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Does the Stock Market Anticipate Economic Growth? Empirical Evidence Based on the U.S. Stock Market

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ABSTRACT

It is essential to understand the relationship between stock market returns and economic growth. We investigate whether the stock market is a leading indicator, a lagging indicator, or it has no relation to economic growth. Identifying this can help households plan their investments for business cycle contractions and expansions, as well as provide legislators and federal government agencies with the information they could use to maximize the effectiveness of their policies. Through our research, we identified the relationship between stock market returns and the changes in the percentage of gross domestic product (GDP) growth in the prior and the year following the market returns. By running a regression analysis of GDP percent change on the prior-year S&P 500 annual return, we find a significance level of 0.00159, which is highly statistically significant. Therefore, we conclude that the stock market is a leading indicator of a recession, which further allows us to better understand how policymakers can make optimal decisions.

Introduction

Following the macroeconomic policies of the United States of America's government's response to the COVID-19 pandemic, inflation rates increased significantly. With inflation being the highest in 40 years and unemployment at an all-time low, many prominent investment banks (i.e., Goldman Sachs, Morgan Stanley, and Deutsche Bank) are predicting the United States economy will enter into a recession in the next two years. After the investment banks released these predictions, the United States stock market embraced a significant correction, and the Standard & Poor 500 Index's share price decreased. In addition, we have seen two consecutive quarters of negative GDP growth, indicating the economy is headed for a recession. Since there is debate among policymakers on the current state of the United States' economy, we feel it is important to analyze the stock market's relationship with recessions as proxied by GDP growth.

We investigate whether the stock market (specifically, the Standard & Poor 500 Index) is a leading indicator of a recession. Since recessions are periods of negative GDP growth, we hypothesize that the S&P 500 will lead the Gross Domestic Product's Percent Change.

Literature Review

As a part of our literature review, we reviewed "THE STOCK MARKET CRASH OF 2008 CAUSED THE GREAT RECESSION" by Roger E.A. Farmer as a part of the NBER Working Paper Series. This paper shows evidence of a high correlation between the value of the stock market and the unemployment rate in U.S. data since 1929. In figure 5, we can see that the change in the S&P 500 is highly correlated with the change in the unemployment rate, but at a significantly smaller magnitude. By giving an example of the relationship between the stock market and the economy, the paper further supports our hypothesis that the stock market predicts a recession as a leading indicator. The paper's

methods accounted for externalities by using post-war "quarterly data to estimate a bivariate time series model of unemployment and the real value of the stock market." The author shows that this model remained stable both before and post-1979.

