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Abstract

This paper aims to explore the correlation between how some macroeconomic and microeconomic variables, especially the Consumer Price Index (CPI), predict stock performance. CPI is an index measuring the price level of goods and services consumers buy, with social security benefits and inflation tied to this index (Little, 2012). This study derives the expected return in the stock market as a result of fluctuations in percentage change in CPI, which is defined as inflation.

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I. INTRODUCTION

In today's increasingly interconnected world, nothing exists independently in a vacuum, which is also true for stock prices of all the stocks traded in the economy. Even back in the 1970s, Castanias (1979) admits that the stock price distribution has been a popular topic. The author challenged the widely accepted opinion that security price changes in competitive security markets are inter-temporally interdependent. Castanias initiates my exploration of what factors influence the so called invisible hand that controls prices in the stock market.

This paper aims to explore the correlation between how some macroeconomic and microeconomic variables, especially the Consumer Price Index (CPI), predict stock performance. CPI is an index measuring the price level of goods and services consumers buy, with social security benefits and inflation tied to this index (Little, 2012). This study derives the expected return in the stock market as a result of fluctuations in percentage change in CPI, which is defined as inflation.

Comincioli (1995) uses the stock market performance as a leading economic indicator. He explores the linkage between the leading economic indicator S&P 500 index in predicting the domestic Gross Domestic Product (GDP) and he uses the Granger-causality tests to prove there exists a causal relationship between stock prices and the economy. Comincioli and this study both try to determine the causality relationship between the overall economy and stock market, but the sequence in the causality relation is reversed for on this paper. This paper will aim to determine how the economy determines the stock market return rather than the other way around as described by Comincioli. Later, this paper elaborates on the effects of percentage change in CPI in stimulating the fluctuations in stock price, which is not covered by Comincioli. It will be further explored in this paper how significant inflation is as an indicator of the economy and whether this key figure can be used by investors to determine whether to purchase stock. It is, therefore, hypothesized that inflation is a significant figure and negatively correlated to the stock return.

From there, a theoretical foundation is created, which can potentially help prospective or current investors make their investment decisions. Investors are anxiously waiting for economic reports regarding some key economic factors every month or quarter in the hope of deriving the forecasts of stock return and deciding when to enter or exit the market. There is an old saying that exists, which states that an invisible hand in the economy controls the changes in the stock market. The purpose of this paper is to further explore the effect of inflation in moving this market over time. Hopefully that would shed some light upon how some key indicators like inflation, influence investor decisions concerning stocks.

II. THEORETICAL FRAMEWORK

There are several existing theories used in theoretical framework in order to support the research for exploring the factors influencing the stock price and to test my hypothesis that inflation and other macro- and micro-economic factors have a significant effect when predicting stock price. The following is a description and literature review for each of them:

A. Inflation Theory

Inflation is measured by percentage change in CPI as calculated below (The World Bank, 2012):

$$\text{Inflation} = (CPI_{t+1} - CPI_t)/CPI_t * 100$$

To take into effect the role of CPI in influencing stock performance, inflation is used. Inflation can be a result of demand pull or cost push. The former possibility is a positive sign to the overall economy as the increasing

demand brings prosperity to the economy. The latter possibility is perceived as a negative because the cost push can be driven by an unnatural force, such as the Oil Crisis in the 1970s, which would take tremendous time and effort for the market to adjust from such negative effect. Beyond the two historical possibilities, the recent inflation can be simply as a result of the Federal Bank's excessive printing of cash and flooding the market. Beyond the effects of the invisible hand behind inflation, inflation itself can send mixed signals to the stock market as well. Some companies are good at transferring the pricing pressure to customers, such as those in the consumer staple and energy industry. However companies compete in a global market and a discretionary sector may find it difficult to react to inflation. As a result, their investors end up paying more into their stocks but for less.

