

IB Math Studies SL Project

What is the relationship between the price of a barrel of oil and the stock market?

Math Studies SL Project

Introduction:

The recent dip in the economy has caused serious alarm. It has been hard financially for many families due to vast unemployment, and the price of gas is so high that some workers cannot afford to drive to their workplace. It makes me wonder if there is a relationship between the price of a barrel of crude oil and the stock market. I also wonder if this is only happening here in the United States or if other countries are being affected as well. I will record from the Internet the monthly average price per barrel of crude oil from January 2007 through October of 2008 in both the U.S. and the U.K. Then, also through the use of the Internet, I will record the opening monthly values of the DOW Jones Industrial Average in the United States as well as the FTSE Average in the United Kingdom for the same time period. I will make two scatter plots—one representing the U.S. and one representing the U.K.—and graph the cost of oil against the stock market value by making each point signify one month. If the scatter-plot shows a linear relationship, I will create a line of best fit, calculate the slope of the line

A2

and find the correlation coefficient. To further compare the economic situations, I will calculate the mean and range of the gas prices. Additionally, I will determine the standard deviation of each data set.

A2

Year-Month	Dollars per Barrel of Crude Oil in the U.K.	FTSE 100 Average (pounds)	Dollars per Barrel of Crude Oil in the U.S.	DOW Jones Industrial Average (\$)
2007-Jan	56.66	6220.8	54.63	12459.54
2007-Feb	55.7	6203.1	52.11	12617.2
2007-Mar	60.87	6171.5	57.83	12265.59
2007-Apr	68.57	6308	64.93	12354.52
2007-May	66.92	6449.2	63.4	13062.75
2007-Jun	68.91	6621.4	65.37	13628.69
2007-Jul	72.75	6607.9	69.91	13409.6
2007-Aug	76.53	6360.1	73.81	13211.09
2007-Sep	74.27	6303.3	71.42	13358.39
2007-Oct	78.07	6466.8	75.57	13895.71
2007-Nov	89.4	6721.6	86.02	13924.16
2007-Dec	90.63	6432.5	85.91	13368.22
2008-Jan	98.42	6456.9	92.93	13261.82
2008-Feb	93.15	5879.8	88.71	12638.17
2008-Mar	102.3	5884.3	98.01	12264.36
2008-Apr	101.35	5702.1	98.39	12266.64
2008-May	113.52	6087.3	110.21	12818.34
2008-Jun	125.47	6053.5	121.36	12637.67
2008-Jul	142.45	5625.9	137.11	11344.64
2008-Aug	125.29	5411.9	121.29	11379.89
2008-Sep	108.46	5636.6	106.41	11545.63
2008-Oct	96.2	4902.5	93.38	10847.4

B2

Gas Prices in the U.S.

Mean: $\frac{54.63 + 52.11 + 57.83 + \dots + 93.38}{22} = \boxed{\$85.9}$

Range: $137.11 - 52.11 = \boxed{85}$

Standard Deviation:

