The Correlation of Monetary Policy, Inflation and Stock Returns during periods of Inflation and Deflation

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Abstract:

This paper examines the debated issue of the existence of a relationship between a country's monetary policy and the relative stock market and stock returns. Specifically, the paper examines the affect and correlation of overnight interest rate (known as federal funds rate in U.S.), inflationary rate and stock returns on and with each other, respectively, during periods of inflation and deflation. The deflationary period investigated is the period of deflation in Japan and the inflationary period examined is over the last decade in the United States. The analysis is performed using multivariate VAR/VEC co-integrating specifications to supplement the results from the Granger-causality test. In addition, this paper contributes to the topic by comparing the effectiveness of both central banks use of policy instruments during these recent periods and whether both countries could have implemented different policies to better combat the macroeconomic problems in their country at the time, in order to provide future insight.

JEL Classification: E52, E44, C22, G01, G10, O11
Keywords: stock returns, deflation, inflation, monetary policy, VAR, United States, Japan.

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1.0 INTRODUCTION

The relationship of overall performance of the stock market and macroeconomic policies from central banks has been a highly debated issue. Through monetary policy, central banks attempt to regulate money supply and interest rates in order to manage and stabilize inflation, currency and long-term economic growth. Pertaining to the economic situation, the central bank will pursue either contractionary or monetary policy but the transmission of the desired policy to the economy includes considerable lags (inside and outside lags). An individual stock in a stock market is defined as a financial instrument that represents equity in a corporation and a claim to it assets, and assuming efficient markets, the price of it is the present value of all *expected* future cash flows. As a result, the stock market includes new information announced by the central bank in its expectations more quickly than the macroeconomic variables the policy is initially targeted towards

Bernanke and Kuttner (2005) provide substantial evidence to support that monetary policy can affect real stock prices in the short run and in addition, other economists argue monetary policy affects asset market performance in the long-term as well. Historically, in respect to inflation and the stock market, Fama et al. (1977) explain that real stock returns and inflation have historically been negatively correlated. However, in the long run the relationship is irrelevant, as real stock returns take inflation into account when determining the return.

When central banks raise the Federal Funds rate, banks are less willing to borrow and consequentially will lend less as well as lend at a higher rate. This makes it harder for businesses to borrow money and slows the economy; this is referred to as contractionary

monetary policy. In contrast, expansionary policy is implemented through decreasing the rate, so overnight lending is cheaper, banks are more willing to lend more money at a lower rate, and this causes businesses along with the economy to expand.

The objective of this study is to identify and explain if and how overnight interest rates, inflation rate, and the relative stock market are interrelated during periods of deflation and inflation in Japan and the U.S., respectively. The study will seek to reveal any significant correlation and causation between each of these three variables, either positive or negative.

The study will use three variables, previously mentioned, including inflation rate, stock market returns, and overnight interest rate. For the United States the measures will be the calculated monthly percentage change for the inflation rate based on the CPI, the S&P 500 Index adjusted monthly returns for the stock market returns variable, and the Federal Funds rate for the overnight interest rate. For the period of deflation in Japan the measures in the model will be the calculated monthly percentage change for the inflation rate, the Nikkei 225 adjusted monthly returns for the stock market returns variable and the Bank of Japan's call rate for the overnight interest rate.

The econometrics element of this paper includes determination of the model through a multivariate co-integration test to determine the co-integrating vectors to determine the VAR/VEC model. The results of this time-series regression will provide the relationship between the three variables in both instances of inflation and deflation.

This paper is organized with the following components: Section 2 Literature Review provides extensive information about the information previously discovered about the

relationship between the three variables as well as further analysis of each country during the specified period of time. It aims to reveal all critical points of knowledge already known about all aspects of this study in order to provide an unbiased and comprehensive view of the topic. Section 3 Data and Empirical Methodology includes the construction of the data, definition of the variables, the multivariate test and VAR/VEC analysis. Section 4 provides empirical analysis and description of the observed results from the tests of Granger-Causality and from the Multivariate VAR/VEC estimates. Section 5 states the conclusion and discusses critically the policy measures differences in the two different economies and their effectiveness followed by the Appendix.

