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Master Thesis U.S.E

The relation between Stock returns and Inflation rates: International Evidence from Central Bank Independence level

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Abstract

Extreme inflation and volatile stock markets have recently considered as a serious problem for society around the world. The study of the relation between inflation and stock returns has been one of the more fascinating historical issues. This paper adds to the knowledge of previous studies by using the adjusted CBI factor as a variable to explain the relationship between stock price return and inflation rate using a data set from the G7 countries. By extending the analytical framework of earlier study, an empirical study was carried out. When central bank independence is included as an explanatory variable in the regression analysis, the results show a stronger negative association between inflation rates and stock returns. The findings have important implications since they offer different insights on central banks' independence level, knowledge from earlier studies of inflation and stock returns, and considerations for both investors and monetary officials who determine the CBI's constituent parts.

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1. Introduction

We expect the value of our money to increase when we invest in the stock market. At least, that's our hope. However, rising food prices and soaring inflation as a result of the Russo-Ukrainian war prompted the Federal Reserve to hike interest rates for the first time in years, driving stock prices to plummet. As a result, the relationship between inflation and stock prices is receiving increasing attention. On 9th of May 2022, stock markets plunged to their lowest point in over a year, continuing a five-week slide as investors consider the potential of interest rate hikes and rising inflation. The Dow Jones Industrial Average dropped 654 points, or nearly 2%. The broad-based S&P 500 dropped 3.2%, while the high-tech Nasdaq lost 4.3% (CBS Interactive Inc, 2022). According to data provider FactSet, the S&P 500 has now lost five weeks in a row, its longest losing streak since 2011. Such a reaction by the stock market to inflation news is not unusual. Historical literature has found that inflation and stock returns have been inversely correlated. The conventional theory from Fisher (1930) implies that stocks should provide a hedge against inflation, therefore this widely documented relationship has surprised economists.

The press, in contrast to academic debate, perceives this relationship to be general knowledge: The S&P 500 has been flirting with a bear market, and a 20% plunge, which has dropped more than 16% since its January peak. As long as inflation remains high and a recession approach, it may fall even farther (NYC, 2022). When inflation gets out of hand, the Fed raises interest rates to cool it down, and rising interest rates will cause earnings to decline and stock values to fall. This explanation reaches to as the *popular* hypothesis; *stock returns are negatively correlated with inflation* (Fama & Schwert, 1977)**.** This hypothesis will be evaluated in my thesis as a possible explanation for how the variable for each country's central bank independence affects the relationship between them.

In the past decade, various theoretical frameworks have been developed to explain the relationship between stock returns and inflation. Starting from the study that inflation is represented in the stock prices and thus in stock returns (Fisher, 1930), Fisher views that stocks should be good hedges against inflation. However, Fama (1981) proposes what has become known as the proxy hypothesis to explain the observed negative correlation and that is driven by the more fundamental relation between stock returns and future output. Most of the recent literature on the relationship between inflation and stock returns has focused on Fama's (1981) hypothesis. These contrasting assumptions of this relationship can be demonstrated by one of

the explanations that emphasizes the role of the monetary policy. It suggests that once central banks control the role of prospective monetary policy, the correlation could lose its significance.

Since the 1970s, the high inflation issues in the US led to a decline in stock returns, which triggered extensive research on stock returns and inflation. The financial press frequently discusses this, such as, “An unexpected high inflation sent stock price falling, as the market fears the Fed will increase interest rates in coming weeks”. COVID-19 has brought this correlation to the spotlight once again. The pandemic led to an unprecedented decline in stock markets across the globe, and to reduce the impact of the pandemic, central banks and finance ministries around the world have taken unprecedented expansionary monetary policy (Martin Feldkircher, 2021). The decision that central banks made aimed at stabilizing prices, and these have considered the effects of inflation on asset returns. Based on the prevalent hypothesis that stocks react negatively to inflation, the relationship between inflation and stock returns will vary among countries due to the differences of how they operate monetary policy. Therefore, I expect that the relationship will be dependent on the different central banks because each country has a distinct inflation rate, and central bank independence.

Previously done research mostly focused on whether the relationship between stock returns and inflation is positive or negative, and if the relationship between them at short and long horizons are different. If the stock price/inflation correlation is negative, the extent of the negative correlation will differ by country. The aim of this paper, then, is to examine how strong this correlation is in each country. The strength of the correlation may vary since each country has a different level of the central bank independence rate regarding the country's monetary policy. To find their significance, this study examines the G7 countries, which include Germany, Japan, the United Kingdom, Canada, France, Italy, and the United States. However, CBI (Central Bank Independence) in France, Germany, and Italy is identical to that offered by the European Central Bank, hence, in my analysis, these three countries are considered a part of the eurozone. Additionally, those countries account for 65.1% of the eurozone's GDP, which might serve as a reliable proxy for the eurozone (Eurostat, 2017). A focus on these G7 countries ensures accurate data, while the central bank's behavior in developed markets is sufficiently diverse to create contrasts. Moreover, the data from the advanced countries is accurate and has been available for a long time, and the G7 accounts for a significant portion (45 percent) of the world economy (CFR.org, 2022).

