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PY 538

Term Paper

Investigation of the Effects of Supply and Demand on the Stock Market

The basis of economic theory focuses on the idea of supply and demand. Supply and demand is "one of the most fundamental concepts of economics and the backbone of a market economy".[1] In theory, the supply and demand of any good or service is what drives companies to exist and profit. The same also applies to the stock price of companies, in that demand for a stock will always drive up the price because there is a fixed amount of shares that exist in the world. Because a company's stock price and the business it deals in are both dependent upon supply and demand, it would seem logical that the prices of goods and services should have some correlation to the stock price of a company that deals in those goods or services. This would imply that the value of a company is directly correlated to the value of the work they do, while proof to the contrary would seem to show that supply and demand may not be such an indisputable bedrock of economics.

In a modern context, supply and demand is not quite as obvious an economic indicator because of the complexity of the modern economy. There is an argument to make for the idea that our economy no longer exists in a state of scarcity, meaning that there is almost no limitations on the supply of any resource or good. While surely there are temporary limitations on the quantity of a specific good or service in a specific area, we can easily bring any amount of that specific good or service to anywhere with ease and haste. With the advent of Amazon and other online vendors, even specialty items which are not sold locally can be procured quickly with only a few clicks and a minor waiting period. This makes the only truly limiting factor of the economy the speed at which a resource can be delivered. If this is true then claiming that scarcity of a resource is a foundational concept of the economy theory seems misguided. Although the economy is effected by global factors and scarcity can be imposed on specific countries through the use of international sanctions, for the purposes of this paper we shall focus on American economic data because for most purposes the United States gives shape to global economic factors and imposes sanctions with that role never being reversed.

[1] https://www.investopedia.com/university/economics/economics3.asp

To investigate if this claim is based on outdated economic concepts or if it is actually a cornerstone of economics, comparing producer price indices to the stock prices of companies that produce goods related to the indices. Because a producer price index is a measurement of prices "at the wholesale, or producer level", companies that are primarily producers of what is measured by the index should see their own value correlated to the market value of their product.[2] Potential goods of interest to this paper should be ones that are ubiquitous to American society and would be considered necessary to the continued functioning of society. That means if these resources were to actually become scarce, they could have huge negative effects on the economy and society at large. These resources should also cover a variety of industries and have different base costs, so that any pricing correlation or lack thereof is not due to their influences on each other.

To determine if these time series have any correlation to each other, they will be compared using Pearson's correlation coefficient. The formula for the equation is:

$$r = r_{\mathrm{xy}} = \frac{\mathrm{Cov}\left(\mathrm{x},\mathrm{y}\right)}{\mathrm{S_x} \times \mathrm{S_y}}$$

Where r is the value of the correlation, determine by the covariance of both time series divided by the product of both time series' standard deviations. As Pearson's correlation is "the most common calculation" used in economic correlation it should provide evidence how pricing, and in turn scarcity, effect economic reality.[3]

The most obvious resource that is produced in massive abundance is crops. In the United States, the government subsidizes farms with about $20 billion a year with most of the money subsidizing staple crops like corn and soybeans.[4] Because of the large amount of government subsidies, this group would be a prime candidate for a resource that has little correlation between a company's value and the resources actual value. As corn is the most widely produced feed grain in the United States, it would be beneficial to start the investigation with corn.

Many companies deal in a plethora of types of business, and commercial farmers are the same in that they grow many different types of crops. However, the producer price index of corn should still

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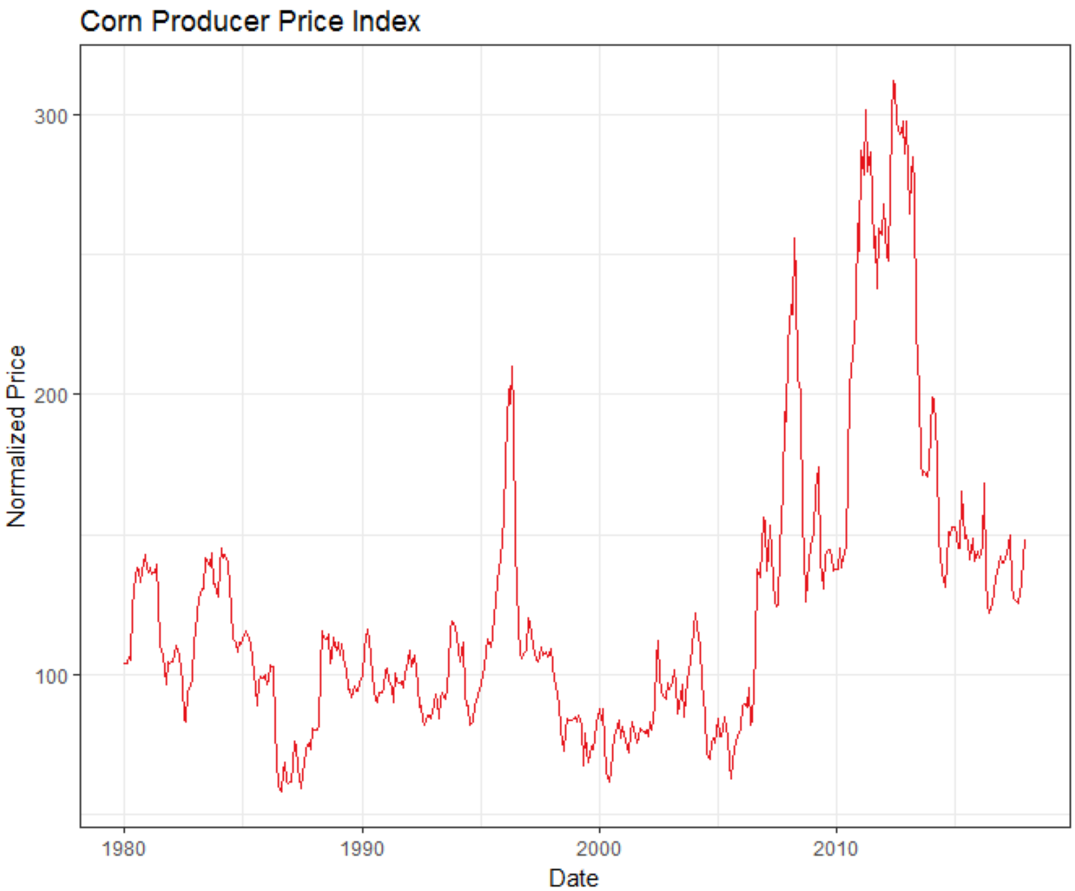
[2] https://www.investopedia.com/university/releases/ppi.asp
[3] https://www.investopedia.com/terms/c/correlationcoefficient.asp
[4] https://www.economist.com/news/united-states/21643191-crop-prices-fall-farmers-grow-subsidies-instead-milking-taxpayers