Abdullah and Hayworth (1983) aim to examine the relative contributions of a set of variables in the fluctuations of stock prices, especially Consumer Price Index (CPI), and they found that inflation has a significant impact on stock return. Chatrath, Ramchander, and Song (1997) study the correlation between the stock price and inflation in the case of India. Despite a number of articles on the stock return and economy in Europe and North America, the authors choose to approach the subject from the angle of a developing country such as India. The article provides limited support regarding the linkage between the real economy activity and inflation. However, the authors bring up inflation as a determinant of the overall economy and this indicates the importance to apply data adjusted for inflation. Their finding informs me that in order to explore the relationship between inflation and stock return, I must have the data adjusted for inflation in case inflation is not embedded in the stock return composite. Chang, Yeung, and Yip (2000) aims to use employment, CPI, and housing statistics in determining the stock price indexes to provide some guidance to investors. Although Chang, Yeung and Yip's regression model fails eventually in building a connection between the economic indicators like inflation and stock price index, it lends partial support to the hypothesis regarding the change in CPI variable in forecasting the investment return and it points out the practical use of the results from the research that confirms my research area.

In addition, Fama and Schwert (1977) estimate the extent to which various assets are hedges against the expected and unexpected components of the inflation rate within the period of 1953 to 1971. They extend the research from stock market to other income-producing assets and give us a comprehensive picture in the investment horizon. Fama and Schwert (1977) arrive at an "anomalous result" that common stock returns were negatively related to the expected component of the inflation rate. This finding demonstrates that the data used was adjusted for inflation to yield convincing results.

Overall, the inflation theory supports the hypothesis that inflation would have a negative impact on the stock return.

B. Aggregate Demand and Aggregate Supply Model

Continued from the Inflation Theory, aggregate demand and aggregate supply theory show that different types of inflation can have different effects on the real economy. For example, demand pull inflation is usually associated with an increase in real GDP. Cost push inflation, on the other hand, is often associated with decreases in real GDP. Cost push is shown by a leftward shift in the Aggregate Suppy (AS) curve while demand pull is shown by a rightward shift in the Aggregate Demand (AD) curve. Therefore, cost push inflation can be shown to cause output to fall. The prospect of recession should lead to a decline in the value of stocks. A little bit of demand pull inflation, on the other hand, would result in a short term increase in production. Stock markets may act favorably to low levels of demand pull inflation. However, extremely rapid demand pull inflation can cause significant inefficiencies in the economy. These inefficiencies, in turn, could have an adverse effect on the value of stocks. This model is important as it brings to the hypothesis that there is a threshold beyond or above, which the effect of inflation would be virtually opposite.

Tobin (1965) aims to explore the roles of monetary factors in determining the capital intensity of an economy. Tobin (1965) uses the Cobb-Douglas model to determine the relationship between the capital production and rate of return. This paper gives a good description of the Aggregate Demand of Money.

C. Capital Asset Pricing Model

Roll (1977) provides a critique on the works done on the Capital Asset Pricing Model (CAPM). Below is the equation for the CAPM:

$$\overline{r}_a = r_f + \beta_a \left(\overline{r}_m - r_f\right)$$

Where:
r_f = Risk free rate
$ß_a$ = Beta of the security
$\bar{r_m}$ = Expected market return

CAPM measures the relationship between expected return and actual return of securities. From the equation listed above, the higher expected return and the higher actual return. The expected high return can possibly draw the investors away from engaging in the consumption market when investors are deciding how to allocate their limited resources to make the maximum return. We usually conceive the risk free rate as the rate of return on the one-year year treasury. This paper is unique in the sense that it concludes the only testable hypothesis is that the market portfolio is mean variant efficient. All other hypotheses tested to arrive at the model are merely mathematical exercise that does not serve any practical use. This paper provides a pessimistic view in considering whether there are any factors that are strong enough to predict the asset price, including stocks. However, it provides a useful theoretical framework of the asset pricing model.

