Impact of Inflation on Stock Market Indices 1980-2020

Empirical Project

MGT 700-A Econometrics

Group -6 | Pratik Shinde | Eva Shah | Nikhil Makkena

Contents

The Centre Question

The stock market is a dynamic environment with dramatic changes that provide investors with favourable or negative indicators of stock market returns. Inflation is an important macroeconomic factor that has significant effects on the economy and the stock market in particular. When an economy's inflation rate is high, the actual worth of money falls, resulting in lower buying power, lower profitability, and lower real returns on investments (AboulSoud, 2018).

The purpose of this project is to look at the

"Impact of inflation on stock market indices using from 1980 through 2020"

Growth stock investors make an assessment of the present worth of that future stream of earnings. When inflation or interest rates rise faster than predicted, the current value of a future stream of profits is reduced. Part of the rationale is that the risk-free rate of return – government bonds — rises, making them more tempting to investors than equities (Pisani, 2022).

When the rate of inflation rises, practically all market product prices rise at the same time. According to different studies, stock prices, on the other hand, are inversely related to inflation. According to Brandt and Wang's model, inflation affects the investor's risk aversion and, as a result, has an influence on the predicted high necessary return on capital and the real discount rate (Limpanithiwat & Rungsombudpornkul, 2010).

Money illusion is what causes the true effect of inflation. Money illusion affects stock market investors because they discount actual cash flows using nominal discount rates, resulting in behavioural issues and inflation-induced valuation inaccuracies. The Modigliani–Cohn hypothesis predicts that during periods of excessive inflation, the stock market will become undervalued, but that this undervaluation will be eliminated once actual nominal cash flows are exposed (AboulSoud, 2018).

The project has further research questions to be answered with the data collected from different websites and data points for the 9 stock indices all over the world.

Sub Research Questions

Consumers may buy fewer things when inflation rises, input costs rise, and earnings and profits fall. As a result, the economy slows until the situation stabilizes. High interest rates and price increases don't make for an appealing investment profile for most investors. Keeping this basic mechanism in mind there two major questions to be answered as follows:

- Directional impact (positive/ negative) of inflation on stock price for the time period 1980 - 2020?
- What are the implications of financial distress position on the stock prices?

Data Sources

The data for this project was collected from various websites. The websites are as follows:

- FRED - Federal Reserve Economic Data (https://fred.stlouisfed.org/)
- Macrotrends (https://www.macrotrends.net/)
- Stooq (https://stooq.com/)
- US Energy Information (https://www.eia.gov/)

Table 0.1 Data Sources as per Variables

Stock Indices Prices	**https://www.macrotrends.net/** **https://stooq.com/** **https://fred.stlouisfed.org/**
Inflation Rate	https://www.macrotrends.net/ https://fred.stlouisfed.org/
Unemployment Rate	https://www.macrotrends.net/ https://fred.stlouisfed.org/
Oil Prices	https://www.eia.gov/
GDP Growth Rate	https://www.macrotrends.net/ https://fred.stlouisfed.org/
US Treasury Bond Yield	https://fred.stlouisfed.org/
Currency Exchange Rates	https://fred.stlouisfed.org/

Data Variables & their Rationale

Table 0.2 Data Variables & Rationale

Variable	Rationale
Stock Indices Prices	An index is a standardized technique of tracking the performance of a collection of assets. Indexes are used to track the performance of a group of securities designed to imitate a specific market segment.
Inflation Rate	Inflation is caused by increases in government expenditure, stockpiling, tax cuts, and price increases in overseas markets. Prices rise as a result of these variables.
Unemployment Rate	In general, economists have discovered that when the unemployment rate falls below a specific threshold, known as the natural rate, inflation rises and continues to grow until the unemployment rate recovers to its natural rate.
Oil Prices	• In general, economists have discovered that when the unemployment rate falls below a specific threshold, known as the natural rate, inflation rises and continues to grow until the unemployment rate recovers to its natural rate. • Companies' profit expectations are lowered when economic growth prospects deteriorate, resulting in a dampening influence on stock prices.
GDP Growth Rate	• The stock market is frequently used as a sentiment indicator, and it may have a positive or negative influence on GDP. In a bull market, when stock values rise, individuals and businesses have more money and confidence, which leads to more spending and GDP growth. • Inflation is caused by GDP growth over time. Inflation, if left unchecked, has the potential to become hyperinflation. Once in place, this process may soon turn into a self-reinforcing feedback loop.