have some correlation to the stock prices of companies that deal largely with corn and its derivatives. For this purpose we will look at Archer Daniels Midland Company (ADM) which produces food, ethanol and biofuels, and animal feed, all of which are corn based products.



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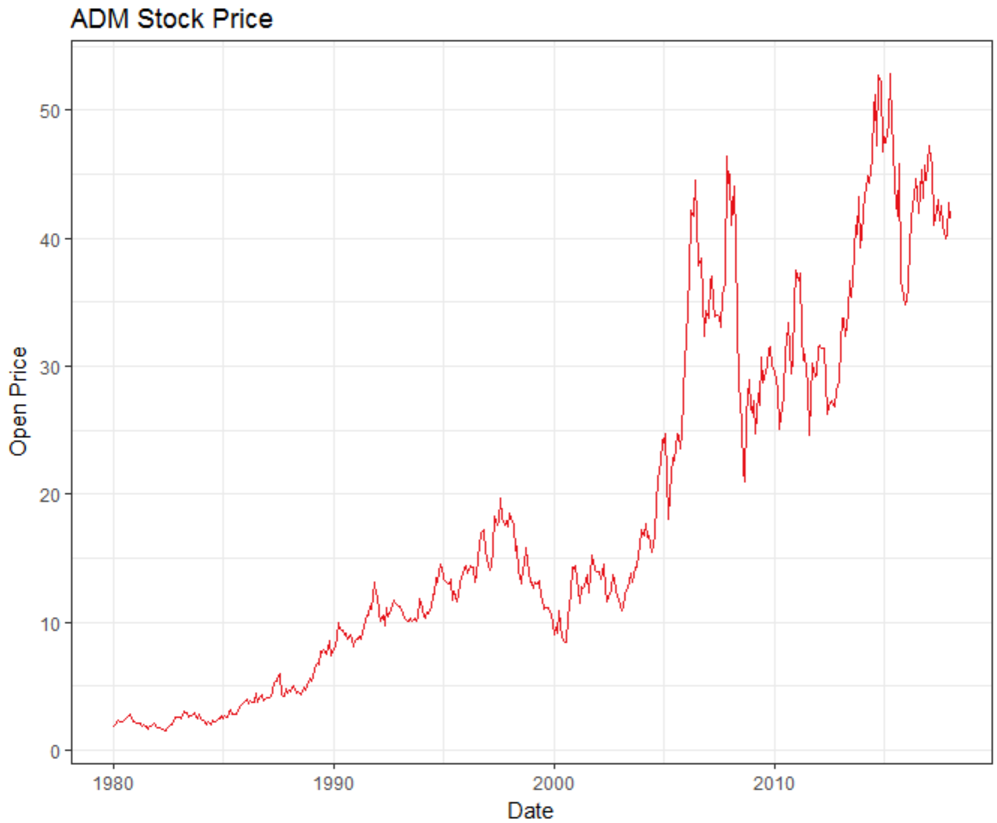
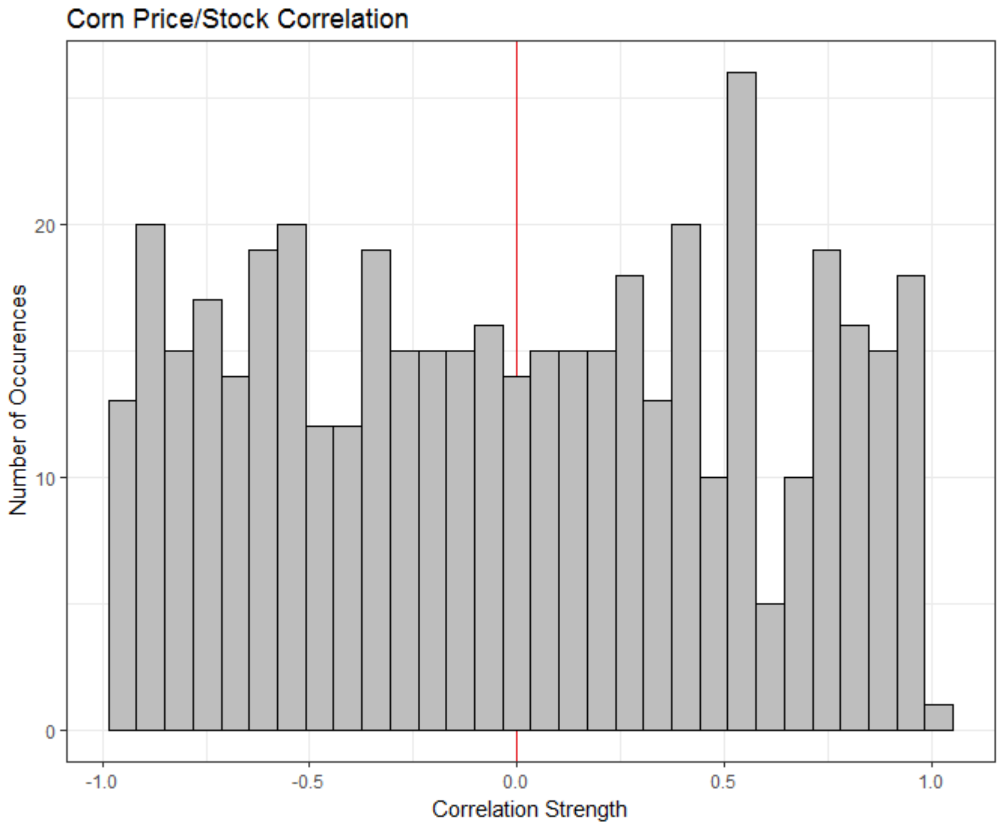
[5] https://fred.stlouisfed.org/series/WPU012202