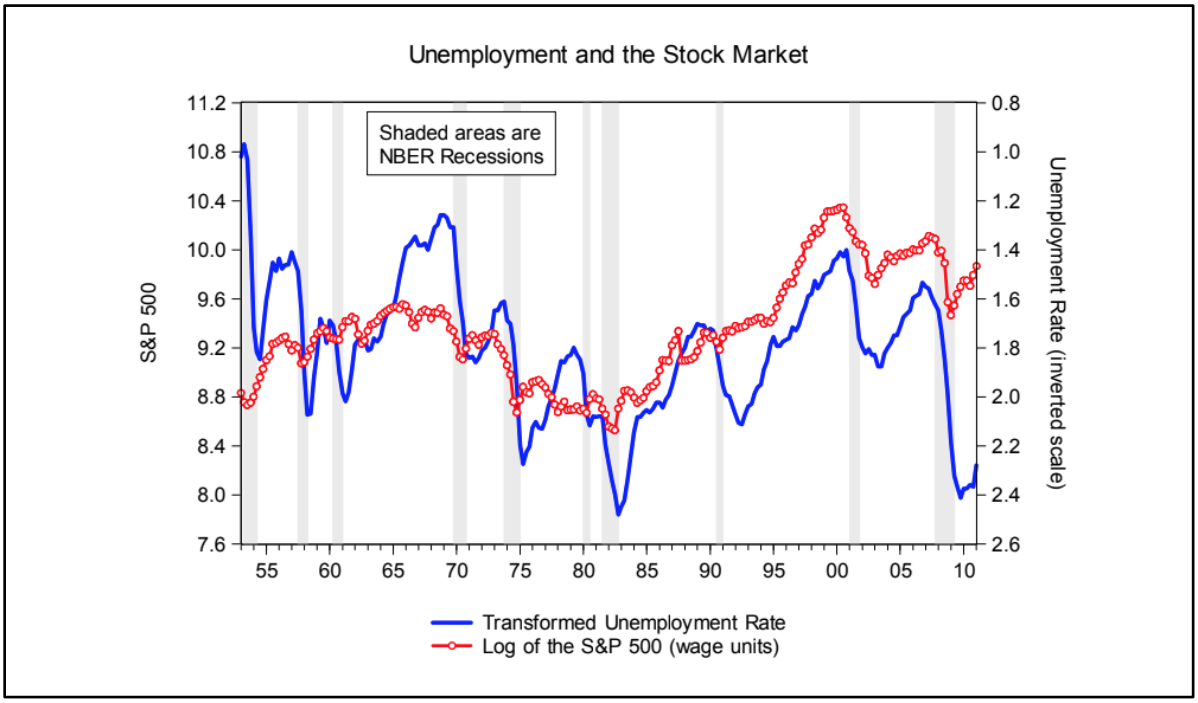

Figure 1. "THE STOCK MARKET CRASH OF 2008 CAUSED THE GREAT RECESSION" - Roger E.A. Farmer

As seen in figure 1, Farmer used unemployment to measure a recession, as, during periods of high unemployment, there is a recessionary gap in the business cycle. According to Oxford's dictionary, a recession is "a period of temporary economic decline during which trade and industrial activity are reduced, generally identified by a fall in GDP in two successive quarters." As the definition states, GDP is the leading measure of a recession, and as many economic patterns show: a fall in GDP in two consecutive quarters indicates a recession. This can even be taken into the context of the current state of the United States economy. With the GDP percent change being negative for the second quarter in a row, many economists have stated the United States is experiencing a recession. Another paper we reviewed was "THE STOCK MARKET AS A LEADING INDICATOR: AN APPLICATION OF GRANGER CAUSALITY" by Brad Comincioli of Illinois Wesleyan University. This paper shows theoretical reasons for how stock market values can help predict economic activity (leading indicator) and, more specifically, recessions. One of the reasons referenced in this paper is the traditional valuation model of stock values, which shows how stock prices can mirror the nature of future economic conditions. Another reasoning referenced was the "wealth effect", which essentially proves stock prices lead to economic activity by being a causal factor for future economic activity.

In "THE MYSTERIOUS GROWING VALUE OF S&P 500 MEMBERSHIP" by Morch and Yang as a part of the NBER working papers, we see why the S&P 500 is a relatively accurate representation of the stock market as a whole. The research published analyzing the occurrence of recessions and trends in the stock market has mostly reached the consensus that the Standard & Poor 50 (S&P 500) Index is an accurate measure of the United States stock market.

Our paper differs from past studies as mentioned above since we used data sets that spanned 90 years to receive more accurate results when we conducted regressions. Additionally, we decided to use GDP percent change to indicate economic recessions as opposed to using the unemployment rate because the latter has a few additional

drawbacks that may not show the full picture, such as not including the labor force participation rate, the underemployed, or discouraged workers (people who drop out of the labor force and don't meet the BLS' definition for "actively seeking employment").

Past research papers and studies have failed to clearly state the number of years the stock market leads or lags a recession. Our paper clearly defines the number of years the stock market returns lead the GDP percent change, and this is done through conducting various regressions with differing leading/lagging timings between the stock market percent change and GDP percent change.