2.0 LITERATURE REVIEW

To gain a comprehensive perspective on the correlation between monetary policy and stock returns during these deflationary and inflationary periods, evaluation of past studies on the interrelationship of these economic variables is necessary. Firstly, Mishkin (2004) contributes to the topic by his critical research of monetary policy changes by the Bank of Japan, specifically amid deflation from 1998 to 2003. Mishkin identifies that the cost of deflation for a country can be dramatic and escaping a deflationary trap is difficult due to the fact that a zero-bound overnight interest is no longer an instrument at the central bank's disposal. Further, the paper proposes the best way to escape from deflation is to manage expectations through price-level targeting and non-conventional monetary policies. Ahearne and Gagnon (2002) add to the critique of Japanese policymakers during this period stating that the slump was unanticipated and this was a key factor along with the zero-bound interest rates approaching zero which explain the authorities' failure to provide the necessary economic growth and positive inflation.

Moreover, they conclude that the general lesson from the Japanese experience is that if a country has a risk of deflation, and interest rates have fallen close to zero, monetary stimulus must go beyond levels conventionally implied by baseline forecasts of future inflation and economic activity.

Further, to gain a comprehensive view of the interaction and relationships of monetary policy, inflation and stock returns, understanding prior research on the topic is critical. In regards to stock market fluctuations and interest rates, Ioannidis and Kontonikas (2006) specifically focus on the impact of interest rate changes on stock price changes in thirteen OECD countries over the period from 1972-2002 and they confirm the notion of monetary policy transmission via the stock market. Evidence is provided that eighty percent of the OECD countries examined have periods of tight money associated with declines in the stock market value. Therefore, the research implies that central banks can affect stock market valuations by altering interest rates. Bernanke and Kuttner (2005) additionally contribute this topic through analyzing the impact of changes in monetary policy on all equity prices. Their ultimate goal was to measure the average reaction of the stock market and understand the economic sources of the reaction, and their findings were that unanticipated monetary policy actions account for the largest part of the response of stock prices. The strong reaction of stock market response to unexpected monetary policy actions is shown as every unexpected 25 basis point cut typically leads to a 1.3 percent increase in stock price.

In regards to the correlation of all three variables inflation, interest rates, and stock market fluctuations, Bordo et al. (2008) demonstrate through VAR analysis that inflation and interest rate shocks had strong impacts on market conditions during their

study of second half of the 20th century in the U.S. Further, they provide that central banks can promote financial market stability through minimizing unanticipated changes in inflation. Fama et al. (1977) studied the period of 1953-71 seeking to estimate which assets hedge against components of inflation. Contrary to widely-held belief, their results illustrate that common stock returns are negatively related to the unexpected inflation rate as well as changes in expected inflation rate. Lastly, Bullock and Rider (1991) looked at the relationship between inflation and interest rates across industrialized countries over three decades. Uniquely the paper portrayed a positive relationship between interest rates and inflation during the second half of the 1980s, and a negative relationship between the two in the 1970s. This illustrates the uncertainty of the direct relationship between the two variables.

3.0 TRENDS

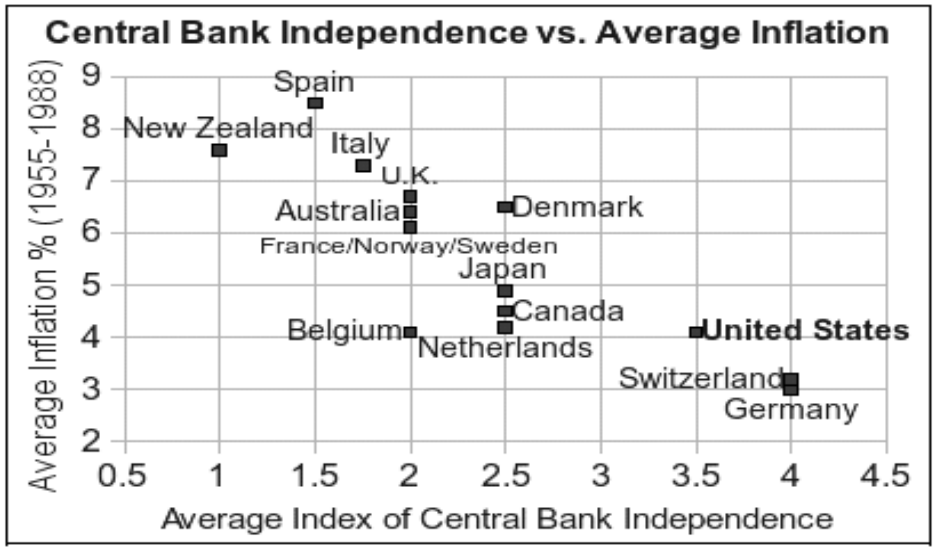
FIGURE 1: Global Inflation rate

SOURCE: Ethiopolitics.com

Over 250 countries worldwide have central banks, from the Bank of Albania to the Reserve Bank of Zimbabwe, so it is crucial for countries to understand the impact of

