Integration Between Stock Market Returns and Interest Rate and its Impact on Inflation : Empirical Evidence from Five Countries

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Abstract

Purpose : The present study tried to investigate the impact of the equilibrium relationship between deposit interest rates and the stock market return on inflation.

Methodology : Five countries, namely Brazil, Hong Kong, India, Japan, and the United States of America, were used as a subject of study. Statistical tools such as Granger and Toda Yamamoto causality were used to understand the causal relationship along with some other auxiliary statistical tools such as Johansen cointegration, *t*-test, and auxiliary autoregression. For inflation, we used the consumer price index as a proxy, whereas the residual series of purchasing power generated by the deposit interest rate and the stock market return were used as the second series.

Findings : We found that for countries where there is no equilibrium relationship, a unidirectional causal relation was established from the residual to the consumer price index, and no causality was found for countries where the relationship existed. The outcome indicated that if the difference in purchasing power generated by two variables has some kind of trend or seasonality, it will cause some sort of movement in the inflation of a nation.

Practical Implication : The findings can help in curing economic illnesses, such as deflation and inflation, with proper policy implementation.

Originality : The literature consists of mixed results and bidirectional causality; thus, through this paper, I tried to build a narrative to explain the causal direction. Furthermore, I avoided using return or interest for the analysis ; rather, it was converted into purchasing power concerning the base year.

Keywords : **stock market returns, interest rate, inflation, Granger causality, cointegration, purchasing power**

JEL Classification Codes : E31, E43, E44, G10

Although the relationship between inflation and the stock market has long been examined, it is unlikely that all experts will agree. According to "Fama and Schwert," the US macroeconomic data are an enigma. Numerous notable authors on the subject have presented their ideas in bygone years. The first observation was made by Fisher (1955), who asserted that the nominal interest rate and the inflation rate are correlated. Numerous economists then shared their opinions. Real interest rates and inflation rates were found to be inversely connected by Mundell (1963). Haymes (1966) vehemently dismissed the theory, claiming that there is no tenable explanation for why co-movement should occur. With time, the focus of economists shifted from interest rates and inflation to stock market returns and inflation. Prior researchers were concerned with the hedging property of stock market return regarding the growing price level of the nation. The result of the

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empirical analysis was largely diverse because the evidence was found in the economic data of the US in comparison to other nations. Thus, these studies were focused on presenting deposit interest rates and stock market return as a cure for a certain illness, namely inflation.

Owing to the limited mixed evidence, upcoming researchers have changed their approach from unidirectional causality to a spatial relationship between stock market return and inflation that is the autoregressive distributed lags (ARDL) methodology. However, a clear direction of causality is still eluded from the literature. Thus, using the interest rate, we tried to explain the causal direction between market return and inflation. The main aim of this study is to open a new front in understanding the association between market return and inflation. The knowledge of the precise direction of the association will not only help future research in this field but also provide a clear vision to policymakers at a time of adversity, as uncontrollable inflation is the biggest threat to an economy.

Literature Review

The association between stock market return and inflation has been broadly studied in the past without any definite conclusion. A negative correlation was observed when studies were conducted using US time series (Bodie, 1976; Gultekin, 1983; Jaffe & Mandelker, 1976). Firth (1979) reported a startlingly different conclusion from their American counterpart's assertion that the United Kingdom stock market offers some level of inflation hedging.

In recent years, different methodologies have been applied. Al-Rjoub (2005) employed generalized autoregressive conditional heteroskedasticity (GARCH) and ordinary least squares (OLS) methods in his investigation, and the relationship and outcome he found were adverse. In their study, Campbell and Vuolteenaho (2004) discovered a favorable correlation between two variables using the vector autoregressive modeling approach. Panel data analysis was employed by Gregoriou and Kontonikas (2006) to explore the issue, with conflicting results. If we consider the aggregate of all the findings, which are scattered and mixed in nature, the outcome of this investigation was pretty much compatible with prior studies. An emerging market with higher inflation experiences higher variance in the stock price than a comparable market where the inflation rate is low (Adusei, 2014; Jepkemei, 2012; Reddy, 2012; Silva, 2016; Uwubanmwen & Eghosa, 2015). Geetha et al. (2011), using data from the US, China, and Malaysia, investigated the relationship between two variables. It was found that long-term associations existed, but there was no evidence of short-term relationships. The vector error correction model (VECM) analysis used by Ahmed et al. (2015) showed that the correction term between two variables was as high as −0.93. Jelilov et al. (2020) investigated the impact of COVID-19 on the relationship between stock market return and inflation and only found that the pandemic had distorted the positive correlation between the two variables.

In the Indian scenario, this problem has been studied as part of a broader question about the association between the stock market and macroeconomic variables. Das and Megaravalli (2017) reported a long-term and positive relationship between the two-time series. In a similar kind of study, Srivastava et al. (2019) found a positive correlation between the industrial index product (IIP) and the wholesale price index (WPI). Prakash (2021) studied the impact of five macroeconomic variables (crude oil price, gold price, balance of payment, foreign exchange reserve, and foreign direct investment) on the NIFTY 50 using a multiple regression model, and it was observed that apart from crude oil prices, no other variable had any effect on the index. Nayak and Barodawala (2021) reported a short- and long-term relationship between the interest rate, inflation rate, foreign institutional investments, foreign exchange reserves, gold prices, money supply, and Sensex 30 using the ARDL model. Furthermore, it showed that the negative error correction term was indigenous to the model. A univariate analysis of inflation using the WPI concluded that the series is nonstationary at this level and the ARIMA model can be used for forecasting (Kothadia & Nayak, 2020).