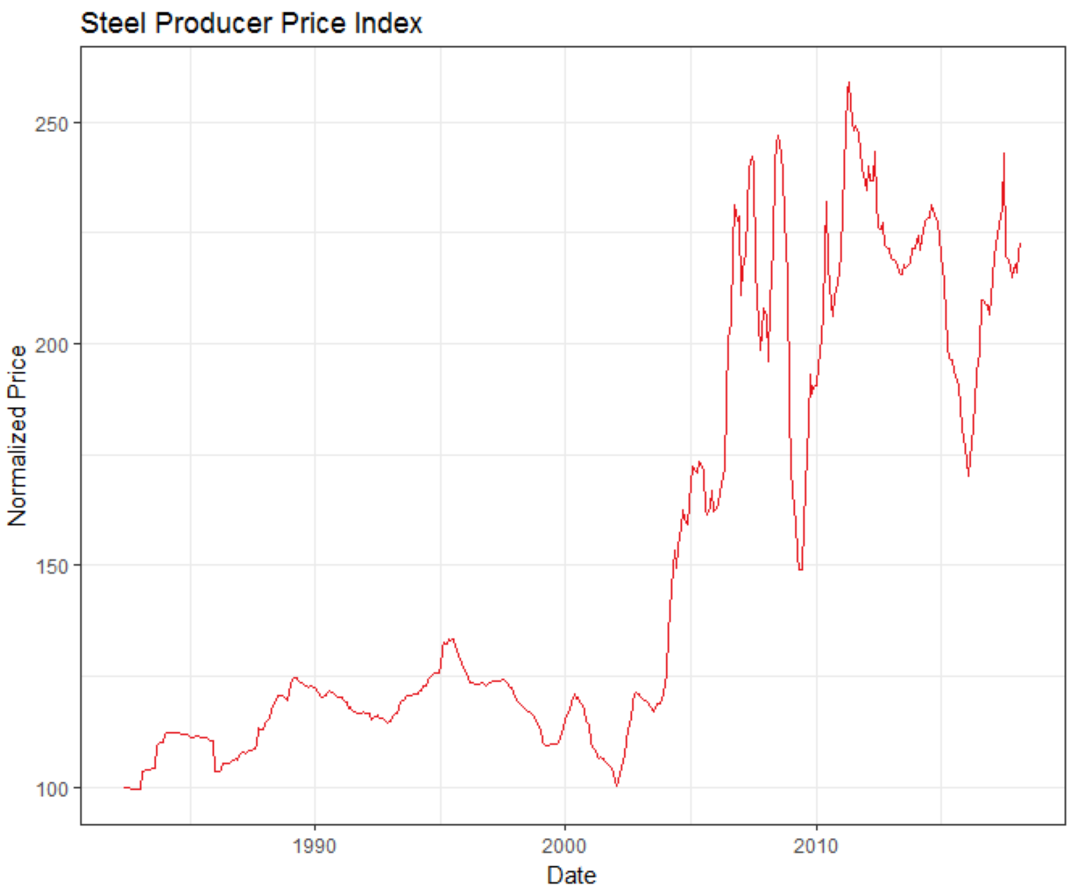
Using a visual comparison the graphs appear to have seem to have some correlation. From a statistical perspective of comparing each 6 month segment to find if there is correlation between the producer price index and ADM's stock price we find that this may not be true.



In the above histogram, bars to the left of the red line account for negative correlations between producer price and company value during a given 6 month period while to the right are positive correlations. Looking at the correlation histogram it would appear that there actually is not any correlation between the producer price and the stock price of ADM. This lack of correlation may be due to the variety of products that ADM produces, but it seems more likely to attribute this to the governmental subsidies that would prevent any change in the price of corn from negatively effecting a company that deals in it.