US Treasury Bond Yield	• Investors will seek a higher return to compensate for inflation risk, therefore the higher the present rate of inflation and the higher the (anticipated) future rates of inflation, the higher the yields will increase throughout the yield curve. • The stock market falls during a bond market rise. To add to the confusion, the higher the price paid for a bond with a $1,000 face value, the lower the yield; hence, yields fall during a bond market rise.
Currency Exchange Rates	• The returns on exchange rates are positively skewed, whereas the returns on stock market indexes are adversely skewed. • Inflation, which is defined as a fall in a currency's purchasing power, tends to devalue it.
Per Capita Income	• Increases in stock values and, as a result, the total worth of the stock market, result from a general rise in disposable income. When families' disposable income rises, they have more money to save or spend, which naturally leads to increased consumption.
Manufacturing Output	• Higher output leads to decreased unemployment, which fuels demand even more. Increased earnings contribute to increased demand as customers are more willing to spend. This leads to a rise in both GDP and inflation. • The stock market has a major beneficial impact on the production of the industrial sector.
Trade Balance	• A persistent trade imbalance might harm a country's economy and markets. If a nation imports more commodities than it exports over an extended period of time, it may be in debt (much like a household would).
Dummy Variables	• Covid 19 • Tax Act 1981 • Securities Act 1990 • Monetary & Fiscal Policy • Securities Law India 2014

Data Description

Dependent Variable

The stock prices are of 9 different countries namely United States of America, United Kingdom, India, Japan, Hong Kong, China, Germany, France & Spain.

Table 0.1 Stock Indices of Different Countries Considered for Project

Country	**Stock Index**
United States of America	NASDAAQ (National Association of Securities Dealers Automated Quotations)
United Kingdom	FTSE 100 (Financial Times Stock Exchange)
India	Nifty 50 (National Stock Exchange 50)
Japan	NIKKEI 225 Stock Average
Hong Kong	HIS (Hang Seng Index)
China	SZCOMP (Shenzhen Stock Exchange Composite Index)
Germany	DAX 30 (Deutscher Aktien Index)
France	CAC 40 (Cotation Assistée en Continu)
Spain	IBEX 35 (IBerian Index)

The stock prices of indices being for 9 different countries have prices in different currencies, so to remove the error of the currency conversion, logarithmic values have been considered for further analysis.

Univariate Analysis

Variable		Mean	Std. dev.	Min	Max	Observations
log_in~e	overall	3.610542	.4824814	2.23	4.68	N = 369
	between		.3380239	3.12	4.175366	n = 9
	within		.361867	2.720542	4.572737	T = 41
inflat~e	overall	.0378056	.0395929	-.04	.24	N = 360
	between		.019338	.0097561	.077561	n = 9
	within		.0350543	-.0427073	.2278056	T-bar = 40
oilpri~s	overall	39.74317	25.45265	11.35	98.56	N = 369
	between		0	39.74317	39.74317	n = 9
	within		25.45265	11.35	98.56	T = 41
exchan~e	overall	31.28037	51.67266	.9	249.05	N = 326
	between		45.76788	1.546098	132.0888	n = 8
	within		28.70386	-26.11792	148.2416	T-bar = 40.75
gdpper~t	overall	.0352033	.0377639	-.11	.15	N = 369
	between		.0261778	.0153659	.092439	n = 9
	within		.0285539	-.1026016	.1222764	T = 41
percap~e	overall	20719.96	17435.04	27	65280	N = 368
	between		12518.09	792.6585	36879.37	n = 9
	within		12816.52	-3584.401	49120.6	T = 40.8889
unempl~e	overall	.0686236	.0431607	.018	.2612	N = 348
	between		.0419603	.0355	.1666912	n = 9
	within		.0205908	-.0157676	.1631324	T-bar = 38.6667
manufa~t	overall	328.0848	622.3959	.59	3868.46	N = 278
	between		754.6005	4.4885	2412.137	n = 9
	within		292.7914	-1458.832	1784.408	T-bar = 30.8889
tradeb~e	overall	-15.95268	154.3476	-770.93	366.14	N = 366
	between		123.706	-322.1953	99.96537	n = 9
	within		101.6618	-464.6874	293.7226	T-bar = 40.6667

Figure 0.1 Statistical Summary of Variables

Variable Trends

Inflation Rates

Inflation rates fluctuate widely between euro area nations. This is natural, and huge countries made up of numerous states exhibit the same pattern. In fact, prices do not fluctuate uniformly across a country's regions.

