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Oil Price Fluctuations and Volatility of Firm Risk

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Abstract *Prior literature reports that macro-economic factors of a country affect stock exchange performance and thus firm performance. Recent strands of literature and the fluctuations in currency have a substantive effect on countries' economies. These fluctuations are also a cause of price fluctuations of imports and exports. One such factor which directly affects firm performance is the oil price fluctuations. Thus, this thesis empirically investigates the effect of oil price fluctuations on firm risk for the firms listed on PSX for the period 2012-2017. Secondary data is taken from SBP, Balance Sheet Analysis Database, Pakistan Stock Exchange and the company's website in some cases. Using Panel data, results show that oil prices increase firm risk (beta), which indicates that market participants react to change in oil prices and thus increases risks. The study indicates that policymakers need to control oil prices to keep firm risk in control and thus manage the market towards a better investment environment.*

Key Words:
Macroeconomic Factors, Oil Price Fluctuations, Firm Performance, Firm Risk.

Introduction

Oil prices are the essential element of world-wide economic performance. Overall, when there is an upward direction in the prices of oil, then it transfers the income from that country that imports the oil to that country that exports the oil. Oil as a commodity is a rich business and thus has an increased positive budget for exporting countries than imported ones. The gas prices will go upward due to an upward direction in oil prices, the degree of gas of the country and the influence of increased prices of oil and gas on other origins that work with or in the form of electricity are obtained through oil and gas. When the prices of oil increase highly, then the higher rates will be continued, and the macro-economic impact will be high. For those countries who export the oil, the upward movement in oil prices directly high real national income over more earning in exports, but this return will not be for continuous-time because this would be later end-up by failure because of the exports normally demand by the economic downturn occurs by trading countries.

Thus, variations in the rates of oil are the important elements of stock prices which find both aspects of the stock exchange, i.e. the volatility of market return as well as stock return. The change in the macroeconomic variables shows the risk, i.e. systematic risk, which is not controllable. This is important to observe/look at that country related factors, i.e. supply of money, interest rates, inflation rate etc., affect the stock exchange as well as the Universal factors and can affect the efficiency of the market. Those Universal factors are fluctuations in interest rate, variations in the prices of gold and variations in the US Dollars value as long as the initial oil crisis which had occurred in 1973, so the oil prices shock has caught the attention of the people as an essential element which affects macro-economic elements as well as stock exchange indices in dissimilar designs in a dissimilar portion of the universe. Seven out of eight after the war, bankruptcy in the US has been anticipated by more increase in the prices of crude (Hamilton). The average experimental projection advised that oil prices doubled and went in an upward direction between 2003 and 2005, collectively decreased world productivity by about $750B till 2005 (Ragof, 2006). For the country which has more reliance on oil-importing and that country that exports the oil, the trade would be more profitable between them. Advanced countries, i.e. the USA, now have more energy today as compared to twenty years before, with oil utilization for each dollar of Gross Domestic Product lower than half of what they had in 1970 (Basher and Sadorsky, 2006). This development is the cause of using advanced technology means the use of advanced machinery and divergence against other sustainable assets, but the growing countries, for example, China and India, are the users of oil, and this is because of their continuous growth and causing its demand for oil to rise.

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Pakistan is a growing economy and is faces issue, for example, the low level of employment, amazing foreign exchange, and slow economic development. Energy is an important determinant for the country. Pakistan mostly depends on imports of oil as well as on energy sources. In 2014 they spent 14.77 billion Dollars on oil-importing, and its importing bill was high as compared to previous years. Their oil import bill falls in 2016, i.e. about 37%, and it is because of a downfall in the prices of oil in the global market and is reduced to 7.667 from 12.166 billion dollars in Financial Year 2015. Accordingly, when there is an upward direction or downward direction in international oil prices, then it is a central problem for a country, and in the current study, our main aim is to find out the association of variations in oil prices and the volatility of firm risk in Pakistan. Usually, upward movement in the prices of oil has a positive relationship with the cost of productivity and inversely relationship with the profits of corporation's means that when upward movement in oil prices occurs, then the production costs will be increases and profits of corporations will be decreased. An upward movement in oil prices may cause upward movement in the inflation rate, accordingly minimum extra amount available to customers to consume it. Furthermore, when a fluctuation in oil prices occurs, then it results in more demand for returns by investors and becomes the additional separate element to stop or restrict the extent of investment at the stock exchange. The above upward movement in the productivity costs decreases earnings due to downfall in demand raised unpredictability limits the level of investment in real assets as well as financial assets. When profit falls and discount rates increase, then the share price falls. Thus, fluctuations in oil prices have a very good function on macro-economic changes through the short-run to medium-run.