Theoretical work on central bank independence also provides mixed results. However, it is commonly agreed that more conservative and autonomous central banks are more likely to

threaten financial stability (Papadamou, Sidiropoulos, & Spyromitros, 2017). A notable example is the case of the ECB which has a more conservative profile than the Federal Reserve (Fed).

Therefore, the following hypothesis is proposed based on the factors:

> ***"The relationship between inflation and stock return is more inversely correlated with higher central bank independence."***

Eventually, this paper revisits the important policy question of how monetary policy influences the way stock returns react to inflation. The data is gathered from 1997 to 2012, according to the dataset availability, with five different nations and panel data analysis is conducted by pooling time-series observations across these countries. This dataset contains not only rich information on stock returns and inflation, but also each country's central bank's independence level that contains substantial variations of other macroeconomic factors and financial indicators. It is possible to make comparisons between countries and across different monetary policy parameters by considering at the CBI level. This will enhance society in comprehending the impact of monetary policy on stock returns and inflation.

Following is a description of the paper's structure. The literature review on the connection between stock returns, inflation rates, and central bank independence rate is presented in the next section. The theoretical foundation and hypotheses are presented in section three. The sample data, variables, and empirical technique are described in the fourth section. The empirical results are presented, and interpretations are given in the fifth section. Finally, the conclusion, consequences, and limitations of this study are covered in the last section.

2. Literature Review

Overview of traditional theory

Contrary to the traditional theory that stocks are good inflation hedges (Fisher, 1930), the most widely documented relationship has discovered that real stock returns and inflation are negatively correlated (Lintner, 1975; Fama, 1981; Aarstol, 2000). Economists have been surprised by this widely documented relationship because, as Fama points out, "Previously accepted wisdom that common stock, representing ownership of the income generated by real assets, should be a hedge against inflation" (Fama, 1981). According to this argument, the stock price declines in response to inflation because a tightening monetary policy is anticipated,

which indicates an increase in interest rates, and as a result, the relationship between the two variables is negative. As of, the focus of my paper will be on if the relationship of stock returns and inflation affect each country differently as an extension of this well-known story.

Stock Returns and Inflation

To highlight a few key economic terms that are discussed in this paper, first, Stock Return. The advantage of retaining the stock is called stock returns. It is usually made up of two parts: a payout and price change (Porta, 1996). Inflation is defined as a steady rise in the overall level of price (McMillan, 2018). Depending on the basket of commodities you choose as the explanatory variable, it may be quantified in a variety of ways. Price indexes are often used. Inflation is defined as the ability to buy less items with the same amount of money in the future. In other words, your purchasing power will be reduced. These methods of measuring inflation are not very effective for predicting inflation because they are decided after a particular amount of time. As a result, interest may be used as a proxy for the inflation rate for forecasting predicted inflation (Fama, 1977).

Previous papers have discussed the short-term and long-term relationship between stock prices and inflation. Historically, when inflation in developed countries rises, real stock values tend to fall. Equity shares, which are claims on a company's future output, do not appear to be a good inflation hedge in the short run, according to researchers, who discovered a negative relation between real stock returns and inflation in industrialized countries. Study of long-term relationships shows different results. The study from Whitelaw (1994), has found a positive relation between nominal stock returns and inflation at long horizons in the United States and the United Kingdom. However, a recently developed econometric technique for improving conventional long-horizon testing, there is little to no evidence that securities can hedge inflation (Engsted & Tanggaard, 2002).

Central Bank Independence Index

CBI refers to the central bank's power to control monetary instruments or, conversely, the set of limits on the government's influence on monetary policy management by the central bank (Bernhard, 2002). The article ‘Central Bank Independence in the World: A New Data Set (2016)’ by Garriga provides the most comprehensive dataset on *de jure* Central Bank Independence (CBI) index that I adopted for my thesis. The new data set, according to the literature, has a significantly bigger coverage, allowing scholars to investigate critical research

problems in larger and more representative samples. Between 1970 and 2012, the data set codes central bank legislation in 182 countries. It is coded in approximately 840 documents, including central bank charters, constitutions, statutes, amendments, and decrees that directly relate to central banks. Legislation was primarily gathered from online sources, and it was coded for all countries where texts in English, Spanish, French, Portuguese, or Italian were available. This assisted in identifying legislation that may have gone unnoticed in previous CBI data sets. Researchers will be able to answer these essential questions in several domains with greater certainty because of the new data set disclosed here, which uses in-depth data from a globally representative sample.

Legal CBI indices have been challenged for failing to adequately represent actual independence from the government. Furthermore, for specific research issues, other features of central bank organization and administration, such as transparency and accountability, may be similar or even more essential than CBI. De jure measures, on the other hand, are suitable for examining the determinants of financial institutes. Other aspects, such as regime type or rule of law, must be considered in order to completely comprehend the effects or the meaning of CBI in different countries.

The data coverage not only allows researchers to compare opposing ideas for the causes and consequences of CBI in both rich and developing countries, but it also serves as a useful tool for cross-national research in a variety of subjects. CBI has been a popular variable in research on the causes and consequences of monetary policy, liberalization, and dissemination, as well as political institutions, democracy, and crisis responses (Aklin, Negre, & Kern, 2021).