In addition, the risk free rate and the expected market return would reflect inflationary expectations. When Beta is different from 1, changes in inflationary expectations would affect the price of the security. CAPM alone emphasizes the importance of risk free rate, denoted by the one-year treasury rate in deciding the actual return. The empirical model of this paper incorporates the one-year treasury rate as a factor that influences the stock performance. For all these elements incorporated, CAPM proves to be an effective model to be used.

D. Time Value of Money (TVM)

When professional analysts calculate the net present value of expected future cash flow, they will always discount the cash flow expected to receive to the present value, assuming the economy is in a long-run inflating stage. This is also why a majority of people prefer to receive the money today rather than in the future with the same amount, just as why people will be paid interest for having money in the savings account. Meanwhile this is what investors are considering when making their investment choices: whether to spend the money today in consumer products or invest it somewhere with a positive expected return. This is how behavior in finance comes into play. The Time in Value of Money (TVM) Theory is a continuation of the Inflation Theory as it suggests the higher inflation leads to the lower future value. Thus TVM Theory supports the hypothesis that inflation has a negative impact on the stock market. Below is the equation used to represent TVM and its effect on future value:

$$F = P (1 + i)^n$$

Where:
F = future value
P = present value
i = reflects the time value of money including anticipated inflation
n = number of periods

A counter argument to this is that if the time value of money increases, investors would prefer to hold assets like stocks instead of money. The increased demand for stock will increase their prices. The idea is that inflation causes shifts away from assets that are sure to lose value with inflation, like money held in savings or even treasuries and bond in some cases, to assets that have a chance of appreciating in value like stock. However, this paper uses the supporting side of inflation theory and to see to what extent it can support the hypothesis.

III. DATABASE AND EMPIRICAL MODEL

The database applied is from Robert Shiller's United States stock price data for a time period from 1871 to 2012. Robert Shiller is an American economist, who explored in depth the correlation between economic factors and stock performance since the early 1980s while Bulmash and Trivoli (1991) investigate the relationship between the stock price and the national economic indicators. The authors proved how the existence of the relationship will lead to the use of the stock price index as an indicator in overall economy. Bulmash and Trivoli apply a time series data in exploring the relationship between the performance of stock market and overall economy.

The database is obtained through the website of Yale University Economics Department originally in Excel format. I hereby provide the link to retrieve the data for your reference: www.econ.yale.edu/~shiller/data/chapt26.xls. The data is appropriate as Shiller has traced the historical stock prices all the way to 1871, which is very rare and highly valuable for stock data and including both micro- and macroeconomic variables.

An OLS regression is used in addition to the S&P composite index, calculated as an index of the stock (equity) prices of the weighted average market

capitalization to be my dependent variable.

Hondroyiannis and Papapetrou (2001) study industrial production, interest rates, exchange rates, performance of the foreign stock market, oil prices, and stock returns to examine whether economic activity movements affect the performance of the stock market for Greece. This paper provides one of the most comprehensive lists of economic indicators listed that could potentially be the variables chosen in my research. Although this paper only examines the big picture of Greece, the indicators such as interest rate and industrial production shed some light on the situation of United States and also give me some insight in the choice of variables.

Inflation is calculated as a percentage change in CPI and use inflation as a key independent variable. A statistic description shows the possible convergence of the inflation and stock return graphs when combined together as their high and low points to some extent correspond.

The one-year treasury rate and its P/E ratio would be crucial to the model as well as explained by the CAPM. Besides that, the ten-year bond return and its P/E ratio are used to find how investors are making the trade-off decision of whether investing in short-term or long-term investment products. P/E ratios in both cases are derived from past data and show investors' expectation for future return. The higher the P/E, the higher expectation the investors have for its future return. It can also be argued that high P/E means certain investment product is overvalued and that tend to draw investors away from the treasury and bond and possibly bring investors back to the stock market. In that case, P/E ratios send mixed signals to the market. Additionally, all the variables, if necessary, are converted to 2005 dollars to adjust for inflation to examine movements in real terms.

