used to examine the causal relationships between the research variables using the optimal number of intervals.

Table (5): Results of the Wald Asymmetry Test for the Model Quantiles

Variable	Quantiles	Statistics	P-Value
COVID-19	0.1-0.9	1.4022	0.5827
	0.2-0.8	0.8582	0.1492
	0.3-0.7	0.6110	0.0264
	0.4-0.6	0.4230	0.3616
OIL	0.1-0.9	14.558	0.4735
	0.2-0.8	5.5431	0.0770
	0.3-0.7	4.9378	0.3216
	0.4-0.6	4.0789	0.6057
GOLD	0.1-0.9	0.6064	0.4549
	0.2-0.8	0.3686	0.8274
	0.3-0.7	0.2277	0.7216
	0.4-0.6	0.1670	0.8081
GPU	0.1-0.9	1638.0	0.3614
	0.2-0.8	873.35	0.5001
	0.3-0.7	819.21	0.2210
	0.4-0.6	701.16	0.5917

Source: Research Results

The results of this test showed that there are causal relationships between the dependent and independent variables. Due to the presence of outlier data in the financial development variable and the non-normality of the error rates of the estimated model, the results of ordinary least squares are expected to be biased, therefore quantile regression was used. The results showed that the regression coefficients in different quantiles have significant differences. According to the quantile regression results, the impact of Covid-19 deaths on financial development is positive in the lower deciles, negative in the upper deciles and insignificant in some other deciles. Finally, structural stability tests were carried out on the investigated model, and the results of these tests showed that, in addition to the absence of structural failure in the

model, there were no systematic changes in the regression coefficients, but there was a deviation from the stability of the coefficients. The Wald test also confirmed the problem of asymmetry in the model equations.

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