Relationship between CBI and Inflation

Central bank independence refers to how free central bankers are from government interference. The ability of a central bank to oversee its own budget improves its independence; it cannot be destroyed or amended by simple legislation (or, worse, executive fiat), and it is increased when central banks are made up of people who serve long, nonrenewable periods (Saylor Academy, 2012).

Scholars, central bankers, and politicians from all across the world agree that having an independent central bank lowers inflation. Given the ambiguity that has been documented in empirical studies, this is somewhat perplexing. The article about weak causality between Central bank independence and inflation makes the case that, overall, there isn't much of a causal relationship between independence and inflation. It is possible that introducing central

bank independence could even have a significant inflation-boosting effect (Philipp F. M. Baumann, 2021).

Research from Garriga (2019) has discovered that the more independent a central bank is, the lower the inflation it can allow without harming economic and employment goals. In addition, research on the effectiveness of central bank independence and inflation in developing countries discovered that higher central bank independence is linked to lower inflation rates. However, this effect on inflation is stronger when a country is more democratic, it can also be found in non-democratic countries (Garriga, 2019).

It has been acknowledged that central bank independence (CBI) helps economies recover from financial crises and maintain price stability. Indeed, one of the three institutional bases of inflation targeting's success in producing low and stable inflation rates has been linked to independence (Mishkin, 2004). In both rich and developing countries, a considerable empirical study indicates that inflation and central bank independence are inversely associated (Cukierman, 2008). Central bank independence is also regarded as a major factor in reducing production volatility (Bernanke, 2004).

Central Bank Independence affects stock market

The financial crisis of 2007 - 2008 highlighted central bank characteristics such as independence and transparency, which are fundamental goals of financial stability. The analysis from Papadamou (2017) indicated a positive correlation between central bank independence and stock market volatility in the paper analyzing the relationship between stock market volatility and central bank independence. Increased central bank transparency has also been shown to have a positive impact on stock market volatility. Nearly 20% of stock market volatility is due to these two factors. The paper concludes that reducing central bank independence and increasing monetary policy transparency is beneficial since it reduces stock market volatility, and an interesting policy implication is that a high degree of central bank independence can lead to financial instability (Papadamou et al. 2017).

Förch and Sunde (2012) looked at the impact of central bank independence on stock market returns and discovered that economic independence had a positive impact. According to their opinion, a pre-emptive rate hike decreases inflation during boom years, causing it to fall below independent central bankers' inflation targets, which is undesired. Borio and Lowe (2002) argue that credible low-inflationary policies remove the barriers between investors and financial institutions against future economic downturns, resulting in more borrowing and

lending, which has a beneficial effect on asset prices. According to Berger and Kißmer (2013), central bankers with more independence are less likely to use preemptive monetary tightening to ensure financial stability. Central banks that are more conservative and independent are more likely to negatively impact financial stability (Papadamou et al. 2017).

Role of Monetary Policy

Among various results to explain the stock return-inflation correlation, existing hypotheses in monetary economics assert that the negative stock return-inflation correlation is the result of the central bank's countercyclical policy reaction: when inflation rises, a central bank that aims to maintain price stability and conducts countercyclical monetary policy will raise its policy rate.

The stock market is an important monetary policy route. If it were announced, for example, that it would be raising its policy interest rate shortly, causing stock prices to decrease. A drop in share prices caused by tighter monetary policy will lead to lower consumer and company expenditure, whilst a rise in share prices will lead to higher spending (Simpson, 2014).

Kaul (1987) also supports this explanation. This suggests that depending on whether monetary policy is pro-cyclical or counter-cyclical, the relationship between stock returns and inflation can be either negative or positive. He offers evidence of a negative relationship during the post-World War II period of counter-cyclical monetary policy as well as evidence of a positive relationship during the Great Depression era of pro-cyclical monetary policy between stock returns and inflation. The impact of monetary policy on stock returns has been studied previously by a number of economists. This provides strong evidence that stock returns are sensitive to monetary policy.

With a conservative monetary strategy, the central bank is more concerned about inflation than the government. The more independent and conservative the central bank is, the lower the incentive for the government to default. In other words, the higher the index of central bank independence, the lower inflation will be (Haan & Eijffinger, 2016). According to the model suggested in the literature, a central bank that is independent (conservative) can reduce inflation while increasing output stabilization since political influences on output variance are reduced. Furthermore, several recent research provide proof that CBI can limit fiscal policy (Bodea & Hicks, 2015). This is an important reference for my paper, and it contributes to the establishment of the hypothesis that the consideration of CBI makes the negative correlation between the inflation rate and stock return even greater.

3. Theoretical Framework

The aim of this section is to explain the mechanism of the two relationships using the theoretical framework of an existing paper, as well as to discuss how this framework was modified and enhanced in my paper. Examining the explanations of representative hypotheses of the correlation between stock returns and inflation is worthwhile. A simple structural model is useful for debating the proxies and popular hypotheses, as well as for providing some experimentally tested consequences. An illustrative model from IMF working papers (Zhongxia, 2021) was used to build the equation model for my studies. In my research, I adopt and use the formulas and explanations in the IMF working paper 'Stock Returns and Inflation Redux' for the verification of the association between expected and unexpected inflation and stock returns.