Another resource of critical value to society is steel. Steel is incredibly important to fabricate the foundational objects our society needs like buildings and highways, but it obviously fills a different economic niche than corn. It does not degrade as quickly as crops and it is not directly purchased or required by most citizens. This means that it is likely dependent upon different economic factors that dictate its value, which also may affect steel companies differently.

Steel has also recently been additionally protected by the United States government. While steel may not receive the massive amount of subsidies that American farms receive, the market is still protected by our government as it is seen to be crucially important to the welfare of the nation. The most recent governmental influence on the steel industry has been focused on protecting our domestic production against foreign competition, which is not the same type of incentive as direct subsidies. Investigating the steel industry can help to determine if a resource being in a protected status by the American government in any sense prevents those companies that deal in them from being effected by its price. For steel we will be looking at the Nucor Corporation which is a producer of steel.



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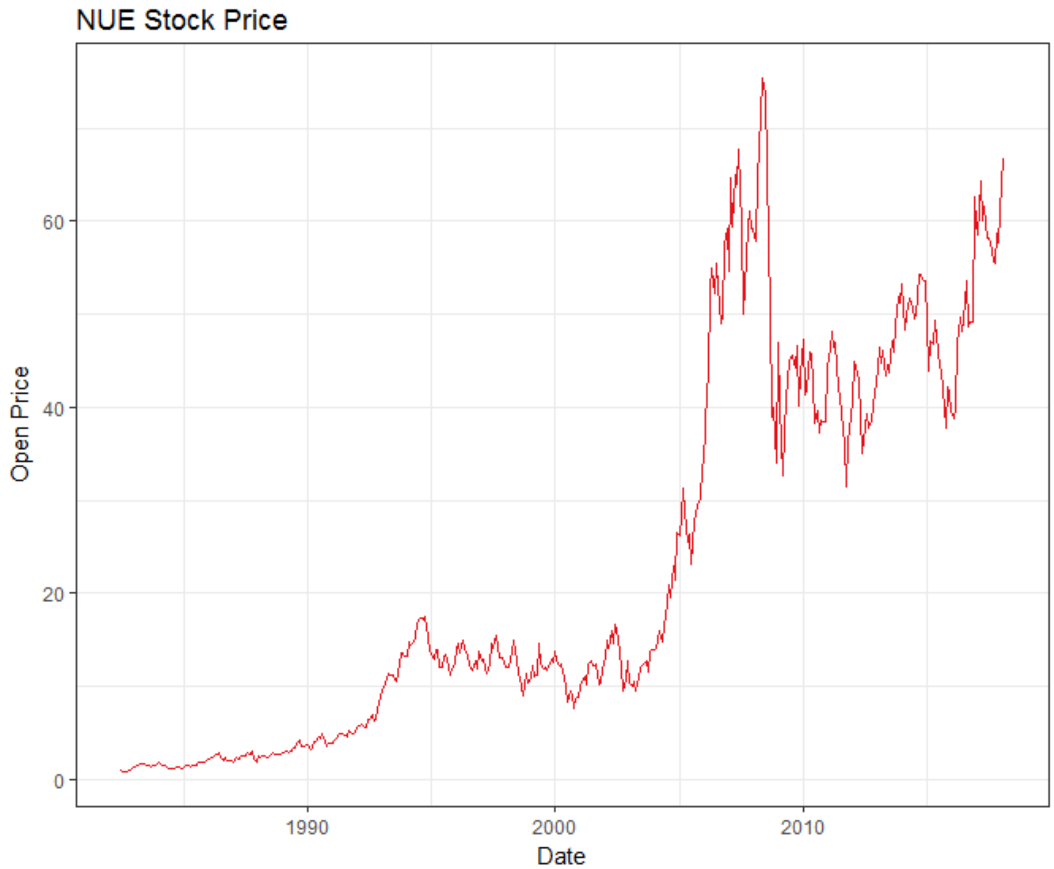
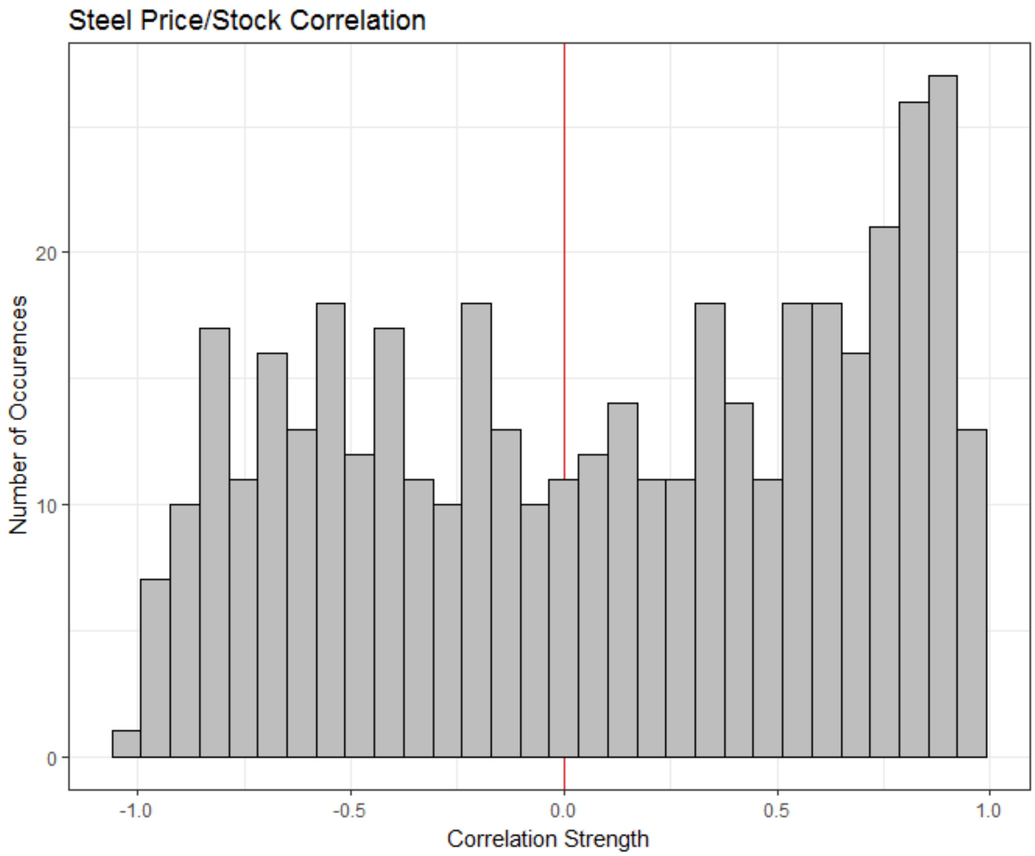
6 https://fred.stlouisfed.org/series/PCU334412334412