changes monetary policy will have on equity markets and inflation. Due to the current crisis, an issue with inflation rates can be seen across the globe, specifically with countries in Africa and Asia. Not only are there areas of extremely high inflation present but also countries experiencing deflation. Dispersion of global inflation rates can be relatively seen in the figure above.

Figure 2: Independence of Central Bank compared to Average Inflation

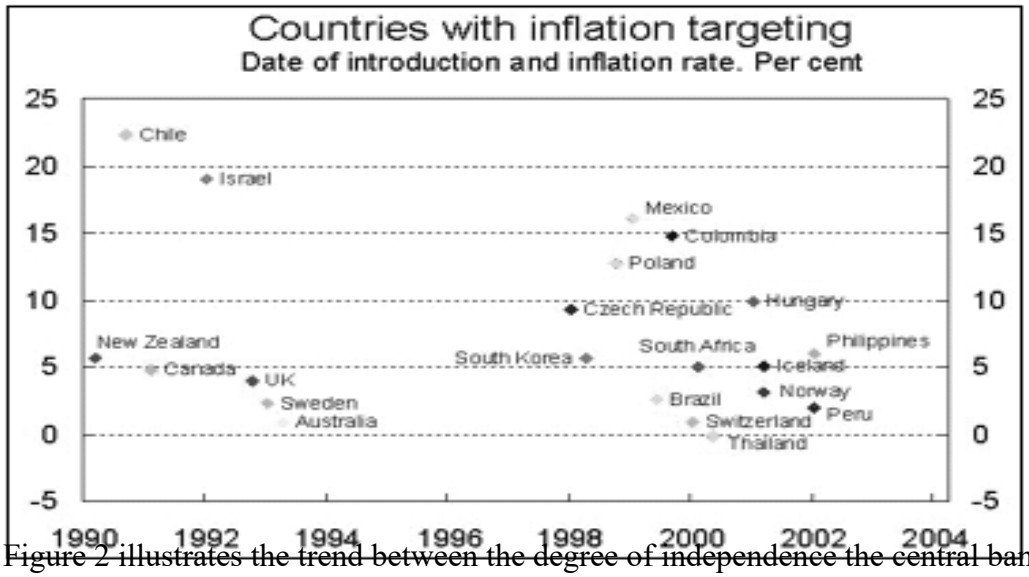


SOURCE: http://upload.wikimedia.org

These worldwide central banks all influence interest rates by expanding or contracting monetary policy. The primary method to conduct this is through open market operations along with manipulating reserve requirements. In the 1980s, the belief that the central bank of a country should be ultimately independent from the other government bodies became widespread. Central banks increasingly gained independence and committee members were given longer fixed terms. This was to avoid political asperations from altering the actual optimal monetary policy. Furthermore, in the 90s another trend became prevalent as central banks started the implementation of official

public inflation targets. The goal of the targets was to keep inflation within a desired range and also make monetary policy of the central bank become more transparent.

FIGURE 3: Countries Introducing Inflation Targeting 1990-2004



SOURCE: http://www.norges-bank.no

Figure 2 illustrates the trend between the degree of independence the central bank and the average inflation rate in the country from 1955-1988. This demonstrates the fact that independence is crucial for central banks to implement effective policy. Figure 3 above displays the increasing trend of central banks beginning to adopt inflation targeting during the end of the twentieth century and into the twenty-first.

Historic trends when relating the stock market and the overall economy show a pattern of stock market changes as a reliable leading economic indicator. This can be seen as a result of the stock market including expectations quicker than other aspects of the overall economy. As stated before in the literature review, trends in the U.S. during the 70s and 80s differed in respect to the relationship of inflation and interest rates. In the 70s and after the 80s the study showed evidence of a negative relationship between the two variables and in the 80s showed a positive relationship between the two.