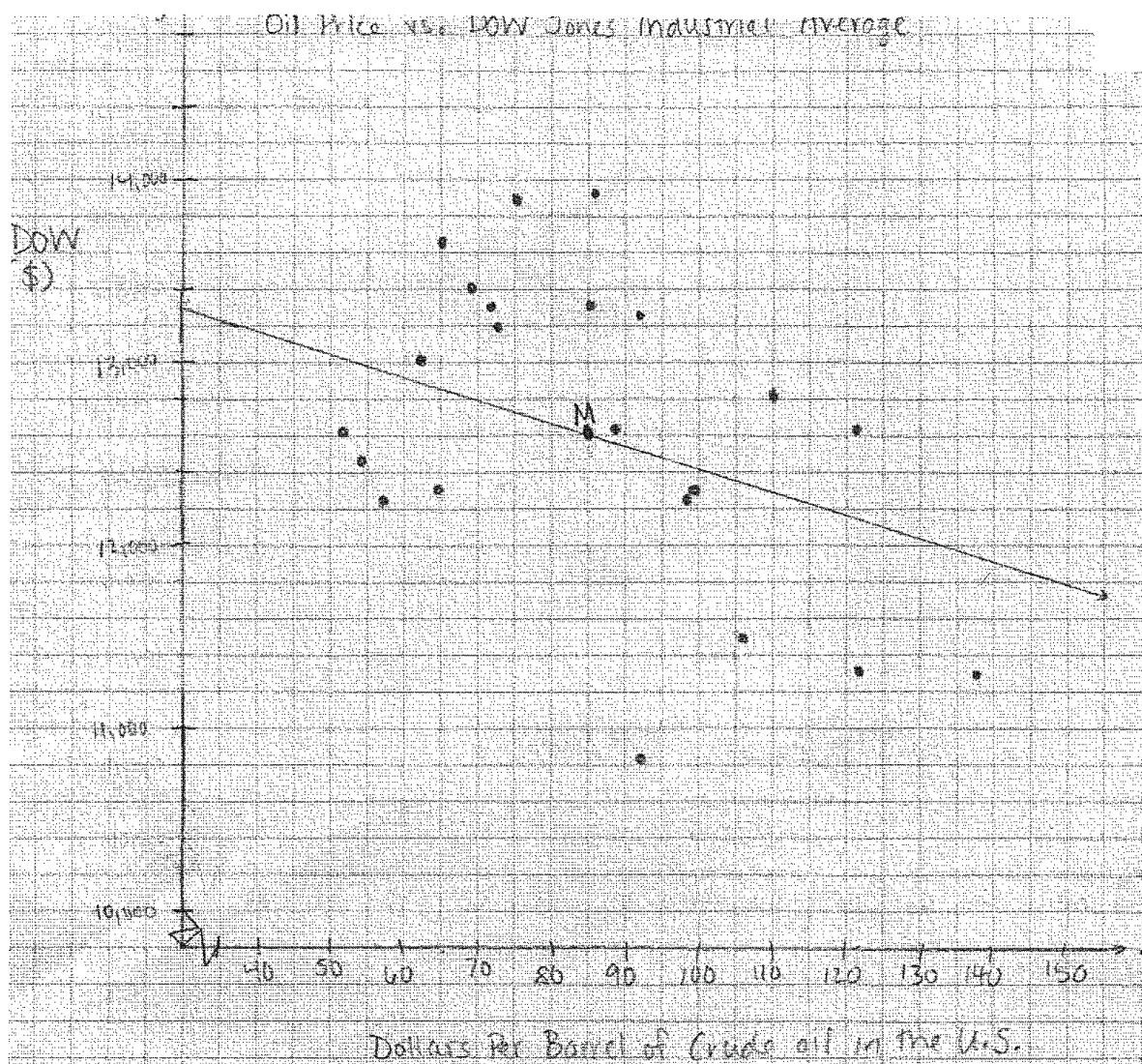
$x - \bar{x}$	$(x - \bar{x})^2$
-31.27	977.8129
-33.79	1141.7641
-28.07	787.9249
-20.99	439.7409
-22.5	506.25
-20.53	421.4809
-15.99	255.6801
-12.09	146.1681
-14.48	209.6704
-10.33	106.7089
+12	144
+01	1
7.03	49.4209
2.81	7.8961
12.01	144.2401
12.49	156.0001
24.31	590.9761
35.416	1257.4116
51.21	2622.4641
35.39	1252.4521
20.51	420.6601
7.48	55.9504

$$s = \sqrt{\frac{\sum (x - \bar{x})^2}{N}}$$

$$= \sqrt{\frac{11,553.0993}{22}}$$

$$\approx \boxed{22.9}$$

$\sum = 11,553.0993$



The Correlation Coefficient (r) is -0.473 . It has a fairly weak negative correlation.

The Slope of the line: $\frac{\Delta y}{\Delta x}$

by using the point M $(85.9, 12661.8)$ and the y-intercept $(0, 13250)$ I can calculate the slope.

$$\frac{y_1 - y_2}{x_1 - x_2} = \frac{12661.8 - 13250}{85.9 - 0} = \boxed{\frac{588.2}{85.9}}$$

I calculated point M by finding the mean of both the x-values and the y-values. (I knew the line would go through that point and I adjusted its angle until it was the best fit)