In order to explore deeper into the effects of inflation, it is assumed that investors are smart enough to forecast the correct inflation and their predicted inflation for the next year is the actual inflation. In that way, inflation is incorporated for the next year as one independent variable which would help explain the stock performance. To better assess the change in the stock return, the dependent variable is changed to "Percentage Change in S&P Index".

Beyond the original hypothesis, the correlation between the inflation and stock return might be a piecewise function where inflation within a different range would have a range of effects on stock return. Inflation is categorized into Deflation(i<0), Low Inflation(0<=i<=.05), Moderate Inflation(.05<=i<=.1), and Hyperinflation(i>.1). Each of them is coded as dummy variable with "1" means the individual year is in that inflation category and "0" means it is not. This leads to Model B1.

Model A

Return on S&P Composite= ß0 + ß1 (Rate of Inflation)+ ß2 (Rate of Inflation for the next year) + ß3(One-year treasury return)+ ß4(P/E of one-year)+ ß5 (Return on Ten-year bond)+ ß6 (P/E of ten-year bond)+μ

Model B

Percentage Change on S&P Composite= ß0 + ß1 (Low Inflation)+ ß2 (Moderate Inflation) + ß3(Deflation)+ + ß3(Hyperinflation)+μ

IV. RESULTS

A. Model A

In the initial model, the Return on S&P Index is used as the dependent variable and is used to run the regression against one/ten-year interest rates, P/E ratio of one/ten-year interest rate, and inflation rates for current/the next year The adjusted R square is .571 as shown in Table 1, indicating that this model explains more than half of the data variation. Below is the regression result for Model A1 in which the dependent variable is Return on S&P Composite Index.

Return on S&P Composite = -674.455+ 29.049 (Rate of Inflation)-14.019(Rate of Inflation for the next year) -55.721(One-year treasury return)+ ß4(P/E of one-year)+ 93.579(Return on Ten-year bond)+ 36.139(P/E of ten-year bond)+μ

Just as hypothesized, the one-year interest rate has a negative impact on stock return. This further supports the reasoning that treasury and stocks as investments go in opposite directions and investors have to make the trade-off choice. The result for ten-year bond rate has a negative impact on stock return which goes against the original guess. The explanation for that is a ten-year bond as an investment might not share the same investor market as the stocks. In that case, ten-year bond serves only as an overall economic indicator, without competition for investors with stocks.

Results also show that P/Es of one/ten-year both have a positive impact on stock return. This can be explained by the earlier reasoning that the value of P/E is in line with investors' expectations regarding certain investments. In this case, the possible negative side of P/E on stocks is not demonstrated by the results. One thing to pay attention to is the P/E for one year is insignificant in explaining the stock return index. This could be a result of a combination of a negative correlation between one-year treasuries and stocks return plus a positive correlation between one-year treasury return and corresponding P/E.

Ironically, the key variables measured, the inflation for the current year and expected inflation for the next year, are found to be insignificant in explaining the stock return index. Moreover, Graph A with S&P Index against rate of inflation demonstrates clearly a positive linear relationship between the two. However, Graph B shows there is hardly a relationship between the S&P Index and the expected inflation for the next year assuming investors are smarts enough to predict accurately the inflation for the next year. The dots in Graph B end up all over the place. This can be explained by the prediction ability of investors are highly over-estimated.

B. Model B

The positive linear relationship demonstrated in Graph A goes against the hypothesis. In order to explore deeper the effects of inflation and focus on the relative changes rather than the absolute value, the "Percentage Change on S&P Composite Index" is used as the dependent variable. A comparison of the mean dummy variables of inflation ratios within different range extends my research on the effects of inflation on stock performance. Based upon the descriptive results, it is found that 41.8 percent of the years from 1871 to 2011 have hyperinflation, where inflation is over 10 percent. Interestingly, the next largest group, those years with deflation, represents 37.6 percent of the entire 141 years. The years which we considered having healthy inflation (Low/Moderate Inflation) merely represents 20.6 percent. The Descriptive Results are shown in Table 2 and the regression results for Model B1 and B2 are in Table 3.