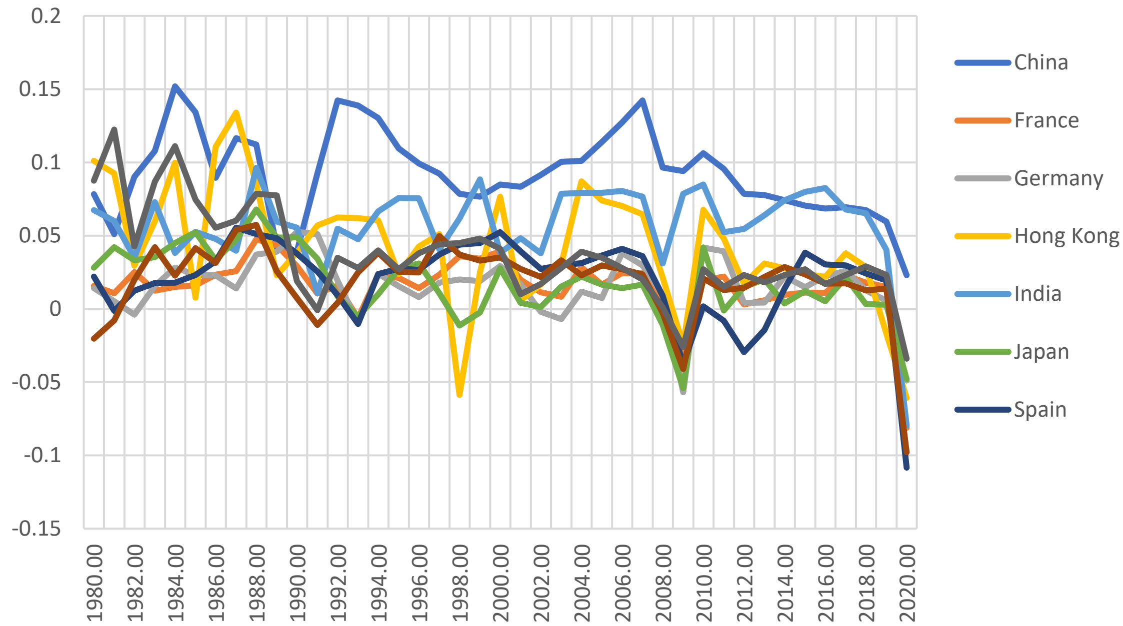


Figure 0.3 Inflation Rates

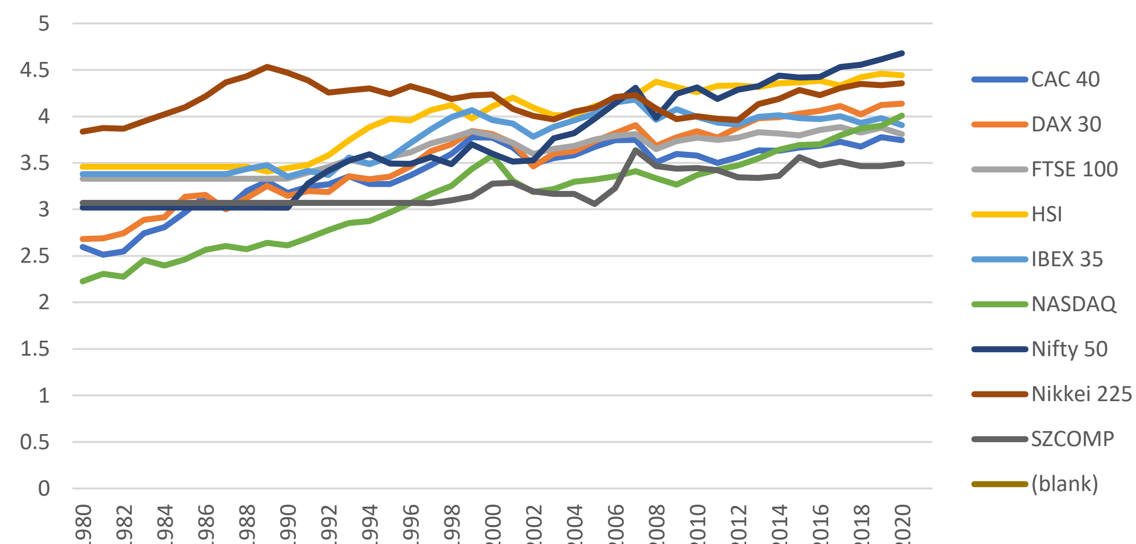


Figure 0.1 Inflation Rates

Relationship Between Variables

Correlation

The strength of the linear link between two variables, x and y, is measured by correlation coefficients. A positive link is shown by a linear correlation coefficient larger than zero. A negative association is indicated by a value smaller than zero. Finally, a value of zero implies that the two variables x and y have no connection.

Table 0.1 Correlations Between Variables

	Index Price	*Logarithmic Index Price*	*Inflation Rate (%)*	*Oil Prices (Dollars per Barrel)*	*Exchange Rate*	*GDP (% Growth Rate)*	*Unemployment Rate*	*US Treasury Bond Yield*
Index Price	**1**							
Logarithmic Index Price	0.8493	**1**						
Inflation Rate (%)	-0.23532	**-0.34156**	**1**					
Oil Prices (Dollars per Barrel)	0.31437	**0.40581**	**-0.22397**	**1**				
Exchange Rate	0.36804	**0.36641**	**0.01626**	**-0.12177**	**1**			
GDP (% Growth Rate)	-0.21015	**-0.29344**	**0.2485**	**-0.1503**	**-0.07229**	**1**		
Unemployment Rate	-0.05438	**0.0388**	**-0.2635**	**0.11227**	**-0.09016**	**-0.29635**	**1**	
US Treasury Bond Yield	-0.45748	**-0.6**	**0.45203**	**-0.59785**	**0.15612**	**0.27295**	**-0.23893**	**1**

Covariance

The directional link between the returns of two assets is measured by covariance. A positive covariance indicates that asset returns move in tandem, whereas a negative covariance indicates that they move in opposite directions.