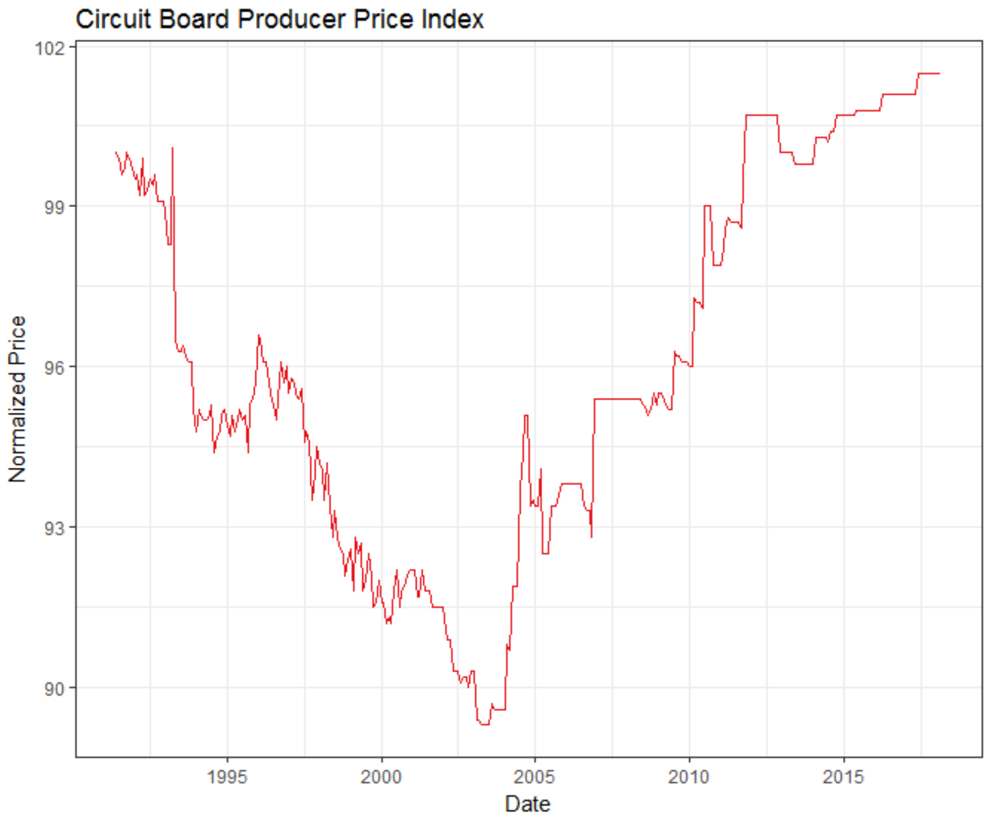


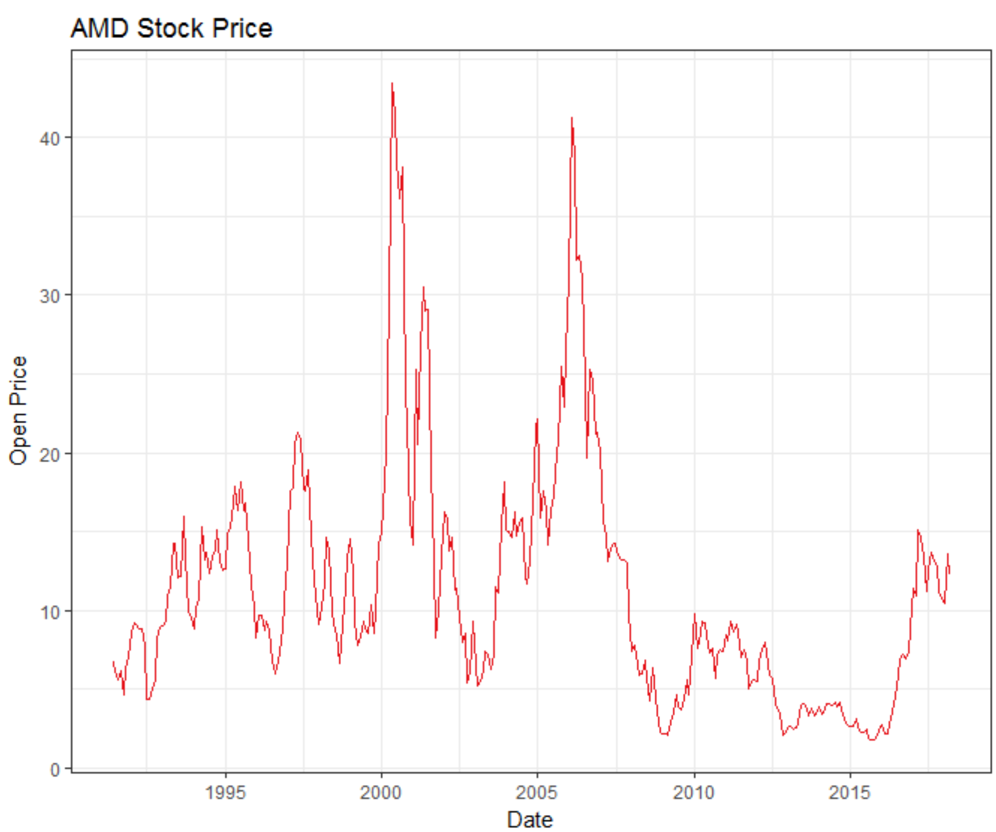
Now there appears to be some correlation between these two time series. We will see how much actual correlation there is in the graph below.

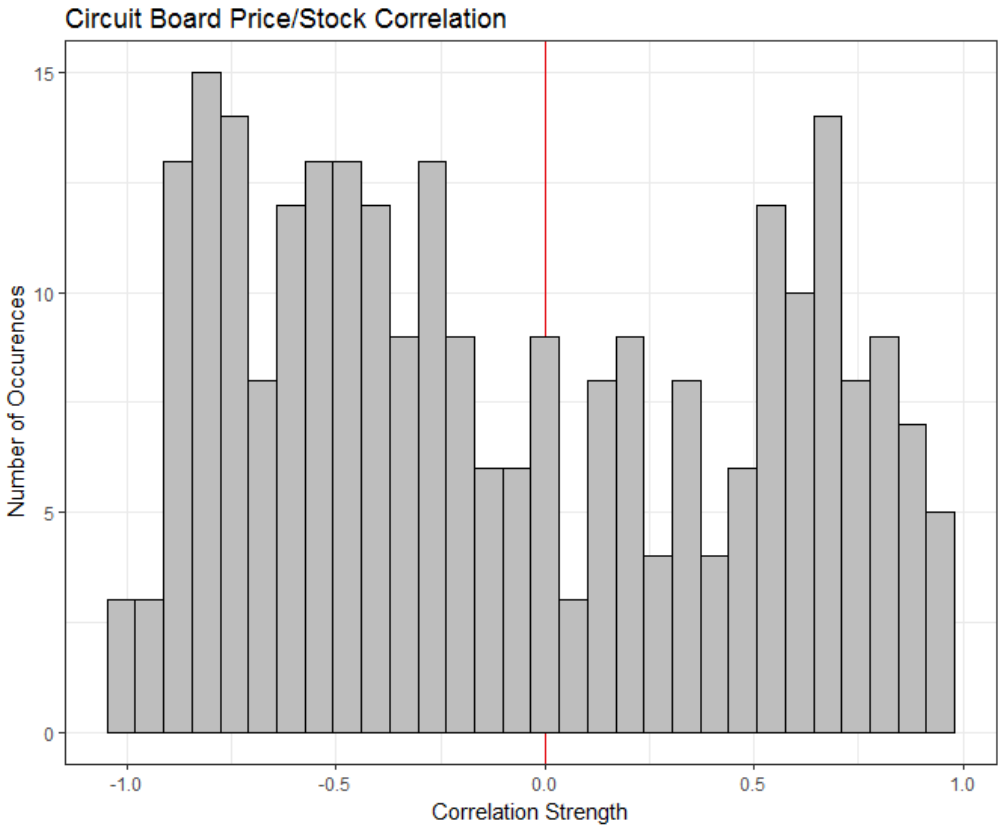


According to this correlation function there appears to be more strongly correlated 6 month time series in this market than we experienced with corn crops. Differences in the type of resource may account for this change in correlation, because steel is much more difficult to produce than corn. Any large shift in the value of steel would understandably have more of an impact on the companies that create it.

A difficult to obtain resource similar to steel but much more prevalent to the consumer market is computer chips. With the advent of the smart phone and laptop computer, nearly every person in America consumes computer chips on a semiregular basis. This would make the market for silicon base computer chips integral to the current function of our society, and as it is fairly young this market does not have the same level of protections that some other markets may have. A computer company that the producer price index will be compared to is Advanced Micro Devices Inc. (AMD) which is known from producing CPU's as well as other computer devices.