Oil prices are playing a main role in uplifting the economy of a country. Investigating the oil price and its effects on the stock exchange, share price, and overall performance of the economy is essential for many reasons. For example, earlier research which was conducted to determine the influence of oil price fluctuations and their relative effect, creates mixed and questionable results with either having a positive association and some reports negative results of the association. Since Pakistan lacks its won production of the oil, it is mostly dependent on oil imports having a total demand of about 16 million tons. Out of the total, 82% is through imports while the rest is produced locally. Pakistan economy is based on oil, as evident from the statistics (its imports got doubled in only a duration of six years from around 114 to 228 thousand barrels). As discussed earlier, prior research reports inconclusive results on the association of firm performance with oil shocks (prices). Studies also report methodological approaches of investigation of the relationship. Earlier studies have used simple approaches, while recent literature uses the Kilian approach (2009) in particular reference to Pakistan.

Literature Review

Hamilton (1983) conducted research on the US economy, and their results mention that there is a strong association of US business cycle and crude oil prices, and inclines to highpoint cost-push inflation effect whereas the study of Brent and Wood (1974, 1978) and their study shows that oil prices and investment are complementarily in the US, before 1973 and after as well. Thus oil price increase causes shocks and may have a greater effect than normally supposed, and further study was done by Hooker (1999), who claimed that uneven and non-linear variations in the prices of oil reinstate that correlation, and hence the economy replies unevenly and non-linearly to oil price fluctuations. Hamilton expanded their study to (2003), then (2005), and then (2009), untaken investigational suggestions proposing that bankruptcy is mainly caused by oil prices in the US. Other researchers, for example, Barsky and Killian (2004), disagree that the effect is small and fluctuations in oil prices separately could not clarify the US downturn in 1970. Bernanke et al. (1997) claim that the influence of oil prices fluctuations on the US is not only from oil prices but also from the monetary policy. The research by Blanchard and Gali (2007) given indication which shows that the effect of oil fluctuations had fallen substantially over time due to an improvement in monetary policy, highly elastic labor markets as well as a lesser share of oil in producing and their consequences shows the increase of 10% in the prices of oil will before 1984, have decreased the US GDP approximately 0.7% from 2 to 3 years period, But the loss will be approximately 0.25% after 1984.

When oil prices increase, then the productivity decreases mean that the deviations in oil rates affect the firm performance, and theories also suggest that deviations in oil price influence firm productivity. For the determination of elasticity, Rati, Ram and Ramsey (1989) conducted a study and their estimations for the US are quite new, and they differentiated the privately capital firms and public capital. The comparative energy price variable is also integrated, the time span for their study was 1948 to 1985, and they have gotten the statistical significance energy price GNP elasticity estimations. The associations of variation in oil prices on the accumulated stock market have determined by many people (Chen et al. 1986, Hameo, 1988, Bashir and Sadorsky 2006, Jones and Coulee 1996, Kilrian and Parc 2009). Some of them have determined the association of variations in oil price and stock returns of a specific area. In the previous study, there is a little study that finds a relationship between oil price fluctuations at a specific firm. Manning (1991) used the weekly data from 1986 to 1988 and analyzed the association of London

stock returns and variations in oil prices. Their results show positive relation from the association of variations in oil prices with the stock returns of oil firms, and he concludes that the response to an upward direction in oil prices is highly important for the oil firms involved in the examination as compared to unified oil businesses.