Deflation (i<0)
Low Inflation (0<=i<=.05)
Moderate Inflation (.05<=i<=.1)
Hyperinflation (i>.1)

Model B1
Percentage Change on S&P Composite=.211-.193(Low Inflation) -.142 (Moderate Inflation) -.343(Deflation) +μ

Model B2
Percentage Change on S&P Composite=.049 + .172 (Hyperinflation)-.171 (Deflation) +μ

In Model B1, just as expected, deflation would be detrimental to the stock market. Declining prices, if they persist, generally create a series of negative events such as falling profits, closing factories, shrinking employment and incomes, and increasing defaults on loans. All these would lead to a stock return to go down. Low Inflation and Moderate Inflation also negatively impact stock performance. Although the common saying is that a slight and healthy inflation would be good to the economy, it does not work in the stock market in this case. A one-digit percentage inflation ratio can be detrimental to the stock market especially when the companies fail to transfer the pricing pressure to consumers and this is usually the case for companies in the discretionary sector. One thing to notice here is the variable Hyperinflation is automatically excluded when running this regression.

In order to find out the impacts of Hyperinflation on stock market, Model B2 is used to run the regression of only Hyperinflation and Deflation against the Percentage Change in S&P Index. Hyperinflation shows to be positively correlated to stock return. This can be explained by the inflation can be derived from the rapid demand pull that results in increasing supply of money. Over the past 141 years, Hyperinflation is overall beneficial to the stock market.

The original hypothesis that inflation negatively impacts stock return is partially correct from the results. The function between inflation and stock market is a piecewise function where inflation would have impacts of different magnitude and direction when the value of inflation changes. Inflation would have a positive impact on stock return when inflation exceeds 10 percent, otherwise inflation would be detrimental to the stock return.

V. SUMMARY AND CONCLUSION

The purpose of this paper was to evaluate the inflation as a leading economic indicator and explore causal relationships inflation together with other economic variables and stock return.

The results indicated a concrete relationship between the inflation and stock market does exist. Inflation, whose value is within different ranges, would play different roles on stock market. Inflation exceeding 10 percent would be a good sign to the stock market while inflation with other value would drag down the stock return.

The policy implication is to have dual standards when considering the impacts of inflation on stock market. Deflation, low, and moderation inflation would be detrimental to the stock market and they are potential warning signs to investors looking to either enter the stock market or increase weight of stocks in their portfolio. Hyperinflation, on the other hand, is a result of demand pull in most cases although exceptions arise when Federal Reserve meaninglessly print extra cash. Inflation figure above 10 percent is considered a good time for investors to either increase current holdings of stocks or enter the stock market. Compared to the interest rate of short-term treasury and long-term bond, inflation is more effective in predicting stock return. This is demonstrated by the more than 20 percent increase in adjusted R square. Therefore, the returns on alternative investments are more crucial figures investors should look at. Overall, inflation serves as supplemental information investors shall look at when making investment decisions.

For future study, the third area should look at the reverse side of this research and explore the causality relationship between the stock return and various economic variables. The results in this paper show an overall good economy is no guarantee to equally good stock return. Can stock market and the overall economy be independent events without concrete relationship between the two? Hopefully future studies in this area would shed some light on this question.