4.0 DATA AND EMPIRICAL METHODOLOGY

4.1 Data Construction

Data was collected for adjusted monthly returns of the Nikkei 225 Index and Standard and Poor's 500 index from finance.yahoo.com adjusted historical closing prices. Inflation rates were retrieved from RateInflation.com which calculates the inflation in specific countries during certain periods of time. The overnight lending rates were taken from each country's respective central bank website, Japan (http://www.boj.or.jp/en/) and United States (www.federalreserve.gov), with help from economic data from FRED (http://research.stlouisfed.org/fred2/). To see more information on the variables, Appendix A is constructed to display descriptions and sources.

Table 1: Multivariate Co-integration Tests

Hypothesized No. of CE(s)	Max-Eigen value Statistic	Trace Statistic	5 % Critical Value	Probability**
United States				
None *	0.201662	44.99894	29.79707	0.0004
At most 1 *	0.111599	18.64779	15.49471	0.0162
At most 2 *	0.040219	4.802890	3.841466	0.0284
Japan				
None *	0.143550	36.63187	29.79707	0.0070
At most 1 *	0.101390	16.95197	15.49471	0.0300
At most 2	0.026224	3.374900	3.841466	0.0662

*statistical significance at the 0.05 level

In order to check for multivariate co-integration, this study uses the Johansen Co-integration Test to understand the number of co-integrating vectors. As determined by the unit root test for both instances, the lag interval is in first differences. Above in Table 1 the results of this test are shown. Examining the relevance of the results shown from the Trace Statistic and Max-Eigen value of the United States, at a five percent level of significance, the hypothesized number of co-integrating of at most two are statistically

significant. For Japan on the other hand the results are significant for at most one number of co-integrating equations.

4.2 Definition of Variables

$$\Delta X_t = \propto + \gamma\beta X_{t-1} + \sum_{i=1}^{k} \tau \Delta X_{t-i} + e_t \qquad (1)$$

The common VEC model above can be used in order to determine the relationship between the three variables in questions, which are inflation, stock returns and overnight lending rate. The alpha variable is a constant vector which demonstrates a linear trend, the gamma variable is how quick it adjusts and the beta variable is the co-integration vector. The variable in the equation depicted as X_t is representing the three variables that this paper is testing. The acronyms for these variables are as follows, stock market returns variables, N225 and SNP, inflation rate variable, JPINF and USINF, and overnight call rate as FFR and BOJC. The three co-integrated variables in this paper have the VEC integration from the following relationship.

$$\Delta IR_{t,c} = \alpha_1 + \gamma_1 z_{c-1} + \sum_{t=1}^{n1} \beta_{1,t} \Delta IR_{t,c} + \sum_{t=1}^{n2} \beta_{2,t} \Delta SM_{j,c} + \sum_{t=1}^{n3} \beta_{3,t} \Delta INF_{1,t} + e_{1,c}$$

$$\Delta SM_{j,c} = \alpha_2 + \gamma_2 z_{t-1} + \sum_{t=1}^{m1} \delta_{1,t} \Delta IR_{t,c} + \sum_{t=1}^{m2} \delta_{2,t} \Delta SM_{j,c} + \sum_{t=1}^{m3} \delta_{3,t} \Delta INF_{t,c} + e_{2,c} \qquad (2)$$

$$\Delta INF_{t,c} = \alpha_3 + \gamma_3 z_{c-1} + \sum_{t=1}^{l1} \varnothing_{1,t} \Delta IR_{t,c} + \sum_{t=1}^{l2} \varnothing_{2,t} \Delta SM_{j,c} + \sum_{t=1}^{l3} \varnothing_{3,t} \Delta INF_{1,t} + e_{3,c}$$

Firstly, in these above equations the delta symbol acts as the difference operator, which is represented before the acronyms for each distinct variable. The e component of the equations is representing the random error term in the equation. The other aspects are the

orders of the autoregressive process for each variable. The equations are essential to portray the relationships among the three variables. If the coefficients of the independent variables in the equations are significant, then they display the short-term impacts of each other and if the gamma coefficients illustrate the long-term effects.