Goodwin and Al-Mudaf (1993) studied specific firms on the returns of 29 oil firms and studied on those firms which were registered on New York Stock Exchange, and the findings of firms that have significant assets in household oil production indicate a direct relationship to fluctuations in oil prices through actual returns. When a country deals mostly in oil, then it is clear to components of price fluctuations in product markets around the world (Rentscheler, 2013). Pindyck. (1991), claims that fluctuations in the rates of energy causes problems in incoming energy prices and cause companies to delay/reschedule un-reversible decisions in response to returns. Hasan and Ratti (2012) claims that when variations occur in the prices of oil, then it affects the stock market prices but it also influences the cash flows and discount rate. Fluctuations in oil price influence firm cash flow because oil is an essential component for producing things and can affect production demands at industry and country levels. The research has been conducted on 6 countries of GCC and taken 5 years data by Arouri, Lahiani and Nguyen (2011) studied on the association of international oil prices and GCC stock markets. The associations of stock market returns of twenty one undeveloped stocks and oil price fluctuations have been studied by Basher and Sadorsky (2006), and their results shows that changes in oil prices of undeveloped countries influence stock returns. The influence of oil price fluctuations on the stock price of energy firms in the UK, US, as well as India has been investigated by Sharuddin, Samad, and Bhat (2009) and determined the reality of significant shorter and longer term association of oil prices and concludes that stocks are influenced by other variables, i.e. by interest rate and stock indices, and also shows that the variations in the costs of oil have strong relation with the instability of the stock market of oil firms in all countries which were studied.

Chiang and Huguen (2017) state that future oil prices have an inverse effect on non-oil stock returns. A positive analysis of both the WTI and crude oil index returns of the S & P index of the negative casual effects has been found in the investigated subsets and so on, and this study was done by Lu et, al. This shows that the variations oil price influence returns of the stock market, but the stock returns also affect oil prices in some situations. The associations of oil prices and stock markets has also determined by the Driesprong, et al. (2008), taken data of 32 developing markets. Therefore, their results show that that in the above nations the stock returns are non-significant from 1988 to 2004. Noor and Dutta (2017) had done the research on the South Asian markets and their results shows that Pakistan, Srilanka, and India stock markets receive the impacts from international oil prices as well as oil fluctuations in their home country. Fowewe (2013) used the Garch-jump model for the examination of the association of oil prices for Nigerian stock market. Thus, the consequences display non-significant influence of Brent as well as WTI oil price on the Stock Market of Nigeria.

Ewing and Thompson (2007) conducted a research and their findings show that the prices of crude oil causes to a series of US user prices. Bjornland (2009) stipulates that when oil prices go upward the national income will also to be rises, and push stock markets for oil producing countries. Nandha and Brooks (2009) determined that prices of oil inversely affect transport sector returns in advanced countries but have insignificant effects in developing countries. Arouri (2011) suggests that variations in the prices of oil occur mostly in European stock market sectors, but this response varies widely across regions. The response to energy and banking divisions is significantly progressive and adverse due to fluctuations in oil prices of transport industries on Australian stock markets, and this study was conducted by Brailsford (1999), McSweeney and Worthington (2008). Crude oil returns are interrelated claims by Bowers and Heaton (2013), among other features and with a regular risk element in the Australian stock market. Cairns and Pagan (1993), Cairney and Daly (1998) examined the association of non-oil factors stock instability. The six foreign goods have an important effect on the Australian stock market and provide provision to see that the market of Australia is based on commodity. Brailsford (2000) for another time studied the risk of equity returns in the sector of oil of Australia and determine that the industries which are in industrial sector are considerably susceptible while industries in the resource sector are not significantly exposed. Hammudeh et al. (2010) regard oil prices and return instability of regions in the US and conclude that prices of oil have higher return volatility for regions in the US with upward movements that rarely use oil.

Prior to the global financial crisis that oil prices and dollar value are positively correlated. Chen and Chen (2007) conducted research on the long-run association of real oil prices with real exchange prices and finally came to the conclusion that international oil prices establish the main basis of exchange rate changes. Narayan et al. (2008) determined the relationship between oil prices and the Fijius stock market and finally came to the idea that an upward direction in the prices of oil results in an upward direction in the Fijian dollar value. Krugman and Golub (1983) document the importance of oil prices and conclude that oil prices are the important elements of exchange rate fluctuations. Kang et al. (2015) explore the influence of variations in global oil prices on the contemporary relationship of the stock returns and volatility, which concludes that organizational oil price fluctuation and stock return is high and highly statistical among the co-spread of volatility. Currently, Ratti and Vespigny (2016) report

that the wealth, industrial production and oil prices world-wide are countered, and an upward movement in oil prices causes a substantial rise in the interest rates of the global.