Theoretical Discussion on How Stock Market and Inflation Could Be Interrelated

Demand within the confined economy is affected by growing real purchasing power. A rise in quantity demand results from an increase in real purchasing power, which raises prices to record levels. Passive income, which includes market returns and bank deposits, increases purchasing power. As a result, the relationship between these two mechanisms may have explanatory power in terms of inflation.

Nominal buying power can be measured by the rate of change in quantity demanded and the rate of change in income owing to the stock market return. This increases demand pressure.

$$D_e = \frac{\Delta Q}{\Delta I} \times \frac{I}{Q} \quad (1)$$

where,

D_e = elasticity of demand,

ΔQ = change in quantity demanded,

ΔI = change in income due R_M,

I = original income,

Q = original demand.

The change in income is expressed as a differential value between two periods, that is, $\Delta I = I_{t-1} - I_t$. Instead of comparing changes in income at t, we can see how an increase in purchasing power due to a bank deposit at $t + 1$ affects changes in demand and possibly changes in price as a result of such changes in demand.

$$D_e = \frac{\Delta Q}{\Delta(I_S - I_B)} \quad (2)$$

where,

D_e = elasticity of demand,

ΔQ = change in quantity demanded,

ΔI_S = change in income due R_M,

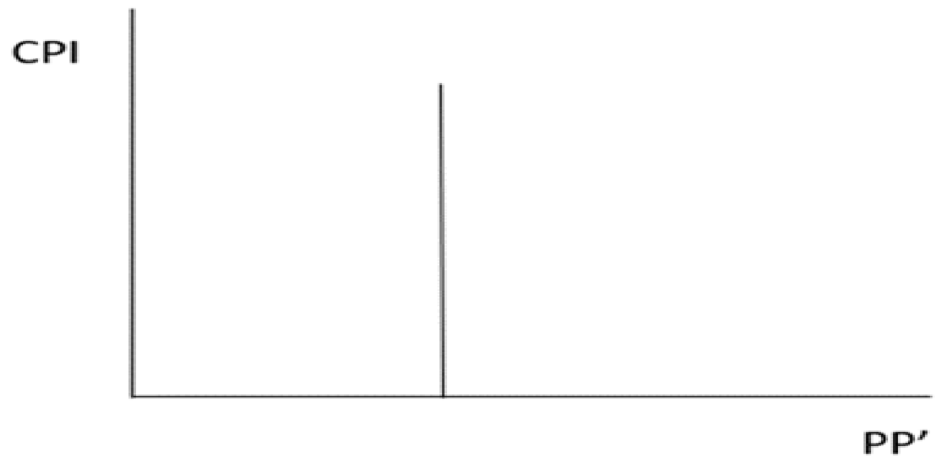
ΔI_B = change in income due to bank deposit.

When $(\Delta I_S - \Delta I_B) = 0$, the return market has no impact on changing quantity demand. Therefore, the price level shift cannot be attributed to R_M. Simply put, stock market participants do not have sufficient purchasing power over others to be able to affect price levels.

Difference between market return and bank interest: Stock markets with positive returns increase participants' purchasing power; the impact of the stock market on inflation can be measured by calculating how much a participant's purchasing power exceeds other capital formation methods, such as bank term deposits. If we assume that the purchasing power produced by the stock market over a year is equal to the purchasing power produced by the bank term deposits, then the difference between the two will be 0, or we can say that the ratio of these two series will be 1.

Figure 1 clearly illustrates this point by showing the consumer price index (CPI) (a proxy for inflation) on the

Figure 1. *Depicting the Relation Between Inflation and the Ratio of Purchasing Price*



y-axis and the purchasing power (PP′) ratio on the x-axis. If there is no difference between the two modes of return, then there is no relationship between stock market return and inflation.

Research Question

Does the causal link between inflation and return from the stock market (RM) depend on the integration of market return (RM) and bank deposit interest rate (BDIR)? Appropriately, we have formulated our null hypothesis, which is as follows:

- **H0 :** Causality between inflation and stock market return does not depend on cointegration between market return and interest rate.

Model Specification

The study aims to establish an association between residual series of stock market return and deposit interest rate and inflation; accordingly, a causal research approach was adopted with longitudinal data from the US, Hong Kong, Japan, Brazil, and India. The selection of countries for the empirical analysis was based on market capitalization and the availability of data. The dataset for the study included the following three variables: the CPI, the bank's annual interest rate on a one-year term deposit, and the stock market index (NYSE, N225, HSI, IBOVESPA, and NSEI) of the respective countries. The World Bank provided the CPI and bank interest rates (in the case of India data on interest rates was collected from RBI), and the website of the relevant stock exchange provided the stock market index. Since we sought to understand the relationship over time, we considered the annual change. The empirical analysis of each country is independent of the others; therefore, different lengths or ranges were used. Each country has a different length dataset, and in many cases, certain data had to be reduced because other data were shorter. These data were as follows: for the US dataset from 1984 – 2019, Hong Kong from 1994 – 2021, Japan from 1982 – 2017, Brazil from 1994 – 2021, and India from 2007 – 2021.