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VII. APPENDIX

Table 1: Regression Results, Dependent Variable is S&P Composite Index on Stock Return		
		Model A
Hypothesized	Dependent Variable	Beta Values
NA	Constant	-674.455 (-8.115) ***
-	One-year interest rate	-55.721 (-3.673) ***
-	Ten-year interest rate	93.579 (5.176) ***
+ or - depending	P/E of one-year	6.153 (1.140)
+ or - depending	P/E of ten-year	36.139 (7.223) ***
+ or - depending	Inflation of current year	29.049 (.228)
+ or - depending	Inflation of next year (assuming the expected inflation-actual of next year)	-14.019 (-0.126)
Adjusted R^2	0.571	
F	29.791 ***	
Sample Size	141	
t-statistics in parentheses *** Significance at the 0.01 level		

Table 2: Descriptve Results of Inflation with Ranges				
	Deflation	Low Inflation	Moderate Inflation	Hyperinflation
Standard Deviation	0.4860777	0.3267847	0.2800347	0.4950617
N	53	17	12	59

Table 3: Regression Results, Dependent Variable is Percentage Change on S&P Composite Index		
	Model B1	Model B2
Dependent Variables	Beta Values	Beta Values
Constant	0.211 (18.799) ***	0.049 (2.904) ***
Low Inflation	-0.193 (-7.771) ***	N/A
Moderate Inflation	-0.142 (-4.974) ***	N/A
Deflation	-0.343 (-20.064) ***	-0.171 (-8.152) ***
Hyperinflation	Auto excluded	0.172 (8.366) ***
Adjusted R2	0.742 ***	0.739 ***
F	135.023 ***	199.626 ***
Sample Size	141	141
t-statistics in parentheses		
* Signficance at the 0.1 level ** Significance at the 0.05 level ***Significance at the 0.01 level		

Figure 1: Graph A

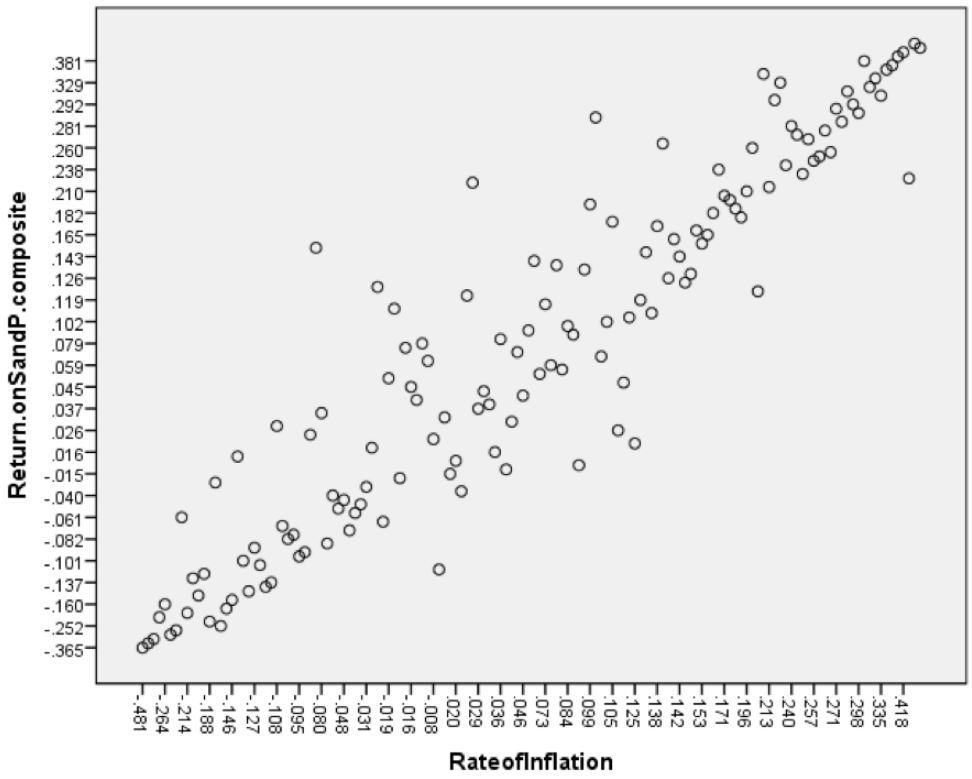

Figure 2: Graph B