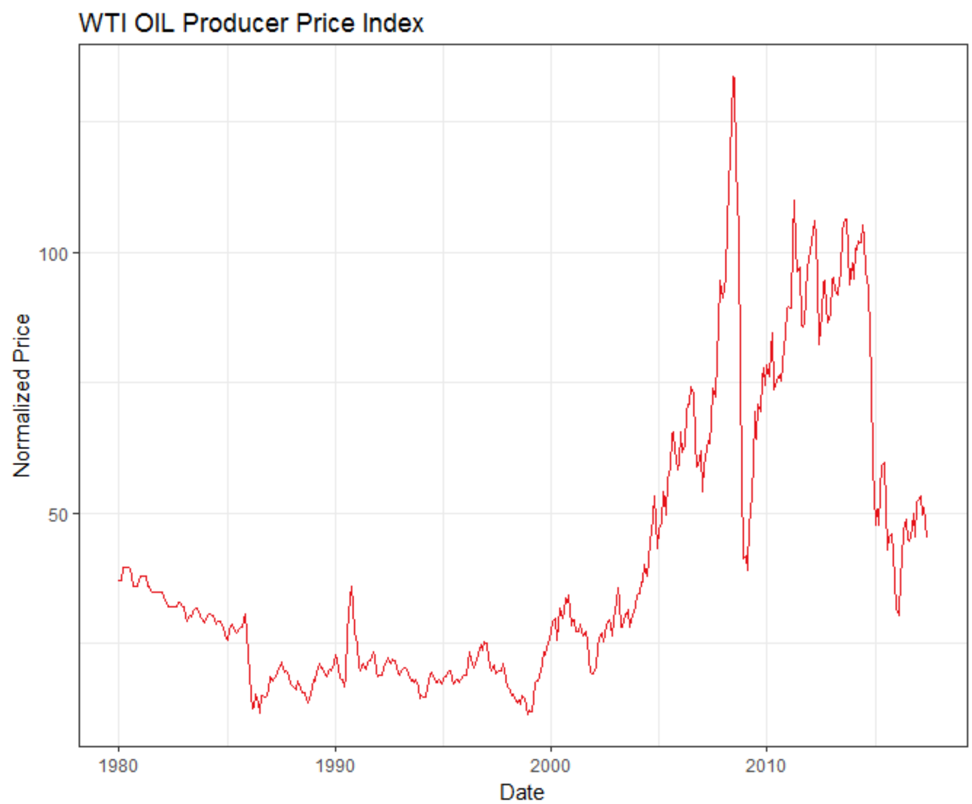

Circuit Board Producer Price Index
Normalized Price
102
99
96
93
90
1995
2000
2005
2010
2015
Date

