Fall 12-10-2021

Effects of Commodity Prices on Stock Returns in the Firearm Industry

Lance Siler
lsiler@mail.stmarytx.edu

Effects of Commodity Prices on Stock Returns in the Firearm Industry

By Lance Siler

HONORS THESIS

Presented in Partial Fulfillment of the Requirements for

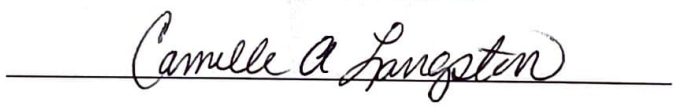
Graduation from the Honors Program of St. Mary's University

San Antonio, Texas

Approved by:

Dr. Violeta Diaz

Professor of Finance



Dr. Camille Langston

Director, Honors Program

December 10th, 2021

Table of Contents

Abstract

A modified version of the CAPM (Capital Asset Pricing Model) is used to evaluate the potential relationship between commodity inputs and the stock returns of public firearm companies. The data analysis involved using the model to develop expected returns for each of the companies' stock and then a regression was run between the returns provided by the model and historical returns. The p-values for each regression are statistically significant. This indicates that there is some sort of connection between metal commodity returns and stock returns.

Introduction

The purpose of this paper is to examine a potential relationship between commodity prices and the stock returns of public firearm companies in the United States. In particular, the commodities being analyzed are lead, copper, and zinc because of the key role these metals play in the manufacturing of firearms. The public firearm companies being analyzed are Smith & Wesson Brands (SWBI), Sturm, Ruger & Co. (RGR), Vista Outdoor (VSTO), American Outdoor Brands (AOUT), Ammo Inc. (POWW), and Olin Corporation (OLN). A modified version of the Capital Asset Pricing Model is used to evaluate how commodity prices influence the stock prices of these companies.

Literature Review

Iscan (2015) used VAR and cointegration analysis to evaluate any potential connections between commodity prices and the performance of the equity markets in Turkey. The conclusion was that there is no connection between commodity prices and the Turkish equity market.

Olson, Vivian, Wohar (2014) studied the volatility of the energy market and the S&P 500. Their analysis concludes that energy volatility is sensitive to the market.

Creti, Joets, Mignon (2013) used GARCH methods to analyze commodities and stocks over a period from 2001 to 2011. The conclusion was that the correlation between the selected stocks and commodities has become more volatile over time, especially after the 2008 financial crisis.

Sadorsky (1999) analyzed the effect that oil shocks have on the equity market and overall economy. The conclusion was that oil price shocks impact the economy, but not the other way around. Also, there is evidence that positive spikes in oil prices depress stock returns.

Chan et. al (2011) determined a relationship to stocks, commodities, and real estate markets, especially how investors tend to change between these assets during good and bad economic conditions.

Methods and Data

The commodity data for this paper was collected from Bloomberg terminals and the stock data was found on Yahoo Finance. The data represents daily prices for the respective commodities and stocks from the 24 August 2020 to 24 August 2021. The methodology that I will be utilizing is a modified version of the Capital Asset Pricing Model (CAPM) to see if commodity price changes for key metal inputs can help predict stock returns of firearms companies. This predictive model is:

$$Expected\ Return\ of\ Company\ i = \alpha + \beta_1(R_m - R_f) + \beta_2 R_{lead} + \beta_3 R_{copper} + \beta_4 R_{zinc}$$

In this model α represents a historical premium over the CAPM required return. This was found in the analytics by subtracting $R_f + \beta_1(R_m - R_f)$ from the daily historical return of the respective company's stock. The values β are the beta values which represent the correlation between company and commodity returns with the overall market. Most of the β values for the stocks were available online but the beta values for American Outdoor Brands and the commodities had to be calculated individually. The R values are the returns from the market, the risk-free return rate, and then the returns for each commodity.

The first step in this methodology is to find commodity beta values for every asset involved: lead, zinc, and copper and each company. This was accomplished by using the S&P 500 as a proxy for the market. Using the price data over the year period, daily returns were calculated for each commodity and the market. Next, the variance of the market returns and the covariance of each commodity with the market was also calculated using Microsoft Excel. One way of calculating Beta values is to take the covariance of asset and market returns and divide it

by the variance of market returns (Corporate Finance Institute). This process yielded the following results:

Beta of lead = 0.1689

Beta of zinc = 0.3015

Beta of copper = 0.2399

The Beta values for each company were found on Morningstar Investment Research Center and Yahoo Finance and are listed as:

Smith & Wesson Brands (SWBI): 0.89

Sturm, Ruger & Co. (RGR): 0.44

Vista Outdoor (VSTO): 0.39

American Outdoor Brands (AOUT): 0.84 (calculated manually)

Ammo Inc. (POWW): -0.57

Olin Corporation (OLN): 1.40 (from Yahoo Finance)

Many of the Beta values are less than 1 which implies that most of the companies and commodities are not as volatile as the market.