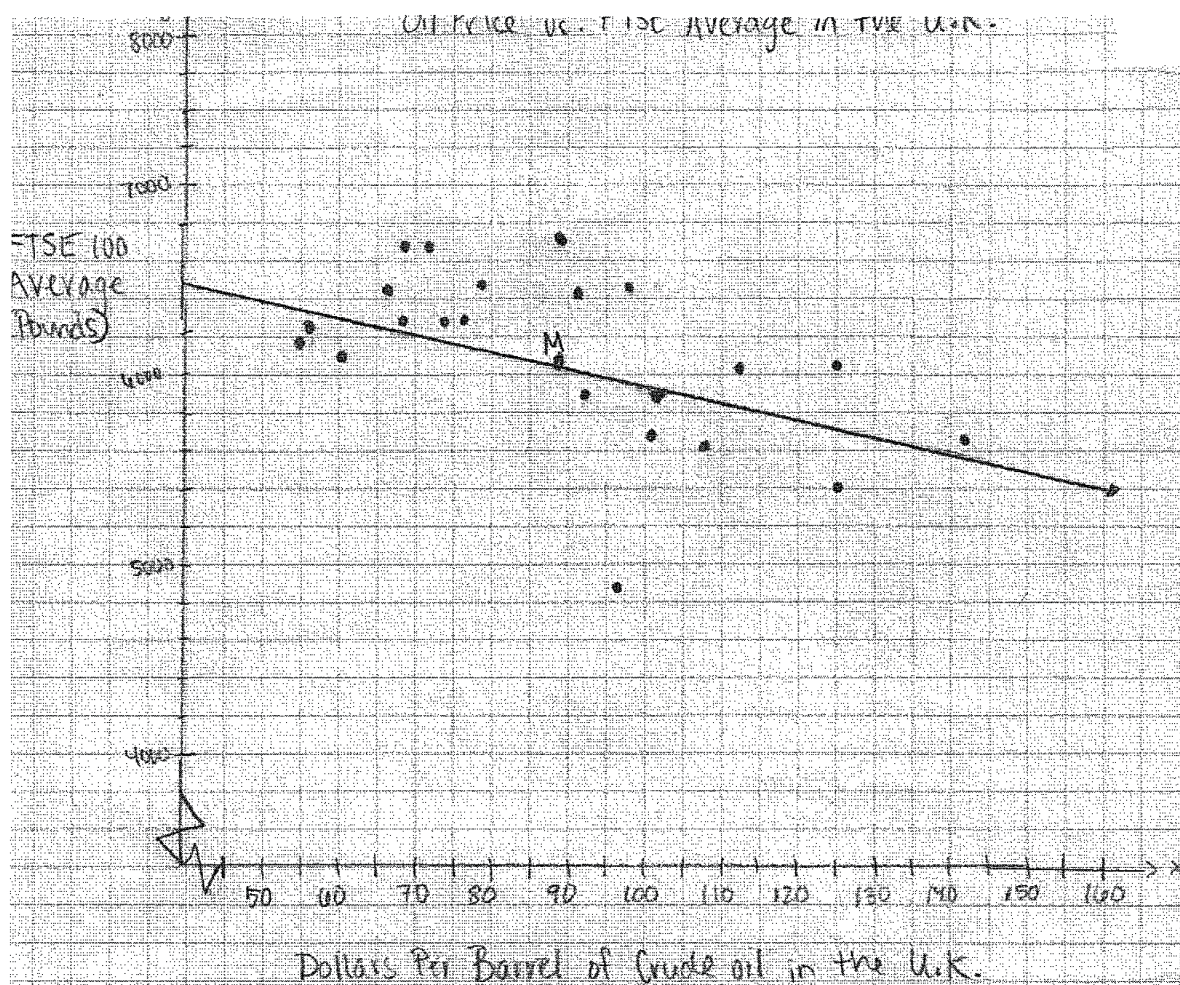
Mean of Gas Prices in the United States:

$$\frac{54.63 + 52.11 + 57.83 + \dots + 93.38}{22} = \$85.9$$

Mean of DOW in the United States:

$$\frac{12,459.54 + 12,617.2 + 12,265.59 + \dots + 10,847.4}{22} = \$12,661.8$$

$$\therefore M: (85.9, 12,661.8)$$



The Correlation Coefficient (r) is -0.557 . It has a moderate negative correlation.

I found point M the same way as before:

$$\bar{x} = \frac{56.66 + 55.7 + 60.87 + \dots + 96.2}{22} = 89.4$$

$$\therefore M: (89.4, 6114)$$

$$\bar{y} = \frac{6220.8 + 6203.1 + 6171.5 + \dots + 4902.5}{22} = 6114$$

The slope of the line: $\frac{\Delta y}{\Delta x}$

by using the point M (89.4, 6114) and the y-intercept (0, 6500) I can calculate the slope.

$$\frac{y_1 - y_2}{x_1 - x_2} = \frac{6114 - 6500}{89.4 - 0} = -\frac{386}{89.4} = \boxed{-\frac{95}{22}}$$

Gas Prices in the U.K.