Akinyomi and Adebayo (2013) determined the influence of firm size on the profitability of Nigeria industrial zone and used Pearson correlation matrix as well as regression technique, and taken the panel data set from 2005 till 2012 from annual reports of the designated manufacturing firms which were recorded on the stock exchange. For the firm size log of turn-over and the log of total-assets were used, while for the profitability, the return on assets was used, and control variables were also selected. Their outcomes show that firm size in the case of total-assets and in the case of total-sales has a positive effect on the efficiency of Nigerian manufacturing firms. Akinlo (2010) determined the long-term association and causation matters between profitability and firm size in Nigeria, selected 66 firms, and 8 years of data were selected. Their consequences show a longer time formal relation between profitability and firm size.

Pakistan is a developing country, and it has more reliance on oil-importing, and there will be ups and downs in its economy if the oil price varies, but less study has been done which have determined the relation of oil price shocks and the instability of the stock market returns. The association b/w oil price fluctuations and the volatility of the stock market in Pakistan determined by Fatima and Bashir in 2004. They take monthly data from 1998 through 2013, determined that oil prices and stock return have an inverse association and asymmetry effects. Naurin and Qayyom (2016) have determined the positive and asymmetry effects of oil price fluctuations with the stock exchange, but Jebran et al. (2017) examined variations in oil prices have unfavorable results earlier in 2007 in financial deadlock and have positive results after 2007.

Since oil prices, fluctuations have a great influence on any country, and it can disturb firm-level investment decisions. Pindyck (1991) reports that energy price fluctuations cause ambiguity and affect the peripheral product of numerous types of wealth, and this is the reason for reducing investment spending during the downturns of 1975 and 1980. Thus, the change in oil prices is not significant with this delay. Mohn and Misund (2009) are the first researchers which they relate oil price fluctuations to the firm-level investment, and they find out the impact of price shocks on investment for international oil and gas firms from 1992 till 2005 and their measures of uncertainty include fluctuations of overall 25 stock market returns and the volatility of oil prices. Their finding shows that the stock market volatility has an indirect influence on investment, but the volatility in oil prices raises the investment.

Research Methodology

Research Design

Research Methodology is all about the research design, Population frame, sample Selection, unit of analysis, type of study, time horizon, data collection, and analysis techniques that will lead to our results and discussions.

Population and Sampling

The population is comprised of data from the year 2012 to 2017 as the objectives of the study is the examination of the influence of ups and downs in the prices of oil on the accumulative firm risks. Firm risk measure data is collected from PSX since the sample is comprised of different firms belonging to different industries of Pakistan, so the variability of its dependence on oil is evident. As some of these firms uses crude oil as a raw input but maybe some, it uses for their ancillary functions. Data in respect of oil prices and other related variables are obtained from (Economic Survey of Pakistan (EIA) and SBP and from the official websites of companies).

Methodology

The research methodology includes the use of descriptive statistics before approaching the mainstream estimation. Such descriptive statistics include the results for the mean, median, standard deviation, minimum and maximum values. The norm used frequently in finance theory relating to risk management is the use of the concept of CAPM, which assumes that risk and return have a direct relationship with each other if there is more risk so the return would be high and vice versa. Beta values obtained from the sources mentioned above are used to calculate the firm risk measures.

Variable Measurement

The main theme of this study is to empirically observe the relationship between oil price fluctuations and the volatility of firm risk of recorded firms on PSX for the period 2012-2017. In this study, the Dependent variable, independent variables, as well as control variables are used. Measurement of oil price is the independent variable, measurement of firm risk (Beta) is dependent variable and also will deploy control variables and they are interest rate, firm size, firm age, and firm growth for the purpose of to control the dependent variables.

Dependent Variable

In our research, the dependent variable is beta, and its data is taken from the balance sheet; first, stock return and market return are obtained from it. The formula of beta is equal to the slope of stock return and market return or the covariance of stock return and market return divided by variance of the market return.

β = slope (R_s, R_m)

OR

β = Cov (R_s, R_m)/ Var R_m

Independent Variable

The independent variable in our thesis is oil prices. Oil prices data obtained from the EIA website but the oil prices data was in Barrel, so the data were converted to litres.