Table 0.3 Covariance Between Variables

	Index Price	**Logarithmic Index Price**	**Inflation Rate (%)**	**Oil Prices (Dollars per Barrel)**	**Exchange Rate**	**GDP (% Growth Rate)**	**Unemployment Rate**	**US Treasury Bond Yield**
Index Price	59805954.83							
Logarithmic Index Price	3164.683865	**0.232164205**						
Inflation Rate (%)	-71.6649932	**-0.00648089**	**0.001550782**					
Oil Prices (Dollars per Barrel)	61794.61631	**4.970095472**	**-0.22418776**	**646.0819631**				
Exchange Rate	140948.6096	**8.743008673**	**0.031706096**	**-153.274464**	**2452.412907**			
GDP (% Growth Rate)	-61.0688594	**-0.00531305**	**0.000367728**	**-0.14356104**	**-0.13452435**	**0.00141207**		
Unemployment Rate	-18.8271512	**0.000837008**	**-0.00046456**	**0.127754406**	**-0.19988411**	**-0.00049856**	**0.002004268**	
US Treasury Bond Yield	-117.56392	**-0.00960669**	**0.000591525**	**-0.50496738**	**0.256909903**	**0.00034082**	**-0.00035545**	**0.0011**

Simple Regression: Stock Index Prices & Inflation Rate

The regression is used to predict how a dependent variable (stock index price) will change when the independent variable (inflation rate) change. The link between two quantitative variables is estimated using simple linear regression.

Table 0.1 Regression Statistics: Stock Price ~ Inflation Rates

Regression Statistics	
R Square	0.1390
Adjusted R Square	0.1366
Standard Error	0.597
Observations	360

R-squared has a range of values from 0 to 1. Although the statistical measure can give some important information about the regression model, we cannot not depend only on it when evaluating a statistical model. The R squared value is 13.9%, which signifies that 13.9% of the data is a good fit for the model.

Output shows that when inflation rises by 1% the stock prices tend to decrease by -4.54%.

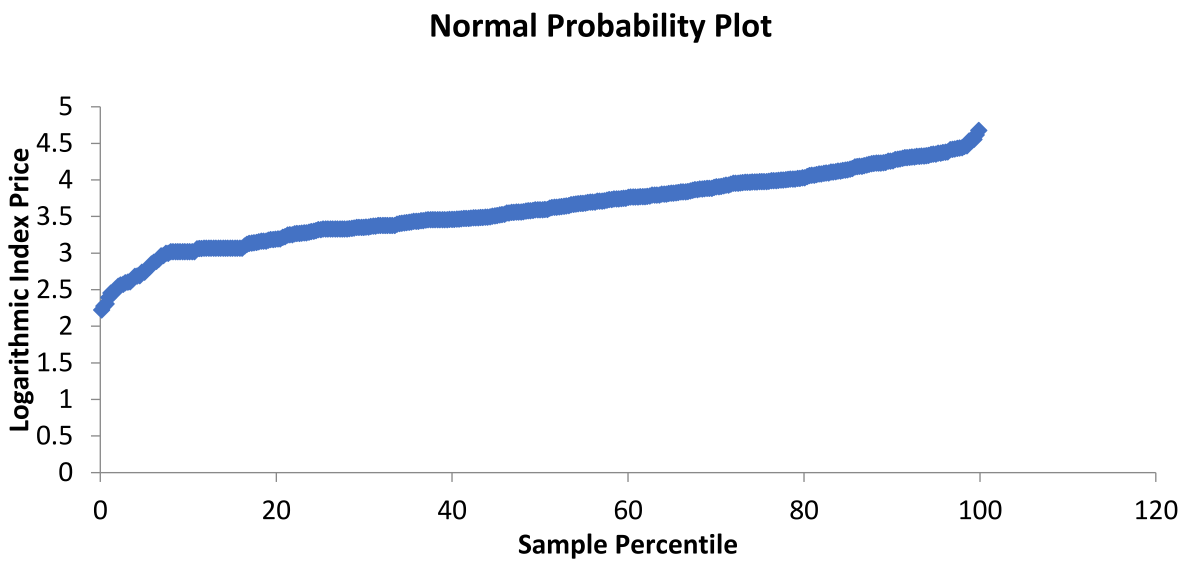
As the value of the coefficient stands negative at -4.54, the simple regression analysis tells that the stock market prices usually go down with the inflation going up. As shown earlier in the covariance analysis too, the direction of moving is typically opposite in the case of inflation and stock index prices.

Table 0.3 Regression Output

```
. regress log_indexprice inflationrate

      Source |       SS           df       MS      Number of obs   =       360
-------------+----------------------------------   F(1, 358)       =     57.82
       Model |  11.6144891         1  11.6144891   Prob > F        =    0.0000
    Residual |  71.9146298       358  .200878854   R-squared       =    0.1390
-------------+----------------------------------   Adj R-squared   =    0.1366
       Total |  83.5291189       359   .23267164   Root MSE        =     .4482

------------------------------------------------------------------------------
log_indexpr~e | Coefficient  Std. err.      t    P>|t|     [95% conf. interval]
--------------+----------------------------------------------------------------
inflationrate |  -4.542929    .597452    -7.60   0.000    -5.717886   -3.367973
        _cons |   3.793637   .0326829   116.07   0.000     3.729362    3.857911
------------------------------------------------------------------------------
```



The normal probability plot (Chambers et al., 1983) is a graphical method for determining if a data set is roughly normally distributed. The data is shown against a theoretical normal distribution with the dots forming an approximate straight line. As the plot in the case of simple regression is a straight line it means that the data is normally distributed.