Theoretical Review

To explain the observed negative relation between inflation and stock returns, Fama (1981) develops what has become known as the proxy hypothesis. According to the proxy theory, the more fundamental relationship between stock returns and future output drives the negative inflation-stock return correlation. Fama explains that simple money demand theory predicts that when future output is expected to fall and no change is made to the nominal money supply, then the price level must rise. As a result, prices and output should be adversely correlated, and Fama empirically demonstrates this stagflation finding. Recognizing that stock returns are positively related to future output completes the hypothesis. In other words, a decline in predicted future output will result in an increase in the price level and an instantaneous loss in stock returns, implying that stock returns and inflation are negatively correlated due to their relationship with output.

Fama appears to be thinking about a supply-driven economy, based on his first pillar that output and prices are adversely connected. Fama gives empirical evidence, however the outcomes are based on the sample period. The claim that supply-side variations are the primary cause of business cycle fluctuations is certainly debatable. The popular hypothesis is based on the expected policy response to inflation rather than the relation of output and prices. When price pressures start to build, the Fed is usually the first to react and employ contractionary policy. Because the stock market expects the Fed to tighten money and predicts the impact of increased interest rates on the economy, it reacts to inflation. Interest rates rise when monetary policy tightens, future output expectations fall, and stock returns fall.

An illustrative Model

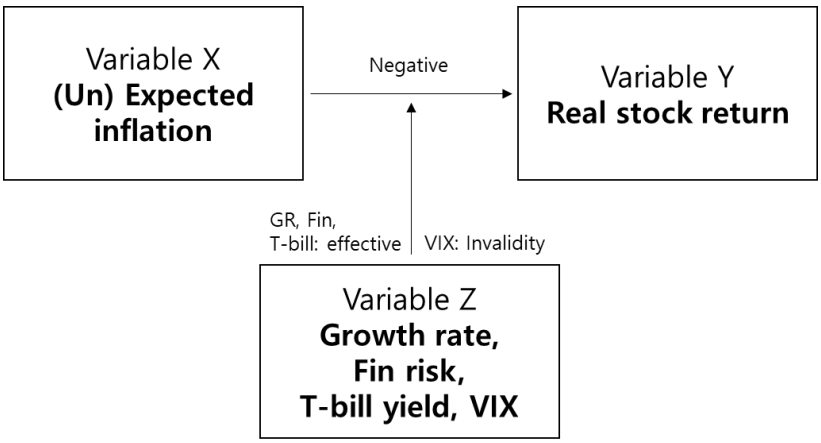
Because real stock returns are so important to investors, the IMF investigates the link between real stock returns and inflation. To assess the impact of inflation on real stock returns, the baseline regression employs panel regressions with fixed effects:

$$Y_{i,t} = \beta_0 + \beta_1 \pi e_{i,t} + \beta_2 \pi u_{i,t} + XB + u_i + \varepsilon_{i,t} \quad (1)$$

where *Yi,t* is the real return, which is calculated as the change in equity index logarithm from one year ago, for nation *i* at time *t*. *πe* and *πu* are expected and unexpected inflation that are retrieved from Consensus Forecasts. Last variable, *X* is a vector of control variables such as industrial output growth rate, change in financial risk, the US three-month Treasury bill yield, and the VIX is a volatility index calculated by the Chicago Board Exchange (CBOE). The first two control variables are country-specific elements, the rate of growth in industrial production takes into account changes in actual economic activity, and the rate of change in financial risk reflects changes in financial sector variables. Whereas the last two capture foreign conditions, where the yield on three-month Treasury bills in the United States symbolizes the level of global liquidity and the VIX is a measure of global financial market volatility. One can analyze whether there is a positive or negative association between stock market return and inflation across countries by looking at the estimated coefficients 1 and 2 from the regression. The error terms of *ui* + *εi,t* introduce contemporaneous cross-correlations across the *i* group.

The above fixed-effects panel regressions provide a good overview of how actual stock returns react to inflation and other control variables. It suggests that actual stock returns are connected with predicted inflation, industrial production growth, and improvements in financial risk ratings, but not with the VIX index. The asymmetric responses of real stock returns to inflation are underlined when the sample is divided by economic status: in advanced economies, the relationship is very negative however, in emerging markets, it is positive.

Figure 1: Variables explanation diagram of the illustrative model



The results of this example model reveal that for each country, the correlation between stock return and inflation rate is different. Expanding on this framework, I built my hypothesis and regression model. Previous literature found a negative relationship between real stock return and inflation rate with the country-specific elements and foreign conditions factors as control variables. As a result, similar hypotheses are created under different conditions to explain the connection between stock price return and inflation rate.

The first hypothesis (H1) examines the prior literature's finding that there is a negative relationship between stock return and inflation rate, using macroeconomic variables such as GDP growth rate and CPI as control variables. The study's main hypothesis, the second hypothesis (H2), is formulated to determine whether the CBI's inclusion in the regression model empirically makes the negative relationship between stock return and inflation rate stronger.

Hypothesis 1 (H1): *Inflation rates have a negative effect on stock returns.*

Hypothesis 2 (H2): *CBI factors cause a stronger negative relationship between Stock returns and Inflation rates.*

4. Empirical Strategy

In this section, the goal is to find and define a relationship between the dependent variable, which is stock return, and inflation rate in each country is selected as independent

variables in my study. With these yearly observations, I try to see what the individual, but also jointly effect is on the index of central bank independence in each country.