Incremental Purchasing Power

Rather than using a straightforward annual return, we altered the data to meet our needs (which is itself a rate of change in the index). We transformed the index into the annualized purchasing power. The sole reason for this approach is the diverse results obtained by the researcher using the rate of return. The first year is used as the base year for the series, and each succeeding year is used as the numerator.

$$PP = \frac{\text{Subsquent year}}{\text{Base year}} \qquad (3)$$

We divided succeeding years by base years primarily to account for changes in participants' long-term purchasing power (cumulative change). After that, the yearly interest rate at the bank received the same treatment. Numerous deposit options were accessible through the banking system, but we chose to focus on annual term deposits because our data series were in annual format. First, the interest rate was divided by 100 to create an absolute figure, and then 1 was added to create a factor. Once more, the first year of the data series was used as the base year. Here, the value produced in the previous year was multiplied by the factor for the following year to obtain the purchasing power of the following year.

$$PP_{t+1} = PP_t \times \text{Factor}_{t+1} \qquad (4)$$

The calculated value of purchasing power generated from stock market return and the deposit interest rate has been shown in Appendix A.

Cointegration Test

These two series are referred to as cointegrated series when the residual from the regression of two non-stationary (unit root) series is stationary at $I(0)$ (zero order of integration) or at the level. Two series are said to be cointegrated when their natures are convergent. According to conventional wisdom, such series are thought to cancel out one another's trends and create an equilibrium point at t periods, hence the difference will be zero at those t periods.

Between R_M and BDIR

A cointegration test was employed to statistically determine whether or not there is zero difference between R_M and BDIR. To check for cointegration between these variables, we subtracted PP_B from PP_S and performed an augmented Engle-Granger (AEG) test (ADF with τ statistics) on the residual value (Gujarati, 2004). We chose not to use simple cointegrated regression for the reason that if the regression itself is not significant (F statistic), the residual results will have no significance.

$$Y = \hat{Y} + u_i \qquad (5)$$

where, u_i is the residual series, $\hat{Y}$ is the calculated value of Y, or the product of X, and the gradient (slope) coefficient.

$$Y = X + u_i \qquad (6)$$

Dividing both sides by Y

$$\frac{Y}{Y} = \frac{X}{Y} + \frac{u_i}{Y} \qquad (7)$$

$$\frac{u_i}{Y} = 1 - \frac{X}{Y} \qquad (8)$$

As residual is not calculated using regression, we have taken some extra precautions while using ADF. A t - test was performed for the mean, and an auxiliary regression was done for the trend. As the regression will start at zero if the mean is statistically zero, there will be no intercept. While for the trend, we have run an autoregression model for the one-third lag value of the series.

$$t = \frac{\lambda - \mu}{S/\sqrt{n}} \qquad (9)$$

where, λ denotes the series mean, μ denotes the theoretical mean (zero), S is the series standard deviation, and n denotes the number of observations.

$$u_t = \alpha_1 u_{t-1} + \alpha_2 u_{t-2} + ... \alpha_k u_{t-k} \qquad (10)$$

where $\alpha_1 = \alpha_2 = \alpha_3 .... = \alpha_{13} = 0$, there is no trend, while any statistical difference from zero confirms the existence of the trend.

Between CPI and Residual

Two variables' cointegration suggests long-term and at least unidirectional Granger causation. The lack of cointegration among the causal variables suggests a short-term relationship. So, the cointegration between the CPI and the residual series was investigated using the Johansen test.

Unit Root

Stationarity of time series is a pre-requisite for testing causal relationships using Granger causality. The stationarity of the residual series is already been tested at the time of testing cointegration between the R_M and BDIR; therefore, a unit root test was conducted only for the second variable, which is CPI using ADF.

Granger Causality

For a few reasons, it might be challenging to prove a correlation between stock prices and inflation. First, given the variety of models that can be built, empirical investigations that attempt to explain the relationship between stock prices and inflation are likely to yield findings that are extremely sensitive to model selection. The following generalizations apply to the linear regression equation to be estimated considering the talks above and the adaptation to be made:

Unrestricted equation:

$$\text{Inflation: } X(t) = \sum_{j=1}^{p} \alpha_{11,j} X(t-j) + \sum_{j=1}^{p} \alpha_{12,j} Y(t-j) + E_1(t) \qquad (11)$$

$$\text{Return: } Y(t) = \sum_{j=1}^{p} \delta_{21,j} X(t-j) + \sum_{j=1}^{p} \delta_{22,j} Y(t-j) + E_2(t) \qquad (12)$$