4.3 Data

4.2.1 Unit Root Tests

Table 2: ADF Fisher Unit Root Test

UNITED STATES		
Method	Statistic	Probability
ADF - Fisher Chi-square	107.015	0.0000
ADF - Choi Z-stat	-8.93509	0.0000
Intermediate ADF test results: **First Difference**		
Series	Probability	
SNP	0.0000	
USINF	0.0000	
FFR	0.0022	
JAPAN		
Method	Statistic	Probability
ADF - Fisher Chi-square	213.298	0.0000
ADF - Choi Z-stat	-13.9487	0.0000
Intermediate ADF test results: **First Difference**		
Series	Probability	
N225	0.0000	
JPINF	0.0000	
BOJC	0.0000	

Above is the unit root test which test results produced the result of first difference. As the results show above the probability shows the results are statistically significant with the probabilities above of zero accept the federal funds rate is at 0.0022.

5.0 EMPIRICAL RESULTS

5.1 Granger-Causality Test Results

Table 3: Granger-Causality Test

Granger Causality Test				
Country	**Null Hypothesis**	**F-Statistic**	**Probability**	**Decision**
Japan	**JPINF** does not Granger Cause **N225**	0.59601	0.703	Reject
	N225 does not Granger Cause **JPINF**	1.25453	0.2884	Reject
	BOJC does not Granger Cause **N225**	2.77898	0.0208	Accept
	N225 does not Granger Cause **BOJC**	0.92710	0.4661	Reject
	BOJC does not Granger Cause **JPINF**	0.54268	0.7436	Reject
	JPINF does not Granger Cause **BOJC**	0.96728	0.4409	Reject
United States	**USINF** does not Granger Cause **SNP**	2.93855	0.0569	Accept
	SNP does not Granger Cause **USINF**	0.71692	0.4904	Reject
	FFR does not Granger Cause **SNP**	2.62743	0.0766	Reject
	SNP does not Granger Cause **FFR**	2.51892	0.085	Reject
	FFR does not Granger Cause **USINF**	3.3615	0.0381	Accept
	USINF does not Granger Cause **FFR**	0.40904	0.6653	Reject

These empirical results are some of the most important as they portray the relationships between all the variables in the study. For Japan the only relationship that accepted the null hypothesis was the one stating that the Bank of Japan call rate (BOJC) does not cause changes in the Nikkei 225 stock returns. This means the following: changes in the Nikkei 225 adjusted stock returns causes changes in the inflation rate as well as the Bank of Japan call rate, changes in Japan's inflation rate causes changes in the Nikkei 225 stock returns and the call rate, and lastly the call rate causes changes in the rate of inflation.

Interpreting these results is essential to this aspect of the paper to study deflation. So during this period of deflation, stock market returns were impacted by changes in the inflationary rate. This illustrates the fact that during this period of stagnant economic growth for Japan, the rate of inflation (deflation) also translated into the stock market.

For the Bank of Japan call rate these results show changes in the overnight rate impact changes in the inflation rate. This is so critical for this period of deflation because the Japanese government implemented inflation-rate targeting and this suggests that these policy actions had a positive effect. The only issue in this case is that the Bank of Japan cut the rate ultimately to a value of zero so it was no longer a tool at their disposal to continue to combat the historically long period of deflation.

In the Granger-Causality test for the United States there was however, two null hypotheses accepted. Firstly, this means changes in the rate of inflation in the U.S. do not cause changes in the stock market returns. This result can seem controversial as inflation usually impacts stock market returns, but the period of inflation in question must be further examined for comprehensive understanding. The rate of inflation during this period remained relatively constant and near the inflation target, which means that the stock market returns already incorporated the correct expectation of inflation in the stock price, therefore changes in the inflation rate had an insignificant impact. Still four of the null hypotheses were rejected and this presents that: changes in S&P 500 stock returns causes both changes in federal funds rate and inflation rate, the inflationary rate causes changes in the federal funds rate, and interestingly enough, changes in the federal funds rate cause changes in S&P 500 stock market returns.

Further analyzing these results portray the fact that the S&P 500 causes changes in both the federal funds rate and inflation rate, which provides proof of a statement made earlier. As a historic leading indicator of economic conditions, changes in the returns in the stock market are later accompanied by changes in the federal funds rate and inflation targeting by the central bank, so this result is providing proof of this fact. The last two

results also have interesting implications. As the federal funds rate in the United States is seen to be caused by the inflationary rate, this exemplifies inflationary targeting reflected in the Fed's open market operations. In addition, the results show that the federal funds rate causes changes in the S&P 500 Index. This confirms the statement by Ioannidis and Kontonikas (2006) that monetary policy is transmitted via the stock market.