Methodology

This study uses panel data regression to estimate the hypotheses proposed in the theoretical framework, with two regression models being constructed. Panel data analysis is well-known for statistically analyzing data sets with many observations per sample unit. This could be accomplished by combining time-series data from a range of cross-sectional entities, such as countries, firms, or randomly sampled individuals or families (Lavrakas, 2008). A set of data collected across a set of years, in this example 1997 to 2012.

The main purpose for collecting panel data is an interest in the analysis of change. In particular, an interest in change analysis at the unit level. Panel data could also be used to provide general cross-sectional questions about levels and trends. In other words, panel data allows us to address all of the research problems that we used to analyze with cross-sectional data, and also extra problems that cross-sectional data cannot answer, such as individual change (Hans-Jürgen Andreß, 2013). One of the most important benefits of using panel data analysis is that it allows us to obtain larger samples. Small sample sizes are usually not a problem for survey researchers. It is only a matter of time, with sufficient financial resources, to collect data on a sample of several thousand people. However, social scientists that study macro phenomenon such as political systems, national economies, often work with smaller sample numbers. For instance, researchers interested in social spending in modern capitalist welfare states, frequently examine OECD or G7 countries.

In my research, I used the G7 countries, which consist of only seven countries, thus drawing a sample causes a problem. Many studies at the country level, such as those found in political science, macroeconomics, and macro sociology, use limited data sets. Because of the small sample size, statistical analysis is severely hampered. Researchers advise extending the data in the time dimension and measuring each macro unit at multiple points in time in this sort of situation. However, it's important to note that a sample of 5 units observed more than 16 times (as Germany, France, and Italy were considered one euro zone from 1997 to 2012) isn't the same as a sample of 80 units, because repeated measurements of identical units do not provide completely independent information. Nonetheless, a panel of this size provides a lot more data than a cross-section unit.

Pooled OLS model

For policy analysis and, specifically, program evaluation, panel data sets are very important. In the most basic program assessment design, a sample of people, businesses, cities, and other entities is collected in the first time period. We can get an independently pooled cross section by taking a random sample at each time period and pooling the results. Using individually pooled cross sections to expand the sample size is one reason. We can acquire more precise estimators and test statistics with more power by pooling random samples drawn from the same population at different periods in time. If we have the same *T* time periods for each of *N* cross-sectional units in a data collection with more than three time periods, we call it a balanced panel: we have the same time periods for all people, firms, cities, and so on. When *T* is small in comparison to *N*, a dummy variable for each time period should be included to account for secular changes that aren't being modeled (Wooldridge, 2014).

In addition, OLS is made up of five following fundamental assumptions (Kennedy, 2008):

1. The dependent variable is formulated as a linear function of a collection of independent variables plus the error (disturbance) term, according to **linearity**.
2. **Exogeneity** refers to the fact that the expected value of disturbances is 0 or that disturbances are unrelated to any regressors.
3. Disturbances have the same variance and are unrelated to one another (a. **homoscedasticity**) (b. **non autocorrelation**)
4. The independent variable observations are **not stochastic**, but rather fixed in repeated samples with no measurement mistakes.
5. The full rank assumption states that independent variables do not have a perfect linear relationship (**no multicollinearity**).

Data Collection and Description

Data on a variety of variables was gathered to see if the hypothesis was correct. The data chosen covers every aspect of the hypothesis. The empirical analysis is based on readily accessible annual data for each of the five nations from 1997 to 2012. The sample contains the United States, the Eurozone (France, Italy, Germany), the United Kingdom, Canada, and Japan, which are all advanced economies. It integrates information from Factset, The World Bank, Bloomberg, OECD, Qontigo, and other sources. The dataset is a balanced panel, which means that the stock returns, inflation rate, GDP growth rate, Consumer Price index (CPI) and Central Bank Independence weight are all calculated to have the same number of observations.

The stock price database used in this research includes the S&P 500 (United States), STOXX 600 (Eurozone), FTSE (United Kingdom), TSX (Canada), and Nikkei indices for the period 1997 to 2012 and the data were gathered from Factset and Qontigo (Japan). When determining the yearly stock return, the amount gained or lost at the end of the year is divided by the initial investment made at the beginning of the year. (Hayes, 2021).

Bloomberg provided the inflation rates, which are based on the US CPI Urban Consumers YoY NSA and the Euro Area MUICP All Items. YoY NSA, Japan CPI Nationwide YoY, STCA Canada CPI YoY NSA, and UK CPI EU Harmonized YoY NSA. Each year, the average inflation rate was determined using monthly data that was retrieved.

The data for the Consumer Price Index (CPI) is obtained from FactSet and comes from the Federal Reserve Bank of the United States, the European Central Bank for the Eurozone, the Office for National Statistics for the United Kingdom, Statistics Canada, and the Statistics Bureau of Japan.