Restricted equation:

$$\text{Inflation: } X(t) = \sum_{j=1}^{p} \alpha_{11,j} X(t-j) + \sum_{j=2}^{p} \alpha_{12,j} Y(t-j) + E_1(t) \quad (13)$$

$$\text{Return: } Y(t) = \sum_{j=1}^{p} \delta_{21,j} Y(t-j) + \sum_{j=2}^{p} \delta_{22,j} Y(t-j) + E_2(t) \quad (14)$$

$$F_R = \frac{(R^2_{UR} - R^2_R)/m}{(1 - R^2_{UR})/(n-k)} \quad (15)$$

The first pair of regressions shows an unrestricted equation in which the lagged values *Y* (residual) and *X* (CPI) were used to forecast *X* and vice versa. As opposed to the last pair of regressions, where *X* is regressed with the lagged value of *X* only and *Y* is regressed with the lagged value of *Y* only, the restricted autoregression is used in this pair. To determine whether the difference between the *R* square of an asserted regression is statistically significant, use the restricted *F* measure. We choose to use the residual series to show that any effects on the macroeconomic level will result from people having more purchasing power than they should, which will help us comprehend the causal relationship better.

Toda Yamamoto

Toda Yamamoto was also used to confirm the Granger causality result. Toda Yamamoto gives causal studies an added advantage because it does not comply with the assumptions of the variable's stationarity and cointegration.

Lag Length

The lag used for the calculation of Johansen cointegration, Granger causality, and Toda Yamamoto have been shown in Appendix B.

Analysis and Results

Unit Root

The estimated *t* value for the CPI series is −0.39, 0.48, −2.35, −0.57, and 1.77 for the USA, Hong Kong, Japan, India, and Brazil, respectively, which is less than their respective critical values (statistics) of −3.62, −3.73, −3.63, −4.00, and −3.69 (at a significance level of 1%). Thus, CPI series are non-stationary at level.

Further inquiry reveals that the series of the USA, Japan, and Brazil are integrated in the first order, whereas the series of India and Hong Kong are integrated in the second order. The result of the unit root is shown in Table 1.

Table 1. *Unit Root Test (ADF)*

Country	Calculated Value	Critical Value	Prob.	Order of Integration
USA	–0.39	–3.62	0.8989[a]	*I* (1)
Hong Kong	0.48	–3.73	0.9825[a]	*I* (2)
Japan	–2.35	–3.63	0.1611[a]	*I* (1)
India	–0.57	–4.00	0.8477[a]	*I* (2)
Brazil	1.77	–3.69	0.9995[a]	*I* (1)

Note. [a] denotes significance at the level of 1%.

Cointegration

Between R_M and Interest Rate

For the USA, Japan, Hong Kong, India, and Brazil, the critical values of the *t* statistic for the mean value (intercept) of the residual series are 2.70, 2.43, 2.77, −2.97, and 2.77, respectively. In the same order, the estimated values for the *t*-test are 6.08, 2.47, 7.56, −4.44, and −5.81. As a result, it may be said that the residual series has an intercept value, which is evident from Table 2.

All the auxiliary regression was insignificant, indicating that there was no trend in the residual series, which is shown in Table 3. Accordingly, we have taken the option while going for AEG (ADF with the τ statistic).

For the USA, Hong Kong, and Japan, the estimated residual series values are −2.41, −2.72, and −1.91, respectively, which are all below the crucial value (τ statistic) of −3.75 (at a significance level of 1%). India's and Brazil's computed values are −4.03 and −3.09, respectively, which are higher than the crucial values of −3.75 (at a significance level of 1%) and −3.00 (at a significance level of 5%). India and Brazil are convergent, that is, cointegrated. As a result, the market returns and interest rates of the USA, Hong Kong, and Japan are divergent and not cointegrated, the same is evident from Table 4.

Table 2. ***t-test for Mean Value (Intercept)***

Residual (by Country)	*t*-statistic	Critical value
USA	6.08	2.70[a]
Japan	2.47	2.43[b]
Hong Kong	7.56	2.77[a]
India	–4.44	–2.97[a]
Brazil	–5.81	–2.77[a]

Note. [a] denotes significance at the level of 1% ; [b] denotes significance at the level of 5%.

Table 3. ***Auxiliary Regression***

Country	*F* - Statistic	Prob.
USA	0.530	0.854[a]
Japan	2.048	0.101[a]
Hong Kong	2.132	0.137[a]
India	0.284	0.899[a]
Brazil	5.426	0.025[a]

Note. [a] denotes significance at the level of 1%.

Table 4. ***Augmented Engle-Granger Test for Cointegration (ADF with τ Statistic)***

Country	Calculated Value	Critical Value (τ *Statistic*)	Prob.	Order of Integration
USA	–2.41	–3.75	0.144	*I* (1)
Hong Kong	–2.72	–3.75	0.082	*I* (1)
Japan	–1.91	–3.75	0.323	*I* (1)
India	–4.03	–3.75	0.009[a]	*I* (0)
Brazil	–3.09	–3.00	0.038[b]	*I* (0)

Note. [a] denotes significance at the level of 1% ; [b] denotes significance at the level of 5%.