Table 4: Multivariate VAR/VEC Estimates

Japan				United States			
	ΔN225 t	ΔJPINF t	ΔBOJC t		ΔSNP t	ΔFFR t	ΔUSINF t
CointEq1.	-0.76624	-0.010685	-0.004208	CointEq1	-0.938985	1.029180	0.016149
	(0.14613)	(0.00871)	(0.00170)		(0.16074)	(0.56362)	(0.01789)
	[-5.24364]	[-1.22654]	[-2.47089]		[-5.84178]	[1.82602]	[0.90282]
ΔN225 t-1	-0.12565	0.011345	0.003185	ΔSNP t-1	0.080646	-0.616002	-0.004807
	(0.12554)	(0.00748)	(0.00146)		(0.12516)	(0.43886)	(0.01393)
	[-1.00088]	[1.51594]	[2.17683]		[0.64436]	[-1.40364]	[-0.34511]
ΔN225 t-2	-0.035386	0.009793	0.002454	ΔSNP t-2	-0.086139	-0.091268	-0.002403
	(0.09134)	(0.00545)	(0.00106)		(0.09415)	(0.33013)	(0.01048)
	[-0.38739]	[1.79832]	[2.30491]		[-0.91493]	[-0.27646]	[-0.22937]
ΔJPINF t-1	-1.75579	-0.073688	-0.017145	ΔFFR t-1	0.034044	0.662332	0.007058
	(1.51812)	(0.09050)	(0.01769)		(0.02720)	(0.09538)	(0.00303)
	[-1.15656]	[-0.81421]	[-0.96901]		[1.25155]	[6.94393]	[2.33148]
ΔJPINF t-2	-1.033855	-0.060207	0.027646	ΔFFRt-2	-0.002327	0.033181	-0.005226
	(1.52537)	(0.09093)	(0.01778)		(0.02684)	(0.09413)	(0.00299)
	[-0.67777]	[-0.66209]	[1.55511]		[-0.08669]	[0.35251]	[-1.74943]
ΔBOJC t-1	3.779896	-0.063971	0.003474	ΔUSINF t-1	-0.207672	-3.657253	0.485240
	(2.87669)	(0.17149)	(0.03353)		(0.82215)	(2.88287)	(0.09149)
	[1.31397]	[-0.37302]	[0.10362]		[-0.25260]	[-1.26862]	[5.30362]
ΔBOJC t-2	-5.268243	0.022916	-0.315351	ΔUSINF t-2	0.571559	0.985919	-0.261464
	(2.89078)	(0.17233)	(0.03369)		(0.82192)	(2.88205)	(0.09147)
	[-1.82243]	[0.13298]	[-9.36001]		[0.69540]	[0.34209]	[-2.85859]
Constant	0.000985	-0.0000407	-0.00014	Constant	0.000854	-0.015524	-0.0000119
	(0.00508)	(0.00030)	(5.9E-05)		(0.00415)	(0.01454)	(0.00046)
	[0.19374]	[-0.13425]	[-2.36205]		[0.20587]	[-1.06791]	[-0.02569]

()Standard Errors []t-statistic

The table above regarding multivariate VAR/VEC estimates shows data for both Japan (left) and the United States (right). These results supplement the information that can be seen in through the Granger-Causality test.

For Japan, the critical elements to focus on are the impact of changes of the inflationary rate on the stock market and changes in the call rate causing changes in the inflationary rate. Firstly, during the first two lags the inflationary rate in Japan negatively impacts the Nikkei 225 stock market returns. The changes seem to become decreasingly negative from the first to the second lag. Secondly, changes in the call rate negatively impact the inflationary rate in the first lag but then positively impact the rate in the second lag. This represents the fact that cuts in the overnight call rate have an outside lag and take approximately a month to start increasing the inflation rate.