Additionally, previous papers fail to connect this trend to macroeconomic policies (Congress + Fed). In this paper, we aim to connect dips in the stock market and GDP percent change to a policy passed by the Government and actions taken by the United States central bank. This will provide more insight into whether the policies were in the right scope, enacted at the right time, and if the Fed/government intervened at the right level.

Methods

We gathered data on the Standard & Poor 500 Index from data put together by Robert Shiller. Using Shiller's data on quarterly Standard & Poor Index share prices since 1871, we calculated the annual rate of return, adjusting for inflation. Next, we obtained data on the GDP percent change from The Bureau of Economic Analysis of the United States Department of Commerce.

To test our hypothesis that the stock market is a leading indicator of recessions, we ran a regression analysis on Microsoft Excel using stock market returns and GDP percent change. We denoted the Standard & Poor 500 annual rate of return as the x variable and the GDP percent change as the y variable. We used the GDP percent change of the t+1 year, analyzing the relationship with the stock market returns in year t.

In addition to understanding the relationship between stock market returns and recessions, we also aimed to use these findings to analyze the United States government's macroeconomic, fiscal, and monetary policies addressing recessions. More specifically, we aimed to see how effective these policies were in their timing, scope, and magnitude.

As for why we decided to use GDP growth to represent a recession, a recession is defined as two consecutive quarters of negative GDP growth. Therefore, to get an accurate measure of a recession, we decided to use the Gross Domestic Product percent change. The GDP we used is adjusted for inflation.

Additionally, as previously mentioned, in "THE MYSTERIOUS GROWING VALUE OF S&P 500 MEMBERSHIP" by Morch and Yang as a part of the NBER working papers, we see that occurrence of recessions and trends in the stock market have mostly reached the consensus that the Standard & Poor 50 (S&P 500) Index is an accurate measurement of the United States stock market.

Results

	Min	Max	Mean	Median
Annual GDP percent change	-12.9%	18.9%	3.405%	3.3%
Annual S&P 500 percent change	-39.288%	53.247%	8.347%	11.435%

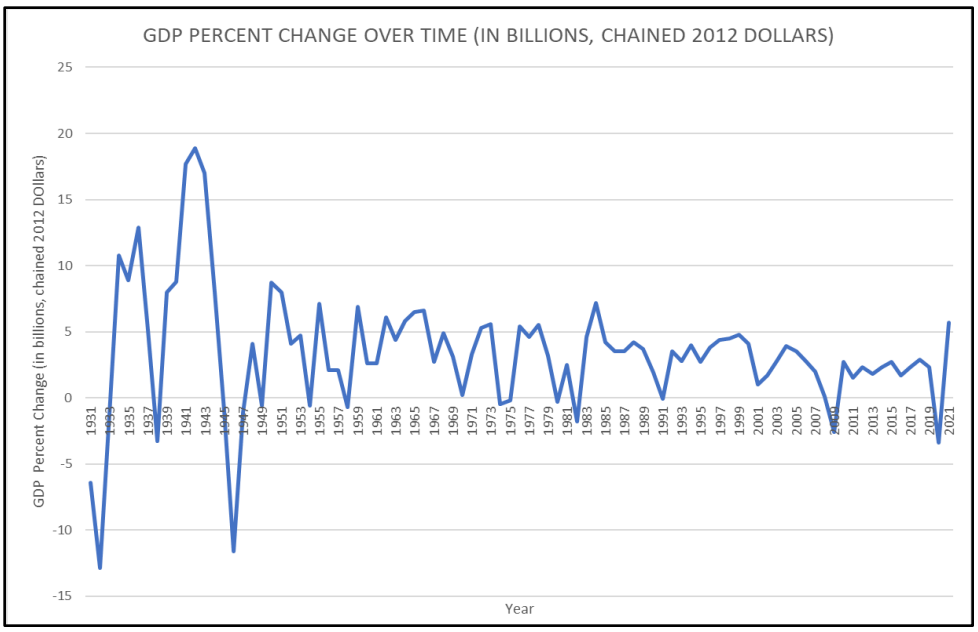

Figure 2: GDP % Change Over Time (In Billions, Chained 2012 Dollars) - GDP % change has fluctuated over time. In Figure 2, we see the GDP percent change plotted over time. The GDP Percent change changed significantly between 1931 and 1947. Between 1931-1933 and 1945-1947, the GDP percent change was negative.