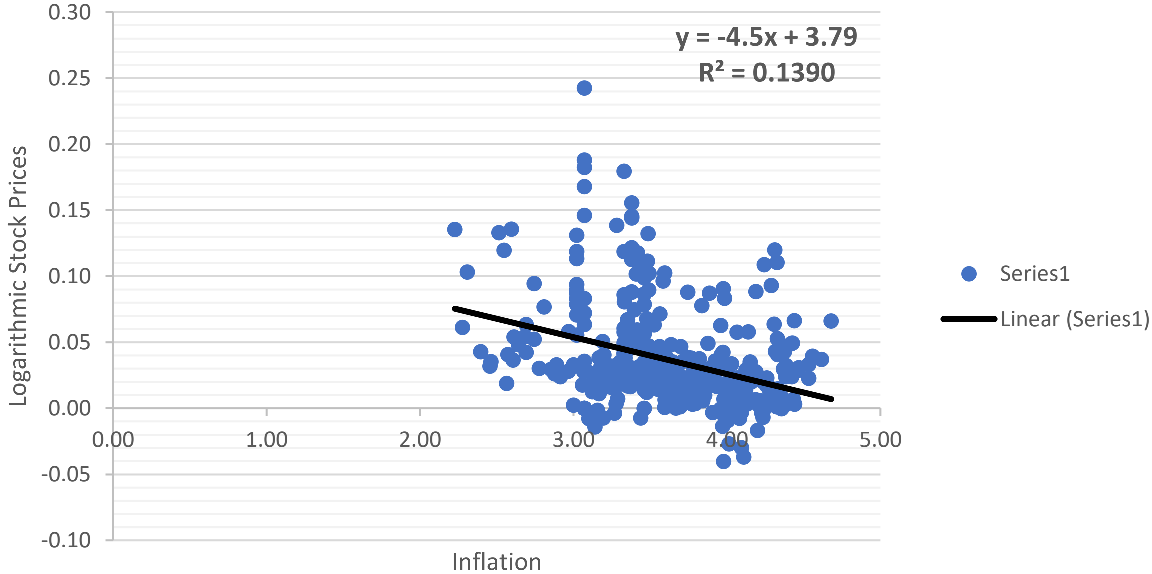


Figure 0.1 Correlation Plot - Stock Index Prices ~ Inflation Rate

Multiple Regression

Source	SS	df	MS
Model	26.8496613	13	2.06535856
Residual	11.5866001	228	.050818421
Total	38.4362614	241	.159486562

Number of obs	=	242
F(13, 228)	=	40.64
Prob > F	=	0.0000
R-squared	=	0.6986
Adj R-squared	=	0.6814
Root MSE	=	.22543

log_indexprice	Coefficient	Std. err.	t	P>|t|	[95% conf.	interval]
inflationrate	.0592312	.748952	0.08	0.937	-1.416521	1.534984
oilprices	.0004872	.0007863	0.62	0.536	-.0010621	.0020366
exchange_rate	.004059	.0003298	12.31	0.000	.0034091	.0047089
gdppercent	2.54951	.71263	3.58	0.000	1.145327	3.953692
percapitaincome	8.57e-06	1.83e-06	4.70	0.000	4.98e-06	.0000122
unemploymentrate	-.1463434	.4397974	-0.33	0.740	-1.012931	.7202436
manufacturingoutput	-.0001739	.0000348	-5.00	0.000	-.0002424	-.0001053
tradebalance	.0001318	.000231	0.57	0.569	-.0003234	.0005869
ustreasury	-6.066646	1.132032	-5.36	0.000	-8.297228	-3.836064
covid	.2119073	.1229947	1.72	0.086	-.0304442	.4542589
monetarypolicy	0	(omitted)				
fiscalpolicy	0	(omitted)				
securities1990	.1690557	.0700099	2.41	0.017	.0311066	.3070047
ecotax1981	.0111983	.1294004	0.09	0.931	-.2437753	.2661719
taxbills	0	(omitted)				
secact2014ind	.543455	.1060531	5.12	0.000	.3344856	.7524245
_cons	3.551351	.2131125	16.66	0.000	3.131429	3.971273

Figure 0.1 Multiple Regression

The next step in the analysis was multiple regression, **we identified monetary policy, fiscal policy, tax bill was having multiple collinearity problem so we omitted those variables from the multiple regression output**, we can also see that there are some other variables which are not statistically significant. Those are as follows: **Inflation rate, oil process, unemployment rate, trade balance, covid and eco tax**. The R-square being 69.86% signifies that 69.86% of the data is a good fit for the linear regression model. The model would be as follows:

$$\begin{aligned}\log stockprice = \ & 3.5 - 0.06 inflation + 0.0004 oilprices + 0.004 exchange_{rate} + 2.5 gdppercent \\ & + 0.00001 percapitaincome - 0.14 unemploymentrate \\ & - 0.0001 manufacturingoutput + 0.0001 tradebalance - 6.1 ustreasury \\ & + 0.21 covid \ + 0.17 securities1990 + 0.02 ecotax1981 + 0.54 secact2014ind\end{aligned}$$

Interpreting Coefficients (Beta)

- 1% increase in inflation leads to -6% decrease in the stock prices.
- $1 increase in the oil prices leads to 0.04% increase in the stock price, mostly due to companies dependent on oil for their business.
- $1 increase in exchange rate alters the stock prices to rise by 0.4%.
- 1% change in GDP increases the stock price by 2.5%.