Table 5. *Johansen Test of Cointegration*

Country	Statistic	Calculated Value	Critical Value	Prob.
USA	Trace value	49.71	19.93[a]	0.000
	Max eigenvalue	49.38	18.52[a]	0.000
Japan	Trace value	39.68	19.93[a]	0.000
	Max eigenvalue	29.33	18.52[a]	0.000
Hong Kong	Trace value	40.66	19.93[a]	0.000
	Max eigenvalue	40.63	18.52[a]	0.000
India*				NA
Brazil*				NA

Note. [a] denotes significance at the level of 1%. * Since residual series of India and Brazil are stationary, therefore, cointegration test can't be used.

Between Residual and CPI

For the United States, Japan, and Hong Kong, the calculated values of the trace and maximum eigenvalue statistics are 49.71 and 49.38, 39.68 and 29.33, and 40.66 and 40.63, respectively. This is higher than the critical values of 19.93 and 18.52 at the 1% level of significance. The same is clear from Table 5. As a result, it can be said that CPI and the residual series are cointegrating variables.

Brazil and India are two cases where we have refrained from using the cointegration test because both series should be non-stationary; however, in these two cases, the residual series is integrated at level zero (zero order). Cointegration cannot be used in this situation. The result of Johansen cointegration is represented in Table 5.

Granger Causality

The result of causality is reported in Table 6, where the F - statistic for causal direction from the CPI to the residual series for the USA, Japan, Hong Kong, India, and Brazil is 6.85, 10.9, 5.77, 0.76, and 0.56, and for causal direction from the residual series to the CPI is 1.26, 1.89, 0.56, 0.11, and 0.00, respectively. Unidirectional

Table 6. *Test of Granger Causality*

Index	Null Hypothesis (H0)	*F* Statistic	Prob.
USA	a. Residual does not Granger cause CPI.	6.85[b]	0.0136
	b. CPI does not Granger cause residual.	1.26	0.2687
Japan	a. Residual does not Granger cause CPI.	6.87[b]	0.0134
	b. CPI does not Granger cause residual.	0.04	0.8259
Hong	a. Residual does not Granger cause CPI.	5.77[b]	0.0110
Kong	b. CPI does not Granger cause residual.	0.56	0.5792
India	a. Residual does not Granger cause CPI.	0.76	0.4016
	b. CPI does not Granger cause residual.	0.11	0.7401
Brazil	a. Residual does not Granger cause CPI.	0.56	0.4831
	b. CPI does not Granger cause residual.	0.00	0.9953

Note. [b] denotes significance at the level of 5%.

causality was discovered for the USA, Japan, and Hong Kong, but there was no evidence of a causal connection for India or Brazil. The result of Granger causality is represented in Table 6.

Toda Yamamoto

The result of Toda Yamamoto causality is reported in Table 5, where the χ^2 statistic for causality direction from the CPI to the residual series for the USA, Japan, Hong Kong, India, and Brazil is 7.66, 9.84, 18.1, 0.41, and 0.02, and for causal direction from the residual series to the CPI is 0.53, 1.56, 3.41, 0.36, and 0.28, respectively. Unidirectional causality was discovered in the USA, Japan, and Hong Kong, but not in India or Brazil. The result of Johansen cointegration is represented in Table 7.

Table 7. ***Toda Yamamoto Causality Test***

Index	Null Hypothesis (H_0)	χ^2 Statistic	Prob.
USA	a. Residual does not Cause CPI.	7.66[a]	0.0057
	b. CPI does not Cause Residual.	0.53	0.4655
Japan	a. Residual does not Cause CPI.	6.38[b]	0.0115
	b. CPI does not Cause Residual.	1.58	0.2087
Hong	a. Residual does not Cause CPI.	18.1[a]	0.0001
Kong	b. CPI does not Cause Residual.	3.41	0.1817
India	a. Residual does not Cause CPI.	0.41	0.5202
	b. CPI does not Cause Residual.	0.36	0.5442
Brazil	a. Residual does not Cause CPI.	0.02	0.8640
	b. CPI does not Cause Residual.	0.28	0.5941

Note. [a] denotes significance at the level of 1%.

Conclusion

In this article, we tried to show how the long-term relationship between interest rates and stock market return affects the relationship between stock market return and inflation. The results of the causality test provide enough evidence to reject H0 and support the theory that was put forth. Where the residual series (difference between market return and interest rate) were stationary at I (0), that is, cointegrated, no causal relationship between inflation and market return was discovered. In contrast, a single-cause relationship was discovered where the residual was non-stationary at I (0). This may be the case because inflation cannot be attributed to one variable when there is cointegration between the two; rather, a collective force drives the price level upward. This can be a result of greater purchasing power's inefficiency. In a free and competitive market, if two entities have equal purchasing power, they will completely exhaust their money. This will continue to be the case until rivals become uninformed of other people's purchasing power. People will adapt (lower) their demand schedule as they become aware of each other's purchasing capacity. When there is a disparity in purchasing power, the individual with more power can affect price levels by spending a little more than their counterparts can afford while also saving some of their own money. Thus, if the interest rate on a bank's term deposit and the return on the stock market are the same, consumers will change their consumption to mimic their saving behaviors.