The second step in this methodology is to find the risk-free rate. The data to estimate a risk-free rate was found on the US Department of Treasury website and contained historical T-Bill rates. 52-week T-Bill rates were collected for the same year period of 24 August 2020 to 24 August 2021. The average rate of this year period came out to about 0.088%. This is an

important component of the predictive model because it is used to calculate alpha and is used to determine market risk premium.

The predictive model can be used to predict stock returns and the predicted returns can be compared to actual returns using a regression to determine if the model with commodity prices is statistically significant.

Results

The results of the data analysis show that there is a statistically significant connection between the predictive model and the historical data. After running a regression between the historical data and the predicted data from the model, every company's data yielded a p-value that is statistically significant. Statistically significant in this case means that the p-value is below 0.05 and implies that there is evidence to reject the null hypothesis. With a regression model, the null hypothesis is that the x and y variables have no relationship. Since the results of the regression indicate that this should be rejected, there is evidence that the model does in fact produce expected returns that have a strong relationship with historical returns.

P-value
0.784575
7.8E-179

AOUT (American Outdoor Brands)

P-value
0.377621
1E-169

OLN (Olin Corporation)

P-value
0.667376
1.3E-230

POWW (Ammo Inc.)

P-value
0.806349
1.6E-136

RGR (Sturm, Ruger, & Co.)

P-value
0.79522
1.1E-190

SWBI (Smith & Wesson Brands)

P-value
0.726691
4.7E-182

VSTO (Vista Outdoor)

Conclusion

The statistically significant p-values imply that the modified CAPM model does work and there is a connection between commodity prices and stock prices. The data analysis fails to show is that there is a causative connection between the two. The reason this is, is because of the inherent connections that result from CAPM. CAPM, which was the base for my predictive model, requires β values, so the entire model, as well as each respective asset, is directly tied to the overall market through those β values. The model developed can be applied for evaluating the worth of firearm company stocks and similar models can be created for other industries such as food businesses and agriculture commodities. Further study that would provide more insight into this is whether or not the new model is better or worse at predicting returns compared to the standard CAPM model or how this model behaves in different economic conditions.

Appendix

Combined Data.xlsx

Bibliography

Beta coefficient. Corporate Finance Institute. (2021, May 31). Retrieved December 9, 2021, from https://corporatefinanceinstitute.com/resources/knowledge/finance/beta-coefficient/

Capital Asset Pricing Model (CAPM). Corporate Finance Institute. (2020, April 14). Retrieved December 9, 2021, from https://corporatefinanceinstitute.com/resources/knowledge/finance/what-is-capm-formula/

Chan, K., Treepongkaruna, S., Brooks, R., Gray, S. (2011). Asset market linkages: Evidence from the financial, commodity and real estate assets. *Journal of Banking & Finance*. https://www.sciencedirect.com/science/article/pii/S0378426610004127

Creti, A., Joets, M., Mignon, V. (2013). On the links between stock and commodity markets' volatility. *Energy Economics*. https://www.sciencedirect.com/science/article/pii/S0140988313000078

Iscan, E. (2015). THE RELATIONSHIP BETWEEN COMMODITY PRICES AND STOCK PRICES: EVIDENCE FROM TURKEY. *INTERNATIONAL JOURNAL OF ECONOMICS AND FINANCE STUDIES*. https://dergipark.org.tr/en/download/article-file/256557

Morningstar Investment Research Center. (n.d.). Retrieved December 9, 2021, from https://library.morningstar.com/mirc/home.aspx.

Olson, E., Vivian, A., Wohar, M. (2014). The relationship between energy and equity markets: Evidence from volatility impulse response functions. *Energy Economics*. https://www.sciencedirect.com/science/article/pii/S0140988314000115

Sadorsky, P. (1999). Oil Price shocks and stock market activity. *Energy Economics*. https://www.sciencedirect.com/science/article/pii/S0140988399000201

U.S. Department of the Treasury. Daily Treasury Bill Rates Data. (2021, December 9). Retrieved December 9, 2021, from https://www.treasury.gov/resource-center/data-chart-center/interest-rates/Pages/TextView.aspx?data=billRatesYear&year=2021