In the regards to the results for the United States the key elements derived from the Multivariate VAR/VEC are as follows: the S&P 500 stock causes changes in both the federal funds rate and inflationary rate, the inflationary rate causes changes in the federal funds rate and the federal funds rate causes changes in the S&P 500 stock returns. During the first two lags the S&P 500 returns negatively impact both the federal funds rate and the overnight lending rate. The impacts for both variables were decreasingly negative from the first lag to the second, which portrays the market returns as mainly a leading indicator of the economy in the short-term. The inflationary rate causes an extreme negative impact on the federal funds rate during the first lag and a positive impact during the second lag. This transmission of the change in inflation and the federal funds rate changes can be explained by the central banks inflationary target, and sensitivity in policies to changes in inflation and the consumer price index. Lastly, and most

importantly, the results depict the transmission of monetary policy by the Fed to the stock market returns of the S&P 500. During the first lag, the federal funds rate has a positive impact on stock returns and during the second lag the impact is a negative change. This represents that monetary policy impacts the stock market returns most crucially in the first month of its implementation (first lag). In this case for the United States, the positive impact of the monetary policy portrayed by the federal funds rate depicts a period of expansionary monetary policy for the last decade.

Charts in Appendix B reflect the U.S. federal funds rate, the S&P 500 index and the CPI changes respectively throughout the period of inflation from 2000 to 2010. Analyzing these trends show patterns and even parallel fluctuations among the three variables. The peaks and troughs of each variable are somewhat consistent with one another and this leads to possible evidence to depict their correlation in a more visual sense. This only explains some trends in the inflationary period in the U.S., and the Japanese charts depict some differences.

The charts in Appendix B on Japan are the Nikkei 225 index, deflation rate or decrease in inflation rate and the call rate changes respectively, from 1995-2005. The charts show a visual graphic of the relationships and the difference is in this case the lending rate reaches zero. So, comparison of these diagrams provides evidence of the relationship to inflation and the stock market when the central bank no longer has this monetary instrument at their disposal. As shown by the graphs, as the call rate became zero, deflation remained constant for an extended period of time as well as the stock market experienced declines.

6.0 CONCLUSION

This paper examines the debated issue of the existence of a relationship between a country's monetary policy and the relative stock market and stock returns. Specifically, the paper examines the affect and correlation of overnight interest rate, inflationary rate and stock returns on and with each other, respectively, during periods of inflation and deflation. The deflationary periods investigated are the periods of deflation in Japan and the inflationary period examined is the last decade in the United States. The contributions of this paper for the period in Japan are first that the deflation causes a problem with stock market returns and causes negative changes in returns, despite the fact that the severity of the negative impact is decreasing from the first to the second lag. The second important result is Japan's overnight call rate positively impacted inflation during the second lag. This illustrates that cuts in the call rate during this period were successful until they ultimately reached zero. For the inflationary period in the United States, a key discovery is that the S&P 500 returns acted as a leading indicator for the economy as they negatively impacted both the federal funds rate and the inflationary rate. Also, an important result is that during this period of inflation; the federal funds rate causes changes in the first month for the S&P 500 stock returns. This supplements the topic by demonstrating that in the last decade transmission of monetary policy to the stock market in evident.

From these conclusions the central banks in both instances can be further evaluated for their effectiveness. In Japan, the results from this paper reveal that not only was the period of deflation harmful to economic growth but it also negatively impacted equity markets like the Nikkei 225 index. This highlights the fact that the Japanese

government, as well as any government combating deflation needs to put primary emphasis on pulling themselves out of the deflationary trap by all means necessary, and not to focus mainly on price stability as the Japanese government did. Secondly, the results implicate that inflation targeting in this instance is crucial, and although there is an outside lag of rate cuts to effectively helping inflation, it is successful. This means that a government faced with a period of deflation must include inflation targeting. For the United States the implications of these results suggest that the S&P 500 index can be used for monetary policy as a leading indicator during a period of inflation. This result can help all central banks globally have better insight into the future economic conditions of their country. Furthermore, the results provide evidence that monetary policy, reflected by changes in the federal funds rate is transmitted via the stock market. This result implicates that central banks have the ability to alter the overall market with either contractionary or expansionary policy, with the impact being prevalent quickly, as it was shown to be more severe and positive during the first lag in the result. All in all, these conclusions contribute to the topic by helping further understand the correlation between the three variables of stock market returns, inflation rate and overnight lending rates as well as providing evidence of effective policy actions by central banks in each situation.