Theoretical Implications

The policymaker uses interest rates as a key tool in monetary policy to curtail any economic mishaps. When deflation is anticipated, the government cuts the interest rate; thus, borrowing becomes easier and the consumption rate does not fall. Similarly, when inflation is expected by the government, it expands the interest rate so that people are encouraged to term deposit their money in the bank, thus cutting their purchasing power. Now let us understand two situations with a well-established stock market and one with a not-so-established stock market.

Weak Financial Markets

The countries with weak financial markets do not have anything to say above scenario. Over here, banking institutes will play a primary role in curing the illness of the economy.

Well-Established Financial Markets

In the case of deflation, a reduction in interest rates led people to borrow from the bank at a lower rate and invest in the capital market with higher expectations. This will cause a boom in the stock market, thus enhancing purchasing power in both the short and long run. And bail out the economy from deflation.

When it came to inflation, the greater the difference between the two returns, the greater the adversity. Even with an increased interest rate, if the difference is substantial, people will invest in the stock market to hedge themselves against inflation. And investment will bring a new boom to the stock market, which will further raise inflation. Thus, the enhancement of the interest rate should be on par with the expected return of the financial market. There are some great examples of this, such as the great depression of 1929 and the Recession of 2008 showed how the stock market turned out to be the last frontier for any financial crisis. The most recent example can be given in India, during the pandemic when the interest rate dropped to 5.175% from 6.75 and a tremendous hike was seen in the stock market (the NIFTY 50 rose by 4000 points in just one and a half years).

Limitations of the Study and Scope for Further Research

The boundary of our study was confined to understanding the direction of causality and providing reasoning for it. What we ignored was the quantification aspect of the research problem. As we have justified our explanation with empirical evidence that shows unilateral causality for the studied variable, future research can focus on quantifying causal relationships using the error correction mechanism (ECM) model. Further enhancement of the literature can be done by studying in a different country. One aspect that we are eager to add to our future study is how the percentage of the population engaged in the stock market affects this relationship.

Author's Contribution

Bishal Routh conceived the idea and developed qualitative and quantitative designs to undertake the empirical study. He also extracted research papers with high repute, filtered these based on keywords, generated concepts and codes relevant to the study design, and wrote the manuscript. The numerical computations were done by him using EViews 12.

Conflict of Interest

The author certifies that he has no affiliations with or involvement in any organization or entity with any financial or non-financial interest in the subject matter or materials discussed in this manuscript.

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Appendix

Appendix A : Incremental purchasing power calculation, where PPS denotes purchasing power by the stock market and PPB denotes purchasing power by bank deposit interest rate.

Table A1. ***USA***

Year	PPS	PPB	PPB/PPS	1-PPB/PPS
1984	1	1	1	0
1985	1.177162	1.106	0.939548	0.060452
1986	1.504685	1.191162	0.791635	0.208365
1987	1.389209	1.29122	0.929464	0.070536
1988	1.606078	1.406138	0.87551	0.12449
1989	1.749403	1.52566	0.872103	0.127897
1990	1.808107	1.656867	0.916354	0.083646
1991	2.180252	1.787759	0.819978	0.180022
1992	2.331771	1.912902	0.820364	0.179636
1993	2.574465	2.025763	0.786868	0.213132
1994	2.466801	2.169593	0.879517	0.120483
1995	3.277415	2.312786	0.705674	0.294326
1996	3.970912	2.460804	0.619708	0.380292
1997	4.921751	2.618296	0.531985	0.468015
1998	5.787397	2.757065	0.476391	0.523609
1999	5.992607	2.914218	0.486302	0.513698
2000	6.396556	3.089071	0.482927	0.517073
2001	5.575924	3.243525	0.581702	0.418298
2002	4.438096	3.392727	0.764455	0.235545
2003	5.972206	3.528436	0.590809	0.409191
2004	6.462808	3.680159	0.569436	0.430564
2005	7.38961	3.838405	0.519433	0.480567
2006	8.436246	4.022649	0.476829	0.523171
2007	8.319046	4.207691	0.50579	0.49421
2008	4.736276	4.363375	0.921267	0.078733
2009	6.274981	4.507367	0.718308	0.281692
2010	7.419336	4.651602	0.626957	0.373043
2011	7.145248	4.781847	0.669235	0.330765
2012	8.108065	4.86792	0.60038	0.39962
2013	9.086115	4.98475	0.548612	0.451388
2014	9.605312	5.109369	0.531932	0.468068
2015	8.780788	5.216666	0.5941	0.4059
2016	10.23041	5.310566	0.519096	0.480904
2017	12.1857	5.432709	0.445826	0.554174
2018	11.21131	5.590258	0.498627	0.501373
2019	12.41007	5.707653	0.459921	0.540079