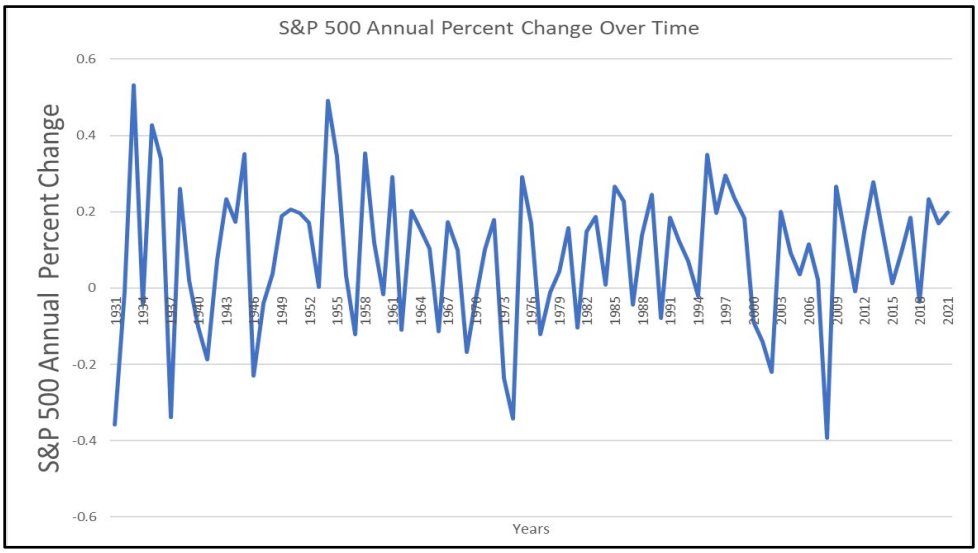

Figure 3: S&P 500 Annual Percent Change Over Time - S&P 500 Annual Percent Change has fluctuated over time. In Figure 3, we see the S&P 500 percent change plotted over time. The S&P 500 percent change changed significantly over time. It was negative for many years indicating periods of recessions.