Control Variables

In this thesis, control variables are firm size, firm growth, firm age and the interest rate. The formula for calculating firm size is the natural log of total assets, and the total assets data were taken from the balance sheet: i.e. Firm size = log of Total assets. For calculating firm growth, the formula is a log of sales and its data were taken from income statement. i.e. firm growth = log of sales. Firm age data is directly given on google and obtained from the google. Interest rate data was taken from SBP website.

Analysis and Discussion

This chapter is consisted on data analysis and interpretation. For data analysis correlation, descriptive statistics, and coefficients are used. For each and every of the performance variable regression outcomes of panel data are described and explained.

Descriptive Statistics

A descriptive statistic is a summary statistic that is used to summarize and describe data in ways that are meaningful and useful. Descriptive statistics of this study consists of mean, median, minimum, maximum, skewness, kurtosis and standard deviation. The descriptive statistics are used in this research for different firms, i.e. listed firms, unlisted firms and privately own firms. Mean as well as standard deviations are the proper instruments that show the whole situations within the timeline. The average values of the variables show by the mean within the samples, while risk during the time period shows by the standard deviation. The outliers are also checked before descriptive statistics, and there are no outliers in the data because which it influences the data mean value.

Table 1. Descriptive Statistics of all Variables

Variable	Mean	Std Dev	Minimum	Median	Maximum	Skewness	Kurtosis
BETA	0.010	0.039	-0.001	0.001	0.458	2.23	3.1
OIL PRICES	50.838	15.788	28.514	54.169	70.520	-0.23	-1.56
FIRM SIZE	15.168	2.014	1.640	15.284	19.165	-0.99	2.21
FIRM GROWTH	9.061	1.452	5.004	9.174	13.553	0.23	0.97
FIRM AGE	36.190	25.380	9.0	29.0	129.0	2.42	3.11
Interest Rate	0.080	0.018	0.058	0.084	0.10	-0.18	-1.78
LgSze	1.176	0.076	0.215	1.184	1.283	1.56	2.44
Lgbta	0.004	0.015	-0.002	0.001	0.164	0.87	2.1

Table 1 displays the descriptive statistics of the independent variable (oil prices), dependent variable (Beta) and control variables.The average beta of the selected firms is 0.010 means that there is less risk in these firms.

The average growth is 9.061. 13.553 is the maximum value while 5.004 is the minimum value, and this indicates that these firms have better chances for higher productivity and using their resources efficiently. When there is an increase in the productivity of a firm, then they show positive signs to the market about the upcoming performance. The average size is 15.168 and its maximum value is 19.165 shows high growth in size and its minimum value is 1.640 shows less growth in size.

The average age of the selected firms is 36.190, which shows that the selected firms which they are present on Pakistan Stock Exchange are relatively older and their highest value 129.0 and lowest value is 9.0.

Average interest rate is 0.080 and its maximum and minimum values are 0.10 and 0.058 respectively.

Correlations

It is a bivariate analysis that finds power of relation within variables and the value of correlation coefficient lies between +1 and -1. If the value lies between +1 and -1 then it shows that the association between variables is in line or if the value comes out from +1 and -1 then it means that the variables are not in line. If the correlation coefficient value comes less than 0 i.e., 0.33 etc., then the association will be weaker between variables, or if the value comes higher than 0, then the association between variables will be stronger. Pearson correlation, Spearman correlation as well as Kendall rank correlation measures are commonly used in statistics.

For calculating the degree of association of directly related variables, the Pearson Correlation is used, and it involves that every variable would be normally distributed, no homoscedasticity among variables as well as linearity among variables. Homoscedasticity supposes that either the data is normally distributed through a regression line, but linearity supposes a straight-line association among every variable in the analysis. On the other side, the Spearman correlation, as well as the Kendall correlation, is non-parametric tests, and it determines the extent of association between two variables (Abu Tawahina, 2015).

Here the question comes to mind that which correlation technique is the good one means that Pearson correlation is the best, or Spearman correlation or Kendall rank correlation among these valuations for the study?

So the Answer to the above question depends upon the results of the normality-test, a test of normality-box, histograms and so on, and these are used to find out that either the data is normally distributed or not. Then the researcher can easily select the best technique for the measure of correlation. For 50 numbers of the sample or less than 50, the Shapiro Wilk test of normality is the best technique.