Table A2. *Hong Kong*

Year	PPS	PPB	PPB/PPS	1-PPB/PPS
1994	1	1	1	0
1995	1.229813	1.056275	1.164293	0.141109
1996	1.642229	1.105321	1.485748	0.326938
1997	1.309095	1.171393	1.117554	0.105189
1998	1.226783	1.248959	0.982245	–0.01808
1999	2.070822	1.305151	1.586652	0.369742
2000	1.842941	1.36781	1.347367	0.257812
2001	1.391431	1.400329	0.993645	–0.0064
2002	1.137992	1.40516	0.809866	–0.23477
2003	1.535336	1.406097	1.091913	0.084176
2004	1.73729	1.406449	1.235231	0.190435
2005	1.816192	1.424182	1.275253	0.215842
2006	2.437397	1.462635	1.666443	0.399919
2007	3.395513	1.498079	2.266578	0.558806
2008	1.756499	1.504795	1.167267	0.143298
2009	2.670309	1.504958	1.774341	0.43641
2010	2.812288	1.505109	1.868494	0.46481
2011	2.250567	1.505259	1.495135	0.331164
2012	2.766075	1.50541	1.837423	0.455759
2013	2.845366	1.505561	1.889905	0.470873
2014	2.881826	1.505711	1.91393	0.477515
2015	2.675424	1.505862	1.776673	0.43715
2016	2.685943	1.506012	1.78348	0.439299
2017	3.652686	1.506163	2.42516	0.587656
2018	3.155378	1.506828	2.094053	0.522457
2019	3.441552	1.508913	2.280816	0.56156
2020	3.324518	1.509793	2.20197	0.545861
2021	2.322718	1.510095	1.538127	0.349859

Table A3. *Japan*

Year	PPS	PPB	PPB/PPS	1-PPB/PPS
1982	1	1	1	0
1983	1.234156	1.058592	0.857746	0.142254
1984	1.439825	1.116483	0.77543	0.22457
1985	1.631997	1.177539	0.721533	0.278467
1986	2.347689	1.220162	0.519729	0.480271
1987	2.689895	1.253716	0.466084	0.533916
1988	3.762036	1.288192	0.342419	0.657581
1989	4.854369	1.327843	0.273536	0.726464
1990	2.97	1.401703	0.471178	0.528822

1991	2.866997	1.485615	0.518178	0.481822
1992	2.111219	1.535391	0.727253	0.272747
1993	2.172628	1.56831	0.721849	0.278151
1994	2.460256	1.594947	0.648285	0.351715
1995	2.478355	1.609325	0.649352	0.350648
1996	2.415136	1.614161	0.668352	0.331648
1997	1.903376	1.619025	0.850607	0.149393
1998	1.726673	1.62333	0.940149	0.059851
1999	2.361871	1.625226	0.688109	0.311891
2000	1.719628	1.62637	0.945768	0.054232
2001	1.315087	1.627298	1.237407	–0.23741
2002	1.070139	1.627877	1.521183	–0.52118
2003	1.331805	1.628569	1.222829	–0.22283
2004	1.433109	1.629876	1.137301	–0.1373
2005	2.009741	1.634294	0.813187	0.186813
2006	2.148751	1.645453	0.765772	0.234228
2007	1.909494	1.658751	0.868686	0.131314
2008	1.105142	1.668517	1.509776	–0.50978
2009	1.315564	1.675773	1.273806	–0.27381
2010	1.275956	1.684153	1.319915	–0.31991
2011	1.054721	1.691927	1.604147	–0.60415
2012	1.296695	1.700015	1.311036	–0.31104
2013	2.032179	1.709232	0.841083	0.158917
2014	2.17681	1.716329	0.788461	0.211539
2015	2.374267	1.723302	0.725825	0.274175
2016	2.384328	1.728479	0.724933	0.275067
2017	2.8397	1.734021	0.610635	0.389365

Table A4. ***India***

Year	PPS	PPB	PPB/PPS	1-PPB/PPS
2007	1	1	1	0
2008	0.482878	1.085	2.246946	–1.24695
2009	0.847501	1.175869	1.387455	–0.38745
2010	1.006632	1.2523	1.244049	–0.24405
2011	0.974881	1.339961	1.374487	–0.37449
2012	0.761934	1.462233	1.919106	–0.91911
2013	1.026806	1.592006	1.550445	–0.55045
2014	1.350666	1.735286	1.284763	–0.28476
2015	1.291327	1.884955	1.459704	–0.4597
2016	1.707345	2.02397	1.185449	–0.18545
2017	1.771108	2.163118	1.221336	–0.22134
2018	1.337858	2.305343	1.72316	–0.72316
2019	1.988373	2.460954	1.237672	–0.23767

2020	2.280702	2.598767	1.139459	–0.13946
2021	2.833283	2.733254	0.964695	0.035305