Breusch Pagan Test

The residuals are distributed with equal variance at each level of the predictor variable, which is one of the essential assumptions of linear regression. Homoscedasticity is the term for this assumption. When this assumption is broken, the residuals are said to have heteroscedasticity. When this happens, the regression's findings become untrustworthy.

We reject the null hypothesis and conclude that heteroscedasticity exists in the regression model if the p-value of the test is less than some significance threshold (i.e., α =.05).

```
. hettest

Breusch-Pagan/Cook-Weisberg test for heteroskedasticity
Assumption: Normal error terms
Variable: Fitted values of log_indexprice

H0: Constant variance

    chi2(1) =   2.67
Prob > chi2 = 0.1024
```

Figure 0.1 Breusch Pagan Test

Ho: This is the test's null hypothesis, which claims that the residuals have constant variance.

chi2(1): This is the test's Chi-Square test statistic. It is 2.67 in this example.

The p-value that correlates to the Chi-Square test statistic is Prob < chi2. It is 0.1024 in this example. **We cannot reject the null hypothesis and infer that homoskedacity exists in the data since this number is bigger than 0.05**.

Advantages & Disadvantages

Simple Linear Regression (SLR) just has one independent variable and offers a straightforward correlation between X and Y, simple regression is simple to perform and comprehend. It avoids the complexities of the multivariate equation. We utilized basic regression to illustrate the influence of the inflation rate on logarithmic stock prices in our dataset. It helps in establishing whether or not there is a link between inflation and stock prices, but it does not assist in removing the bias picked up by Y as a result of other independent factors.

Multiple Linear Regression is an extension of SLR in which we analyse multiple variables at the same time. It aids in the removal of biases in the dependent variables. Multiple Linear Regression's fundamental flaw is that it can't account for the biases introduced by idiosyncratic mistake. We'll need to use advanced panel data approaches for this.

Assumptions: No Perfect Collinearity

The assumption of no perfect collinearity asserts that the independent variables do not have a precise linear connection. Two characteristics of the data on the independent variables are implied by this assumption.

For example: Let's assume we use the model $Y=\beta 1X1+\beta 2X2+u$, where $X1=X2$ and there is perfect multicollinearity. We use regression to attempt to identify $X1=X2$. However, as long as $\beta 1+ \beta 2= \beta$, the least-squares error is reduced equally effectively for various solutions. In this scenario, there is no way to assert independent values for $\beta 1$ and $\beta 2$. For $\beta 1$ and $\beta 2$, there is no method to give confidence intervals. A confidence interval is required for any statistical number to be meaningful.

When this assumption is violated the variables in our regression model are omitted, the variables namely are *monetarypolicy*, *fiscalpolicy* & *taxbills*.

Other assumptions are as mentioned below:

- The sample taken to find out (the impact on stock indices with a change in the independent variables) is chosen at random.
- Given any value of the explanatory variable, the error u has an expected value of zero.
- Given any value of the explanatory variable, the error u has the same variance.

Advanced Panel Data Method

When data on repeated cross sections are available, panel data techniques are used to estimate parameters, calculate partial effects of interest in nonlinear models, quantify dynamic linkages, and conduct reliable inference.

The tests performed are fixed effect, random effect and Hausman test.

Fixed Effect

As the test maintains constant (fixes) the average effects of each stock index, this is referred to as a "fixed effects" regression.

```
Fixed-effects (within) regression               Number of obs     =        242
Group variable: stockindices                    Number of groups  =          8

R-squared:                                      Obs per group:
     Within  = 0.6965                                         min =         17
     Between = 0.0080                                         avg =       30.3
     Overall = 0.3014                                         max =         40

  Thursday April 21 17:59:36 2022   Page 4

                                                F(13,221)         =      39.01
corr(u_i, Xb) = -0.3177                         Prob > F          =     0.0000
```