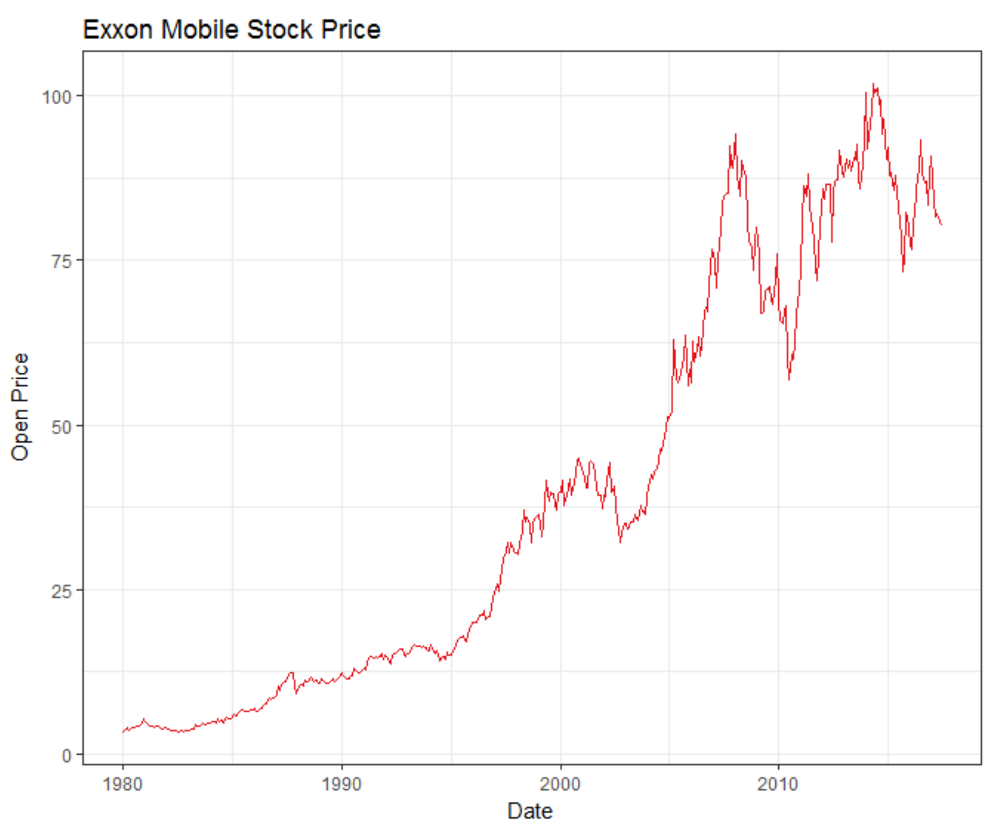

AMD Stock Price
Open Price
40
30
20
10
0
1995
2000
2005
2010
2015
Date

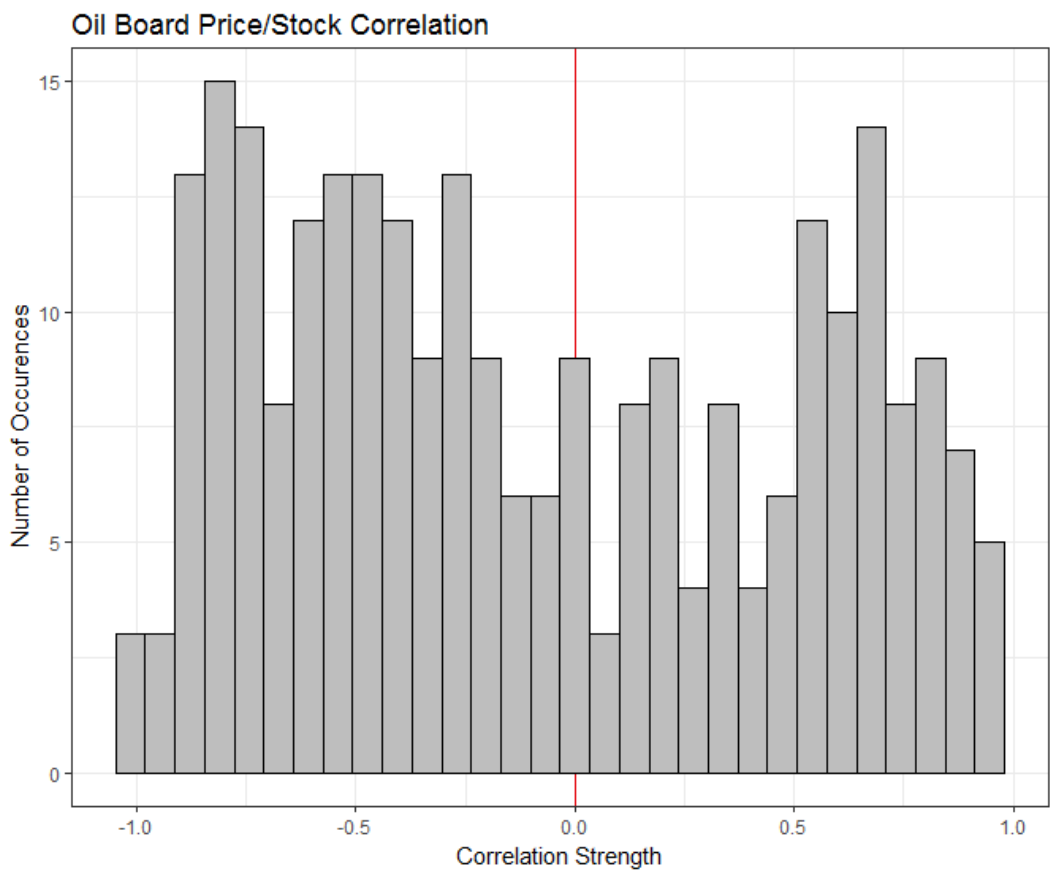


While there is some positive correlation between the price of circuit boards and the stock value of AMD, it mostly has traits that show negative correlation. This is the first market that has a definitive example of negative correlation between the price of the good it chiefly is concerned with and the value of the company that deals in it. Because circuit boards and all computer parts are far removed from the "natural" resources that make them, it seems more understandable that the market surrounding such a good does not obey the "natural" market rules.

The last market that will be investigated is oil, which is known to be directly controlled by the value of oil. If there is not a significant correlation between the price of oil and the value of a company, this would be very surprising. To make sure this investigation is only about American markets we will be looking at the index price of West Texas Intermediate crude oil (WTI crude) and comparing that to the value of the largest oil company in America, Exxon Mobile.


WTI OIL Producer Price Index
Normalized Price
100
50
1980
1990
2000
2010
Date


Exxon Mobile Stock Price
Open Price
100
75
50
25
0
1980
1990
2000
2010
Date



Somewhat surprisingly there appears to be a strong negative correlation between the price of crude oil and the value of Exxon Mobile. Given that the oil industry is known to be directly controlled by those companies that produce the world's oil, it would make sense that they have direct control over the value of oil and therefore direct control over their own value. There may be an argument made for the political power of oil that contributes to this negative correlation, because when the price of crude is lowered to cause foreign competitors to suffer it would be plausible that the value of Exxon would still go up because they are one of the only companies able to profit from selling crude oil at such a low price.

In conclusion, it does not appear that the price of any of the resources investigated have an apparent effect on the value of the companies that produce them. This may be evidence that true scarcity of an item does not really effect the American economy in a meaningful way. This is because if the converse was true we would have to see high correlation between the producer price index and related companies, because they would be profiting off of the increased value of their market. As we do not see any evidence of correlation between resource value and company value, it would follow that the true value of companies does then not directly stem from what they produce but rather what function they play in the grand scheme of the economy. If the market does not truly follow the ideas of supply and demand at its core, then economic theory would be starting from a faulty premise. While supply and demand absolutely has been proven to be the cornerstone of direct exchanges between rational actors, in a modern economy with massive corporations and a seemingly impenetrable amount of data regarding the movement of goods it would be naïve to claim that the economy in its current state is simply an abstraction of that direct supply and demand.

This question would be difficult to fully answer in any definitive sense, but future investigations into this might look more deeply at many companies in each market rather than just the largest players. The size of these entities should reflect their market, but it is possible that by focusing on the largest producers it overlooks those companies that are more directly correlated to the market value.   Large companies can overcome adversity easier than smaller ones, so it would stand that they do not experience market fluctuations in the same way others would. This investigation also excluded much of the world economy by focusing exclusively on the United States. There are places where scarcity of resources still does exist in noticeable ways, and looking into these markets in places where scarcity is still felt would provide a good comparison for American markets.