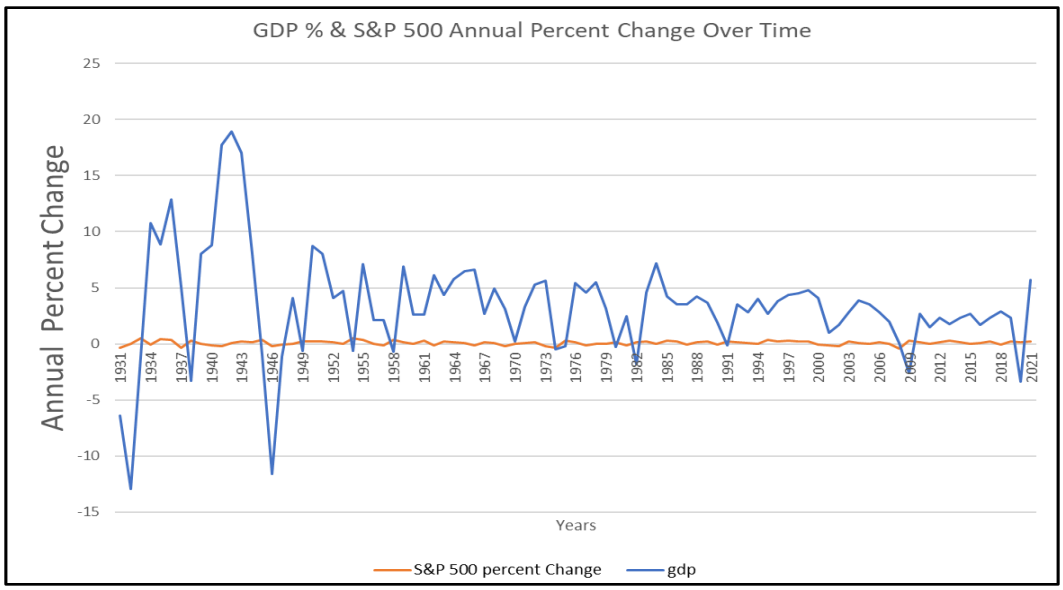

Figure 4: GDP percent and S&P 500 Annual Percent Change Over Time. The S&P 500 did not change as drastically (by annual percent change), in terms of magnitude, compared to the annual GDP percent change +

Looking at the summary of statistics for both GDP percent change and stock market percent change as represented by the S&P 500, we see that there is a strong correlation between both lines. When there is a dip in the S&P 500 percent change, there also seems to be a dip in the GDP percent change, therefore showing a similar pattern. Additionally, we see that the gray line (S&P 500 percent change) changes much more drastically than the blue line (GDP percent change). This shows us that, on average, the annual percent change in stock market returns is more volatile than the annual percent change in GDP value.

Discussion

We completed a regression analysis of t+1 data to analyze the relationship between the annual rate of return on the Standard & Poor 500 Index and the United States' annual Gross Domestic Product percent change. Here is the regression represented by an equation:

$$\mathbf{GDP\_Growth_{t+1} = a + bS\&P\_Return_t + e_{t+1}}$$

a = intercept, b = slope coefficient (sensitivity of GDP growth to stock market returns), e = regression residual

The results show a robust correlation, with a p-value of 0.0016, indicating that the stock market is a leading indicator of a recession. Furthermore, during negative GDP (recessionary periods), the stock market returns were negative in the year preceding the negative GDP growth supporting the stock market as a leading indicator of a recession. The data is statistically significant when the p-value is less than 0.05.

SUMMARY OUTPUT								
Regression Statistics								
Multiple R	0.326408697							
R Square	0.106542638							
Adjusted R Square	0.096503791							
Standard Error	4.481964521							
Observations	91							
ANOVA								
	df	*SS*	*MS*	*F*	*Significance F*			
Regression	1	213.1947214	213.1947214	10.61303555	0.001590421			
Residual	89	1787.832531	20.08800597					
Total	90	2001.027253						
	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	2.723539919	0.514360972	5.294997228	8.50668E-07	1.701515625	3.745564213	1.701515625	3.745564213
X Variable 1	8.169633316	2.507741429	3.257765422	0.001590421	3.186804512	13.15246212	3.186804512	13.15246212

Regression (t+1)

Robustness Tests:

To further test our data and extract accurate insights, we conducted several robustness tests with differing dependent and independent variable values.

SUMMARY OUTPUT								
Regression Statistics								
Multiple R	0.074558706							
R Square	0.005559001							
Adjusted R Square	-0.005614494							
Standard Error	4.72847404							
Observations	91							
ANOVA								
	df	*SS*	*MS*	*F*	*Significance F*			
Regression	1	11.12371189	11.12371189	0.497516758	0.482435296			
Residual	89	1989.903541	22.35846675					
Total	90	2001.027253						
	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	3.240176224	0.548297848	5.909518408	6.19883E-08	2.150720079	4.329632368	2.150720079	4.329632368
X Variable 1	1.884578927	2.671840162	0.705348678	0.482435296	-3.424310563	7.193468417	-3.424310563	7.193468417

Regression (t)