The annual percentage growth rates of the GDP are from the World Bank and OECD National Accounts data files, which use constant local currency. The aggregates are based on 2015 prices that are constant and expressed in US dollars. GDP is calculated as the total gross value added by all producers who are residents of the economy, plus any applicable product taxes, minus any unaccounted-for subsidies. It is calculated without taking into account the deterioration and depletion of natural resources or the depreciation of manufactured assets.

Lastly, as previously detailed in the literature review, the central bank independence weight is derived from The World Bank GovData 360 website, and the CBI weight is provided by the dataset on de jure central bank independence (CBI) (Garriga, 2016).

Variables

The use of market capitalization has been frequently used in previous literature examining the effect of macroeconomic variables, and typically the dependent variables are stock price and market volume. (John, 2019). The dependent variable in this study is stock return, which serves as a proxy for stock market performance. Since stock investors are primarily concerned with the value of their shares, most statistical models for stock investors use the stock price as the dependent variable. These models aim to forecast what an individual share will be worth in the future (Ozyasar, 2012). Stock returns are estimated by forecasts of relevant real variables.

The input that analysts use to forecast the stock price is the independent variable. The independent variables are the combination of systemic and non-systematic factors. They consist of large-scale variables including interest rates, growth rates, lockdowns, and inflation (John, 2019). One of the macroeconomic variables, inflation rate is used as independent variable in this literature. Real variables such as inflation and deflation are modified to account for the changing purchasing power of money over time (Salter, 2017). Additionally, according to the proxy hypothesis inflation can be used as a proxy for economic activity and that as a result, it directly influences stock returns (Fama, 1981).

The role of monetary policy has been highlighted in past literature. It implies that the direction of the relationship between stock returns and inflation depends on whether monetary policy is pro or counter-cyclical (Fama, 1981; Roll & Geske, 1983). In order to explain the relationship between the dependent variable and the independent variable, the central bank independence rate, which reflects the nation's monetary policy (Aklin et al. 2021), is chosen as the primary explanatory variable in this paper. By including the CBI component as an explanatory variable in the regression model, it is feasible to determine if the factor genuinely affects the relationship between stock price return and inflation rate and, in accordance with established hypotheses, strengthens the negative relationship.

The control variables included in the regression model is CPI (Consumer Price Index) and GDP growth rate. The common factors that affect the dependent variable are captured by a collection of control variables (D, 2016). Since the independent variable, inflation, is determined by the percentage change in the consumer price index (CPI) throughout the reporting month compared to one year earlier, the annual rate of change in the CPI is a key indication of inflation (CBS, 2014). Therefore, CPI is the first control variable chosen.

Second control variable is GDP growth rate. GDP growth over time results in inflation, which, if uncontrolled, could eventually turn into hyperinflation. The interaction between inflation and GDP (gross domestic product) takes very delicate forms. A crucial factor for stock market investors is annual GDP growth. Most businesses won't be able to improve their earnings if general economic activity is dropping or even holding steady. However, excessive GDP growth is also risky since it almost certainly accompanies a rise in inflation, which reduces the purchasing power of our money and future corporate earnings, reducing stock market gains (BARNES, 2021).

The control variables in this study have an impact on the independent variable, making them confounding variables. Including confounding variables in a regression model enables the

analysis to account for them and avoid the spurious effects that the omitted variables would have otherwise generated (Frost, 2018).

Descriptive Statistics

The descriptive statistics for the variables in our sample that are of importance are shown in Table 1. Stock returns on average are 0. 0413, and the standard deviation is 0.20 with a minimum of -0. 443 and a maximum of 0.467. This means that the average annual stock return is around 4%. Inflation rate on averages is 0.0168, while the standard deviation is 0.0123, with a minimum of -0.0134 and a maximum of 0.0448 indicating that major deflation and hyperinflation occurrences exist. The CBI weighted index is the main factor in this study. The CBI ranking by country is obvious, but there is no discernible difference by year because it is a steady index for advanced nations. The average CBI index is 0.58, with a minimum of 0.27 and a maximum of 0.86. The GDP growth rate on average is 0.019, while the standard deviation is 0.217, with a minimum of 0.0569 and a maximum of 0.0687. Lastly, the CPI on average is 111.90, with a standard deviation of 43.82, with a minimum of 70.1 and a maximum of 229.6.

Table 1: Descriptive Statistics

Variable	Observation	Mean	Std. Dev.	Minimum	Maximum
Stock return	80	0. 041319	0.207462	-0. 4437	0. 4674
Inflation rate	80	0.016795	0.012309	-0.013417	0.04475
CBI weighted index	80	0.582875	0.167719	0.27	0.86
GDP growth rate	80	0.019485	0.021673	-0.056932	0.068686
CPI	80	111.9016	43.82024	70.1	229.6

In the data set above, each country (corresponds to ‘unit’) is tracked across the same number of time periods resulting in a balanced panel. Because I track the same group of countries in each time period, the above data set is an example of a fixed panel (as opposed to a rotating panel). The specifics of the variables and the logic for their selection will be continued in the data section. For creating panel data analysis, STATA is the software of choice.

5. Empirical results

The regression models

To investigate empirically the theoretical relationship developed in the previous section between real stock return and inflation. Two regression models are constructed, and panel data regression method is adapted from previous literatures while using a pooled OLS regression model.