Mean:

$$\frac{56.66 + 55.7 + 60.87 + \dots + 96.2}{22} \approx \boxed{89.4}$$

Range:

$$142.45 - 55.7 \approx \boxed{86.8}$$

Standard deviation:

$x - \bar{x}$	$(x - \bar{x})^2$
-32.74	1071.9076
33.7	1135.69
-28.53	813.1609
20.55	422.3025
-22.48	505.3504
-20.49	419.8401
16.65	277.2225
-12.87	165.6329
15.13	228.9169
11.53	132.9381
0	0
0.23	0.0529
7.02	49.2804
5.75	33.0625
2.9	8.41
1.95	3.8025
4.12	16.9744
56.07	3142.0449
53.05	2814.3025
55.89	3123.6821
7.80	60.84
6.8	46.24
$\Sigma = 11981.6689$	

$$s = \sqrt{\frac{\Sigma(x - \bar{x})^2}{N}}$$

$$= \sqrt{\frac{11981.6689}{22}}$$

$$= \boxed{23.3}$$

Interpretation of results:

A linear relationship exists between the price of oil and the stock market in both countries, evidenced by the two scatter-plots. The lines of best fit on the graphs for the U.S. and the U.K. alike have negative slopes—meaning that as price of oil increases, the stock market value decreases, on both sides of the Atlantic. However, the slope of the line representing the United States is more severe. This suggests that the changes in the U.S. have happened more drastically.

It is also important to note that the correlation coefficients for both graphs are weak. Still, in relation to one another, there is a stronger negative correlation between the price of oil and the stock market in the United Kingdom. The variables have a more apparent relationship than those in the United States. Similarly, the difference between the standard deviations of both graphs is small, but the value is a bit smaller for the United States. This means that the data for the U.S. is slightly more clustered around the mean and less sporadic than the data for the U.K. is.

That calculated range of the prices of oil in each country show that prices have varied more in the United Kingdom. Furthermore, by calculating the mean price of oil in both countries, it can be seen that, on average, those in the United Kingdom have paid more per barrel of crude oil than Americans.

D2

Overall, the differences among all calculated values are barely appreciable.
Although conclusions can certainly be drawn, it is clear that the economic situations are fairly similar.

Validity:

The methods used are appropriate to compare the economic situations of the United States and the United Kingdom, as well as mathematically sound. This experiment is valid, though not ideal; the final conclusion that the state of the economy is pretty much the same in both countries is justified here mathematically, but in the real world such a statement is not so easy to make. The conversion between the dollar and the pound changes constantly, if sometimes by only a mere fraction. These frequent variations are impossible to include in performing this sort of task. Using countries that have the same currency would be the way to overcome this issue.

F1

Furthermore, my question would be answered most accurately if every country were taken into consideration. Clearly, this is beyond my means. However, the project could be realistically improved if a third country were included. There are several other countries that have radically different cultures than the developed West. The United States and the United Kingdom share more similarities than other country combinations likely would. Additionally, the level of industrialization in the U.S. and the U.K. is fairly equal. It would be interesting to see the results for a country with a very different culture that is less developed. It might alter the overall conclusions drawn.

E1

Bibliography:

"Historical Prices." Yahoo! Finance. 3 Feb. 2009

<<http://finance.yahoo.com/q/hp?s=DJI&a=00&b=1&c=1997&d=09&e=21&f=2008&g=m>>.

"Historical Prices." Yahoo! Finance. 3 Feb. 2009

<<http://www.uk.finance.yahoo.com/q/hp?s=FTSE>>.

"Weekly All Countries Spot Price FOB Weighted by Estimated Export Volume (Dollars per Barrel)." Petroleum Navigator. 03 Feb. 2009

<<http://tonto.eia.doe.gov/dnav/pet/hist/wtotworldw.htm>>.

"Weekly Europe (UK) Brent Blend Spot Price FOB (Dollars per Barrel)." Petroleum Navigator. 03 Feb. 2009

<<http://tonto.eia.doe.gov/dnav/pet/hist/wepcbrentw.htm>>.