Table 2. Pearson Correlations Matrix

Variable	Beta	Oil Prices	Firm Size	Firm Growth	Firm Age	Interest Rate	Lgsze
OIL PRICES	0.08						
FIRM SIZE	0.06	-0.02					
FIRM GROWTH	0.11	-0.11	-0.004				
FIRM AGE	0.02	-0.06	0.171	0.034			
Interest Rate	0.07	0.96	-0.026	-0.133	-0.065		
LgSze	0.05	0.02	0.919	-0.025	0.141	0.013	
Lgbta	0.90	0.08	0.065	0.105	0.025	0.069	0.062

Table 2 shows the correlation among all the variables of registered firms, and the results show that the dependent variable beta has positive relation with all independent variables i.e. oil price, firm size, firm growth, firm age and interest rate by 0.08, 0.06, 0.11, 0.02, and 0.07. This also shows that when the oil prices, firm size, firm age, firm growth and interest rates fluctuates then beta will also be changed in the same direction. There is negative correlation between oil prices with firm size, firm growth and firm age by -0.02, -0.11, and -0.06 means that the association between variables is weak but positively and highly correlated with interest rate, i.e. 0.96. There is an inverse correlation of firm size with firm growth and interest rate by -0.04 and -0.026, respectively means that the association is weak but positively correlated with firm age by 0.171. Firm age is negatively correlated with interest rate by -0.065, and the association between variables is weak.

Regression Analysis

Regression analysis is a very popular and much known statistical tool in social sciences. It is a quantitative method and used for the relationships of dependent variables and independent variables.

The regression model is used for determining the association of oil prices, firm size, firm growth, firm age, and interest rates with beta.

Table 3. Regressions Analysis

Variable	Coefficient	T-Value	P-Value
Constant	-0.049	-2.04	0.043
OIL PRICES	0.03	4.66	0.008
FIRM SIZE	0.01	5.98	0.004
FIRM GROWTH	0.02	3.1	0.017
FIRM AGE	0.002	0.17	0.863
Adjusted-R^2		36.23%	
F-Statistics		42.09	

Table 3 displays the association of beta with oil prices, firm size, firm growth and firm age. The constant value of the regression model is negative, i.e. -0.049, P-value is 0.0, and adjusted R^2 value is 36.23%, so the model is statistically significant, and the adjusted R^2 shows that 36.23% changes in beta is caused by oil prices, and controlled variable. The regression coefficient of oil prices, firm size, firm growth and firm age are 0.03, 0.01, 0.02, and 0.002. Oil prices, firm size, firm age and firm growth have a direct association with the beta, which means that if a one-unit change occurs in oil prices, firm size, firm growth, and firm age will cause 0.03, 0.01, 0.02 and 0.002, changes in beta respectively. This means that if oil prices increase, then beta will also be increased or if oil prices decrease, then the beta will also be decreased, and this is the same for the control variables, too means that the variations in oil prices will affect the productivity of the firm.

Conclusion

In this study, the dependent variable is a firm risk (Beta), Independent variable is oil prices, but firm size, firm growth, firm age and interest rates are control variables. In this thesis, panel data is used. Data have taken from 50 dissimilar firms which are listed on PSX. Taken data from 2012-2017 means six years of data is taken. The secondary data is used in this thesis, and the data has been taken from the Pakistan Stock Exchange website, the Energy information and administration (EIA) website, and the balance sheet analysis of the firms. For data analysis of the descriptive statistics, correlation matrix and regression analysis, the Minitab software is used. Results of the correlation matrix show that the dependent variables, i.e. beta have a direct relationship with all independent variables. This shows that when the independent variables fluctuate, then beta will also change in the same direction. After results, considerations and conclusions this is suggested for the upcoming research that more studies are necessary to examine the association of variations in oil prices and the volatility of firm risk for more than 50 firms because of this research work is limited to 50 firms. The time span of this study is only six years, further studies can be done on more than six years as well as further studies can be done in other countries. In this study the dependent variable is only one i.e. beta, to include more than one dependent variables, and in this study, the control variables are only four, so in future, to include more than four variables. An important recommendation is that to do research on those firms which are unregistered firms and works in Pakistan.

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