log_indexprice	Coefficient	Std. err.	t	P>|t|	[95% conf.	interval]
inflationrate	-.1940744	.6822255	-0.28	0.776	-1.538575	1.150426
oilprices	.0014805	.0006224	2.38	0.018	.0002538	.0027071
exchange_rate	.0026799	.0005068	5.29	0.000	.0016812	.0036785
gdppercent	2.312511	.587153	3.94	0.000	1.155375	3.469646
percapitaincome	5.34e-07	2.01e-06	0.27	0.790	-3.42e-06	4.49e-06
unemploymentrate	-1.843756	.6080377	-3.03	0.003	-3.04205	-.645462
manufacturingoutput	.0000929	.0000382	2.43	0.016	.0000176	.0001683
tradebalance	.0004545	.0002277	2.00	0.047	5.83e-06	.0009033
ustreasury	-5.476691	.9347406	-5.86	0.000	-7.318837	-3.634546
mean_inf	0	(omitted)				
covid	.1813727	.0952736	1.90	0.058	-.0063883	.3691337
monetarypolicy	0	(omitted)				
fiscalpolicy	0	(omitted)				
securities1990	.2069872	.0539405	3.84	0.000	.1006836	.3132908
ecotax1981	.0493546	.0970291	0.51	0.611	-.1418662	.2405754
taxbills	0	(omitted)				
secact2014ind	.546755	.0832879	6.56	0.000	.3826148	.7108953
_cons	3.672489	.1720591	21.34	0.000	3.333403	4.011576
sigma_u	.41082516					
sigma_e	.1678563					
rho	.85694185	(fraction of variance due to u_i)				

```
F test that all u_i=0: F(7, 221) = 27.18                    Prob > F = 0.0000
```

Figure 0.1 Fixed Effects Method

$$\log stockprice = 3.67 - 0.19inflation + 0.001oilprices + 0.002exchange_{rate} + 2.3gdppercent + 0.000005percapitaincome - 1.84unemploymentrate - 0.00009manufacturingoutput + 0.0005tradebalance - 5.47ustreasury + 0.18covid + 0.21securities1990 + 0.05ecotax1981 + 0.54secact2014ind$$

A fixed effects model is a statistical model with fixed or non-random model parameters. In econometrics, a fixed effects model is a regression model in which the group means are fixed (non-random), as opposed to a random effects model in which the group means are a random sampling from a population. In general, data may be categorized based on a variety of observable parameters, such as inflation, GDP, exchange rate, and other variables we took into account in the regression model.

Interpreting Coefficients (Beta)

- 1% increase in inflation leads to **-0.19% decrease** in the stock prices.
- $1 increase in the oil prices leads to **0.001% increase** in the stock price, mostly due to companies dependent on oil for their business.
- $1 increase in exchange rate alters the stock prices **to rise by 0.002%.**
- 1% change in GDP **increases the stock price by 2.3%**.

Regression Statistics

The |t| > 0.05 for some of the variables namely inflation, per capita income and tax act 1981 dummy variable, this implying that the variables are statistically insignificant and **can be replaced or removed for the model to be a better fit for this research if went on to predict data using the same model.**

Regression Statistics	
R Square	0.69(68.7%)
P Value	0.00

Figure 0.3 Regression Statistics Fixed Effect Method

R squared value for the fixed effects method is 68.7%, which is a good fit for data in the fixed effects method. The P value for fixed effects regression is 0 which is a value less than 0.05 or 5% implying that the variables in the regression are statistically significant.

Random Effect

A random effects model (also known as a variance components model) is a statistical model using random variables as model parameters. Random effects models are employed in panel analysis of hierarchical or panel data in econometrics when no fixed effects are assumed (it allows for individual effects).

$$\begin{aligned}\log stockprice = {} & 3.28 - 1.09inflation + 0.0003oilprices + 0.004exchange_{rate} \\ & + 1.93gdppercent + 0.00001percapitaincome - 0.12unemploymentrate \\ & - 0.0001manufacturingoutput + 0.0003tradebalance - 4.79ustreasury \\ & + 0.15covid\ + 0.18securities1990 + 0.02ecotax1981 + 0.5secact2014ind\end{aligned}$$

```
Random-effects GLS regression                   Number of obs     =        242
Group variable: stockindices                    Number of groups  =          8

R-squared:                                      Obs per group:
     Within  = 0.6065                                         min =         17
     Between = 0.8724                                         avg =       30.3
     Overall = 0.7089                                         max =         40

                                                Wald chi2(14)     =     552.83
corr(u_i, X) = 0 (assumed)                      Prob > chi2       =     0.0000
```

log_indexprice	Coefficient	Std. err.	z	P>|z|	[95% conf.	interval]
inflationrate	-1.093995	.8417991	-1.30	0.194	-2.743891	.555901
oilprices	.000378	.0007753	0.49	0.626	-.0011416	.0018976
exchange_rate	.0045068	.000361	12.48	0.000	.0037993	.0052144
gdppercent	1.930612	.734813	2.63	0.009	.4904051	3.370819
percapitaincome	.0000111	2.00e-06	5.53	0.000	7.14e-06	.000015
unemploymentrate	-.1192435	.4332287	-0.28	0.783	-.9683562	.7298693
manufacturingoutput	-.0001626	.0000345	-4.71	0.000	-.0002302	-.000095
tradebalance	.0002971	.0002348	1.27	0.206	-.0001631	.0007574
ustreasury	-4.792616	1.201574	-3.99	0.000	-7.147657	-2.437575
mean_inf	4.198656	1.477062	2.84	0.004	1.303668	7.093644
covid	.1507787	.1230224	1.23	0.220	-.0903408	.3918983
monetarypolicy	0	(omitted)				
fiscalpolicy	0	(omitted)				
securities1990	.1832096	.0691271	2.65	0.008	.047723	.3186962
ecotax1981	.0210887	.1274844	0.17	0.869	-.2287761	.2709534
taxbills	0	(omitted)				
secact2014ind	.5006962	.1055215	4.74	0.000	.2938779	.7075145
_cons	3.284087	.2299764	14.28	0.000	2.833342	3.734833
sigma_u	0					
sigma_e	.1678563					
rho	0	(fraction of variance due to u_i)				