SUMMARY OUTPUT								
Regression Statistics								
Multiple R	0.052205139							
R Square	0.002725377							
Adjusted R Square	-0.00860729							
Standard Error	0.182258123							
Observations	90							
ANOVA								
	df	*SS*	*MS*	*F*	*Significance F*			
Regression	1	0.007988555	0.007988555	0.240488561	0.625074011			
Residual	88	2.923186058	0.033218023					
Total	89	2.931174613						
	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	0.099435819	0.023648374	4.204763439	6.26409E-05	0.052439645	0.146431993	0.052439645	0.146431993
X Variable 1	-0.002000719	0.0040798	-0.49039633	0.625074011	-0.010108463	0.006107026	-0.010108463	0.006107026

Regression (t-1)

As we see through our robustness tests with differing dependent and independent variable values, our significance values on both tests are not as small. As a result, we can conclude that these tests signify a weaker correlation between the annual rate of return on the Standard & Poor 500 Index and the United States' annual Gross Domestic Product percent change. Our strongest regression is when we assume that the stock market is a leading indicator of GDP percent change by one year (regression t+1).

Application to Policy

We can use our learnings from our previous analysis on the correlation between annual GDP percent change and annual S&P 500 percent change to analyze macroeconomic monetary and fiscal policies. In this example, we will study a significant piece of legislation passed to alleviate the effects of the recession that resulted from the coronavirus pandemic.

Following the breakout of the coronavirus pandemic, the United States economy entered a recession. To provide relief to millions of Americans, the United States Congress passed The Coronavirus Aid, Relief, and Economic Security Act, or the CARES act for short, which was signed into law by President Donald Trump in March 2020. The stimulus package helped the country mitigate the effects of the recession by providing small businesses with forgivable loans, taxpayers with stimulus checks, governments with COVID relief funds, and people with unemployment benefits. Ultimately, the CARES act was very effective in spurring America's economy. The Bureau of Labor Statistics states, "the CARES Act transfers boosted lower-income households' resilience significantly more than that of their higher-income counterparts and helped decrease the discrepancy in resilience across racial groups and geographic regions." We believe the reason for the CARES Act's efficiency was the timing. Generally, a drawback of fiscal policy is the time lag since there is usually partisan gridlock in Congress, and the Government is late to act. However, Congress' speed in passing the CARES Act in a bipartisan fashion helped Americans faster than ever by stopping the recession early in its course. In addition to the CARES Act, the US central bank - The Federal Reserve - lowered interest rates to increase investment spending, which is the spending most sensitive to the interest rate. This is because, at lower interest rates, more investment projects are profitable, leading to more significant investment. The government's response time accounted for the Standard & Poor 500's decline in February 2020. Even though the United States was at record-low unemployment, the S&P declined in February 2020, indicating to Congress and the world that America was entering a recession. Congress took appropriate and adequate action in record time to pass the CARES Act.

Conclusion

Since the S&P 500 tracks over 500 businesses in America, the world's financial analysts and economists have agreed that the Standard & Poor 500 (S&P 500) Index is a relatively accurate measurement of the United States stock market. Since a recession is defined as two consecutive quarters of negative GDP growth, we used the Gross Domestic Product percent change (adjusted for inflation) to identify recessions. By running various regressions, we've concluded that the stock market is a leading indicator of economic recessions. Through this, we've understood why the United States considers the stock market when making macroeconomic, fiscal, and monetary policy decisions.

Limitations

The limitations of our findings are that our claim that the stock market is a leading indicator of economic recessions cannot be generalized to every year, especially since the stock market is inherently volatile. Additionally, since the data we used was from 1930 to 2021, we cannot generalize these results with full confidence to other years or timeframes. For example, certain events, such as the stock market crash in 1929 that led to years of depression during the 1930s, have uniquely shaped the stock market return and GDP percent change data we used.

Acknowledgments

We would like to thank Professor Clemens Sialm at The McCombs School of Business at The University of Texas at Austin for aiding us in our research process. Through Professor Sialm's guidance and support, we refined our study and considered our findings' implications for adjacent fields, such as government policy.

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