In order to evaluate the effects of CBI on the relationship between stock return and inflation rate, two separate equations are formulated as follow:

$$\boldsymbol{Stock\_return_{i,t} = \beta_0 + \beta_1\, inflation\_rate_{i,t} + \beta_2\, gdp\_growth\_rate_{i,t} + \beta_3\, cpi_{i,t} + \varepsilon_{i,t}} \quad (2)$$

$$\boldsymbol{Stock\_return_{i,t} = \beta_0 + \beta_1\, inflation\_rate_{i,t} + \beta_2\, CBI_{i,t} + \beta_3\, gdp\_growth\_rate_{i,t} + \beta_4\, cpi_{i,t} + \varepsilon_{i,t}} \quad (3)$$

Equation (2) and *(3)* examine the effect of inflation rates on stock returns, as proposed in the hypotheses. Where $Stock\ return_{i,t}$ is real stock return on index, and $Inflation\ rate_{i,t}$ is inflation rate for each country *i* at time (year) *t*. Control variables $gdp\ growth\ rate_{i,t}$ and $cpi_{i,t}$ are also in the same time period in the same country dataset. *Equation (2)* is estimated to test if the *popular* hypothesis, or hypothesis 1 (H1), is true. In *Equation (3)*, the major explanatory variable $CBI_{i,t}$ is added to determine if the CBI rate has an effect on the relationship between inflation rate and stock return. The error terms of $\varepsilon_{i,t}$ is added to introduce contemporaneous cross-correlations across the i group.

The three explanatory variables are country-specific factors: the GDP growth rate accounts for the overall health of the nation's economy (Callen, 2020), the CPI is a measure of the aggregate price level in each economy (CFI, 2022). Lastly, the CBI weighted index is proposed to capture central bank characteristics, which refers to their monetary policy, of each country (Bernhard, 2002). The independence level of central banks will be one of the most crucial regressors, since it will be used to evaluate if changes in the central bank independence affect the relationship between stock returns and inflation rate, and if so, how strong the impact is.

Estimates of β_1 can be used to directly assess the relative importance of these three control factors. By examining the estimated coefficient β_1 from the regression, *Equation (2)* can analyze whether there is a positive or negative relationship between stock market return and

inflation rate across countries. In *Equation (3),* β_1 investigates the effect of CBI on the relationship between two and this will reveal the main finding of the research. The variation in the degree of central bank independence could be the cause of the changing relationship between stock returns and inflation, according to new estimations of β_2 in *Equation (3).*

Regression results

Table 2 presents pooled OLS results of the regression using two regression models with and without CBI rate as proposed in the previous section. Regression model 1 and 2 were developed to test the effect of the inflation on the annual stock return. The dependent variable stock return, independent variable inflation rate, and explanatory variables CBI, CPI, and GDP growth rate vary across countries and with time.

Table 2: Regressions on Stock returns with Central Bank Independence Factor

Dependent variable: stock return	(1)	(2)
Inflation rate	-4.52739**	-5.963804**
CBI weighted index		0.2178531
GDP growth rate	2.091234*	2.433811**
CPI	0.000328	0.0007875
Constant	0.03996	-0.1210433
R^2	0.0774	0.0967
Observations	80	80

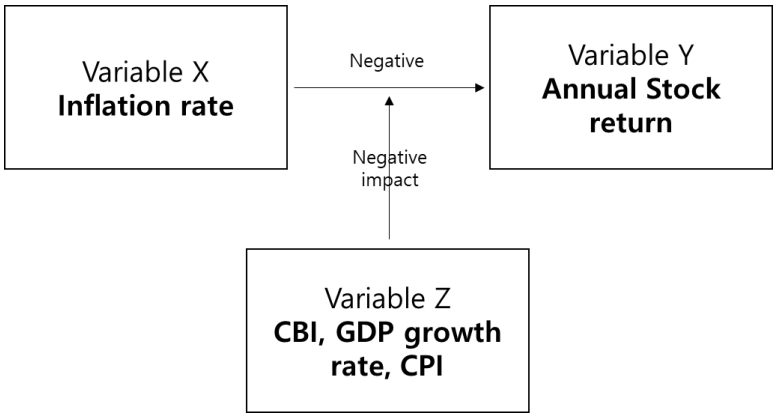
Note: *** p < 0.01; ** p < 0.05; * p < 0.1. Standard errors are in parentheses.

The results from Model 1 in Table 2 demonstrate a negative and significant relationship between inflation and stock return, confirming the *popular* hypothesis that higher inflation causes a decline in stock return. The main estimated coefficient β1 is -4.53 and a standard deviation of 2.04 with a p-value of 0.03, indicating that an increase in the inflation rate with 1 point, decreases the stock return with 4.53 percentage points, all else constant (ceteris paribus). The β2 of estimated coefficient for the control variable GDP growth rate is 2.09 and a standard deviation of 1.12 with a p-value of 0.065. The p-value of 0.065 indicates that the GDP growth rate coefficient is positive and weakly statistically significant at the 10% level. The β3 of estimated coefficient for the last control variable CPI is found to be insignificant.