Appendix A: Variable Description and Data Source

Acronym	Description	Data Source
N225	**Adjusted Monthly Returns for Nikkei225 Index (1995 – 2005)**	**Finance.yahoo.com (Historical Prices)**

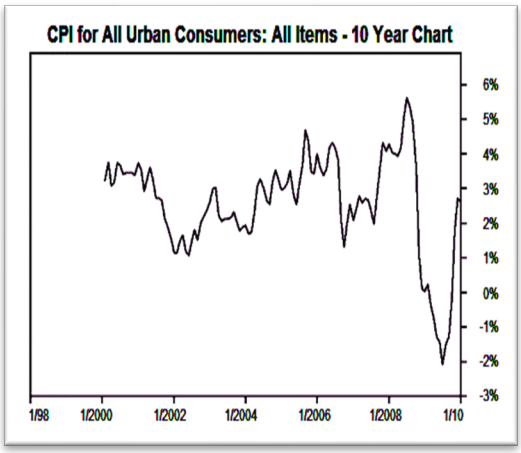
SNP	**Adjusted Monthly Returns for the S&P 500 Index (2000-2009)**	**Finance.yahoo.com (Historical Prices)**
BOJC	**Bank of Japan's overnight call rate**	**Bank of Japan Website (http://www.boj.or.jp/en/)**
FFR	**Federal Reserve Federal Funds Rate**	**FRED- Federal Reserve Bank Data (http://research.stlouisfed.org/fred2/)**
JPINF	**Monthly inflation rate change**	**RateInflation.com**
USINF	**Monthly inflation rate change**	**RateInflation.com**

Appendix B: Visual Graphs on All Variables

Figure 3 : SNP Index (US) **Figure 6: N225 Index**

Source: Finance.yahoo.com

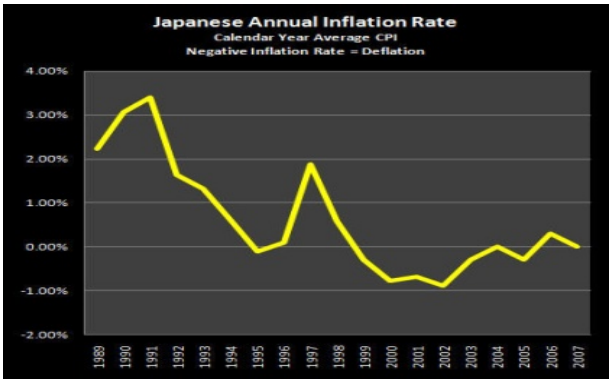
Figure 4: US CPI



Source: RateInflation.com

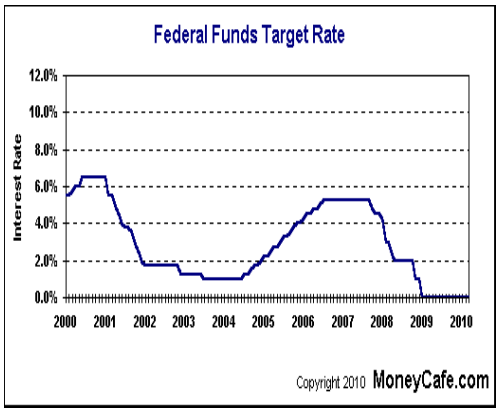
Source: Finance.yahoo.com

Figure 7: Japan CPI



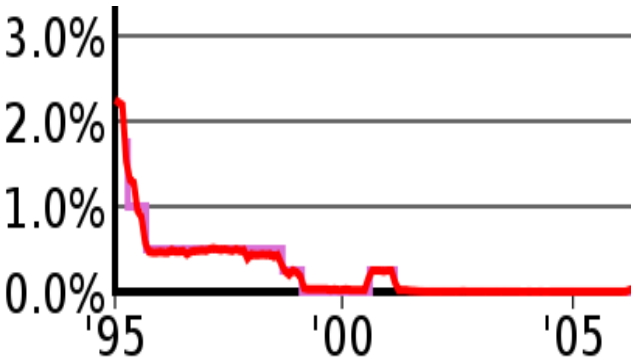
Source: Rateinflation.com

Figure 5: Federal Funds Rate



Source: MoneyCafe.com

Figure 8: Japanese Call Rate



Source: Google.com

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