Table A5. ***Brazil***

Year	PPS	PPB	PPB/PPS	1-PPB/PPS
1994	1	1	1	0
1995	0.892303	1.522465	1.706219	–0.70622
1996	1.325997	1.925133	1.451838	–0.45184
1997	2.050116	2.393915	1.167698	–0.1677
1998	2.501931	3.064291	1.224771	–0.22477
1999	2.103475	3.861697	1.835865	–0.83587
2000	4.218275	4.525876	1.072921	–0.07292
2001	4.549035	5.334047	1.172567	–0.17257
2002	3.274389	6.355129	1.94086	–0.94086
2003	2.816216	7.751395	2.752415	–1.75241
2004	5.624453	8.946361	1.590619	–0.59062
2005	6.267954	10.52349	1.678936	–0.67894
2006	9.879794	11.98967	1.213554	–0.21355
2007	11.49086	13.25785	1.153773	–0.15377
2008	15.31274	14.80309	0.966717	0.033283
2009	10.11609	16.17665	1.599101	–0.5991
2010	16.83449	17.61159	1.046161	–0.04616
2011	17.13642	19.54751	1.1407	–0.1407
2012	16.23475	21.09323	1.299264	–0.29926
2013	15.3825	22.74	1.478303	–0.4783
2014	12.26229	25.01937	2.040351	–1.04035
2015	12.07413	28.17743	2.333703	–1.3337
2016	10.40051	31.68433	3.046419	–2.04642
2017	16.64633	34.38179	2.065427	–1.06543
2018	21.85663	36.74456	1.681163	–0.68116
2019	25.06924	38.73985	1.545314	–0.54531
2020	29.28211	39.59074	1.352045	–0.35205
2021	29.86023	41.31217	1.383518	–0.38352

Appendix B : Lag length: 1 lag was used for Granger causality, 2 lag was used for Toda Yamamoto, 3 lag was used for the Johansen Cointegration test, and 4 lag was used for Granger and Toda Yamamoto causality.

Table B1. ***USA***

Lag	LogL	LR	FPE	AIC	SC	HQ
0	–108.9329	NA	17.42011	8.533304	8.630080	8.561172
1	–27.00288	144.9532	0.043499	2.538683	**2.829013**[4]	2.622288

2	–24.86893	3.447158	0.050599	2.682225	3.166109	2.821566
3	–23.96692	1.318327	0.065349	2.920532	3.597969	3.115609
4	–20.76370	4.188818	0.071771	2.981823	3.852813	3.232637
5	–17.78273	3.439583	0.081911	3.060210	4.124753	3.366760
6	–13.31484	4.467890	0.085922	3.024218	4.282315	3.386505
7	–3.491276	8.312246	0.062297	2.576252	4.027902	2.994275
8	–2.837412	0.452676	0.097340	2.833647	4.478850	3.307406
9	–0.764364	1.116256	0.150250	2.981874	4.820631	3.511370
10	13.72641	5.573374	0.105377	**2.174892**[3]	4.207201	2.760123

Table B2. ***Japan***

Lag	LogL	LR	FPE	AIC	SC	HQ
0	–76.83610	NA	0.787630	5.436972	5.531269	5.466505
1	–26.96251	89.42850	0.033340	2.273277	**2.556166**[4]	2.361874
2	–20.90740	10.02225	0.029093	2.131545	2.603026	2.279207
3	–19.88421	1.552432	0.036172	2.336842	2.996916	2.543569
4	–19.69450	0.261669	0.048132	2.599621	3.448287	2.865412
5	–18.93607	0.941501	0.062487	2.823177	3.860436	3.148034
6	–14.48293	4.913804	0.064135	2.791926	4.017778	3.175848
7	1.221670	15.16306	0.031125	**1.984712**[3]	3.399156	2.427699

Table B3. ***India***

Lag	LogL	LR	FPE	AIC	SC	HQ
0	–56.15709	NA	55.58256	9.692849	9.773666	9.662927
1	–24.14278	48.02147	0.532429	5.023797	**5.266250**[2]	4.934032
2	–19.78869	5.079769	0.547150	4.964782	5.368871	4.815174
3	–14.34539	4.536087	0.540720	**4.724232**[1]	5.289956	4.514780

Table B4. ***Hong Kong***

Lag	LogL	LR	FPE	AIC	SC	HQ
0	–81.48672	NA	9.732844	7.951116	8.050594	7.972705
1	–26.25072	94.69029	0.074250	3.071497	3.369932	3.136265
2	–15.04213	17.07976	0.037925	2.384964	**2.882356**[4]	2.492911
3	–12.15313	3.851999	0.043630	2.490774	3.187122	2.641899
4	–9.470207	3.066195	0.052800	2.616210	3.511515	2.810514
5	–4.339264	4.886612	0.053068	2.508501	3.602763	2.745984
6	2.994298	5.587476	0.046557	2.191019	3.484237	2.471681
7	7.126195	2.361084	0.062604	**2.178458**[3]	3.670632	2.502298

Table B5. ***Brazil***

Lag	LogL	LR	FPE	AIC	SC	HQ
0	–110.5738	NA	480.2533	11.84987	11.94929	11.86670
1	–52.06963	98.53333	**1.556075**[4]	6.112592	6.410836	6.163067
2	–49.66248	3.547377	1.877363	6.280261	6.777334	6.364385
3	–47.28074	3.008516	2.333911	6.450604	7.146506	6.568378
4	–43.21339	4.281417	2.540250	6.443515	7.338246	6.594939
5	–37.91414	4.462528	2.608354	6.306751	7.400312	6.491825
6	–36.06026	1.170867	4.340615	6.532659	7.825050	6.751383
7	–31.99207	1.712926	7.184774	6.525481	8.016700	6.777854
8	–8.496935	4.946343	2.716661	4.473362	6.163410	4.759385
9	854.6933	0.000000	NA	–85.96772	–84.07884	–85.64804

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