Examining the results of Model 2, it can be observed that there is a stronger negative relationship between inflation and stock return, with the explanatory variable CBI. The β1 in this model is -5.96 and a standard deviation of 2.33 with a p-value of 0.013. This indicates that every increase in the inflation rate, it is predicted that there will be a 5.96 percentage points increase in stock return, which is 1.43 percentage points higher than Model 1. It implies that there are effects on the negative relationship between them when CBI is included empirically. The β2 of estimated coefficient for GDP growth rate is 2.43 and a standard deviation of 1.14 with a p-value of 0.037, suggesting that one percentage point increase in the GDP growth rate is associated with a 2.43 percentage point increase in the stock return. The individual CBI rate and CPI are statistically insignificant in affecting the stock return. R-squared value has noticeably increased to roughly 10% in Model 2, indicating that adding the CBI rate also enhanced the model (Hocking, 2013).

[1]Additionally, it was discovered that CBI had a large positive impact on the inflation rate after looking at the association between the two. This suggests that the inflation rate increases with CBI (i.e., the greater the independence of the national central bank). This could have contributed to the final finding of this empirical study, which demonstrated that nations with high CBI have a larger negative correlation between stock price return and inflation rate.

Figure 2: Variables explanation diagram with Central Bank Independence Factors



Overall, the results of the regressions are in line with those found in the study's main findings, supporting the significantly negative relationship between stock return and inflation rate. Moreover, the CBI factor has a negative effect on the relation between two as hypothesized.

[1] See Appendix 2 for the result of the regression

The findings imply that in the period of 1997 to 2012, following the G7 country's Central bank Independence rate, a stronger negative relationship between overall annual stock returns and inflation rates than without considering the CBI rate.

6. Discussion and Conclusions

Discussion and Conclusion

This paper adds to previous knowledge on the relationship between stock return-inflation rate by analyzing how the CBI factor affects that relationship using a dataset of advanced markets. The empirical analysis examines 7 countries listed in the G7 between the period 1997 – 2012, while considering France, Germany, and Italy as one eurozone because of the identical CBI. Garriga's (2016) Central Bank Independence (CBI) indices were utilized as the measurement for the country's characteristics in monetary policy.

One of the factors in influencing the relationship between inflation rates and stock returns is the CBI indices, which refer to how central banks perform assessments of monetary policy frameworks and legislation (Garriga, 2016). CBI refers to the central bank's power to control monetary instruments or, conversely, the set of limits on the government's influence on monetary policy management by the central bank (Bernhard, 2002). By creating a practical analytical framework in which to objectively quantify the relative importance of the CBI factor, I extended the study. Then, using this approach, I revisit the relationship between the G7 countries' inflation rates and stock returns.

The main findings indicate that countries with higher CBI rate tend to have a stronger negative relationship between stock returns and inflation rates, consistent with existing studies that found significant and negative relationship between them. This study contributed to the existing of literature that suggests there is a negative link between stock returns and inflation rates (Lintner, 1975; Fama, 1981; Aarstol, 2000), and the more independent central banks pursue conservative monetary policies to reduce inflation, which results in steady production (Haan & Eijffinger, 2016). The main hypothesis *"The relationship between inflation and stock return is more inversely correlated with higher central bank independence."* is designed based on these previous studies, and it is concluded to be true.

This study extends the relationship between stock returns and inflation rates into the context of central bank independence and provides additional insight into the role of each country's central bank in the economies it faces. The relationship between inflation and stock returns has been the subject of several studies, however, there are relatively few that use central

bank independence rate as an explanatory variable. This paper reaffirms the negative relationship between them and explains the findings of past literature by the factor of CBI.

Finally, the empirical findings of this study have important implications for the issues that investors and society are currently facing. The higher the central bank independence index, the more strongly negative correlation between inflation and stock returns increases the importance of action and response by investors. Investors can expect a decline in stock returns in response to high inflation rates, and the greater the degree of decline in countries with higher central bank independence rate. People who are more resistant to inflation can think about new investments by taking the CBI index into consideration. Furthermore, changes in fiscal policy and central bank independence may have an impact on stock price returns, thus national central banks and decision-makers in the fiscal sector should take this into account. Research on the connection between inflation rates and stock returns, including that of the CBI index, reaffirms that central banks have the power to reduce inflation while also harming a country's economy and stock output.

Limitations

A number of limitations should be taken into account when interpreting the conclusions of this paper. First, the CBI indices used in analytics are inherently vulnerable to measurement limitations and provider bias. Nonrepresentative samples may have had an impact on earlier findings, indicating that the generalizability of some empirical findings in the literature may be constrained (Garriga, 2016).

Second, because this paper's empirical findings are based on the G7 countries, the highly developed nations, the findings might not be applied to developing nations that may be more or less impacted by monetary policy. New empirical research can address theses limitations by extending the study to developing countries and open economies. Additionally, the sample size of this analysis was severely restricted by the CBI data that is only up until 2012. To this extent, future research can identify solutions to overcome these limitations by figuring out how to develop an up-to-date measure of how stock prices respond to inflation over extended horizons.

7. References

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8. Appendix

Appendix 1: Central Bank Independence weighted index

Appendix 2 Regressions on Inflation Rate with Central Bank Independence Factor

Dependent variable: Inflation rate	Coefficient	Standard deviation	P-value
Independent variable: *CBI weighted index*	0.196847	0.0080078	0.017