Figure 0.5 Random Effects Method

Interpreting Coefficients (Beta)

- 1% increase in inflation leads to **1.09% decrease** in the stock prices.
- $1 increase in the oil prices leads to **0.0003% increase** in the stock price, mostly due to companies dependent on oil for their business.
- $1 increase in exchange rate alters the stock prices **to rise by 0.004%.**
- 1% change in GDP **increases the stock price by 1.93%**.
- 1% change in the US Treasury Yield **decreases stock price by 4.79%**
- If the situation of covid or any pandemic exists it **increases the stock price by 0.01%**

Regression Statistics

Generalized least square regression is used to create the random effects model. When there is a certain degree of correlation between the residuals in a regression model, generalized least squares (GLS) is a method for estimating the unknown parameters in a linear regression model. **Both heteroskedasticity and cross correlation may be dealt with using GLS.**

Variables, such as oil prices, unemployment, trade balance & dummy variable tax act 1981, have $|t| > 0.05$, **meaning that they are statistically insignificant and may be substituted or eliminated from the model to make it a better fit for this study if it is used to forecast data**. Non significance simply means that the evidence cannot rule out the null hypothesis of no impact. In other words, the evidence has no bearing on your scientific premise.

Regression Statistics	
R Square	0.61(61.1%)
P Value	0.00

Figure 0.7 Regression Statistics Random Effect Method

R squared value for the fixed effects method is 61.1%, which is a good fit for data in the fixed effects method. The P value for fixed effects regression is 0 which is a value less than 0.05 or 5% implying that the variables in the regression are statistically significant.

Hausman Test

The Hausman test aids in the selection of a fixed effects or random effects model in panel data analysis. The preferred model is random effects, according to the null hypothesis; the alternative hypothesis is fixed effects. The tests basically try to check whether there's a link between the unique mistakes and the model's regressors. There is no association between the two, according to the null hypothesis.

```
                 ---- Coefficients ----
             |      (b)          (B)            (b-B)     sqrt(diag(V_b-V_B))
             |      fe           re          Difference       Std. err.
-------------+----------------------------------------------------------------
inflationr~e |   -1.093995    -1.093995            0                0
   oilprices |     .000378      .000378            0                0
exchange_r~e |    .0045068     .0045068            0                0
  gdppercent |    1.930612     1.930612            0                0
percapitai~e |    .0000111     .0000111            0                0
unemployme~e |   -.1192435    -.1192435            0                0
manufactur~t |   -.0001626    -.0001626            0                0
tradebalance |    .0002971     .0002971            0                0
  ustreasury |   -4.792616    -4.792616            0                0
    mean_inf |    4.198656     4.198656            0                0
       covid |    .1507787     .1507787            0                0
securit~1990 |    .1832096     .1832096            0                0
  ecotax1981 |    .0210887     .0210887            0                0
secact2014~d |    .5006962     .5006962            0                0
------------------------------------------------------------------------------
                          b = Consistent under H0 and Ha; obtained from xtreg.
           B = Inconsistent under Ha, efficient under H0; obtained from xtreg.

Test of H0: Difference in coefficients not systematic

    chi2(0) = (b-B)'[(V_b-V_B)^(-1)](b-B)
            = 0.00
```

Figure 0.9 Fixed Effects Method

Interpretation & Hypothesis

H_o= Random effects is appropriate

H_a= Fixed effects is appropriate

The Prob is > 0.05 which implies that we cannot reject the null hypothesis pertaining to which, **random effects test is more feasible for this particular model.**

Comparison between Results

Table 0.1 Comparison of All Regression Tests

Independent Variables	***Simple Regression***	***Multiple Regression***	***Fixed Effects***	***Random Effects***
Inflation Rate	**-4.54%**	**5.9%**	**-0.20%**	**-1.09%**
Oil Prices	-	0.004%	0.001%	0.0003%
Exchange Rate	-	0.04%	0.002%	0.004%
GDP Percentage Change	-	2.54%	2.3%	1.93%
Per Capita Income	-	0.0008%	0.00006%	-0.00001%
Unemployment Rate	-	-14.6%	-1.84%	-0.12%
Manufacturing Output	-	-0.02%	0.00009%	-0.0002%
Trade Balance	-	0.01%	0.0005%	0.0003%
US Treasury Yield	-	-6.06%	-5.47%	-4.79%
Constant (β*o*)	3.79	3.55	3.67	3.28

The test results gave the highest negative value for the main independent variable in simple regression, -4.54%. in multiple regression model the value came out to be positive at 5.9% which is not the case generally as seen in the graph here and its same the case stated in research that we have referred to. Random effects and fixed effects gave a negative value but it was -0.2% in case of fixed effects which is comparatively lesser impactful than random effects model which has -1.09% when multiple variables are considered.

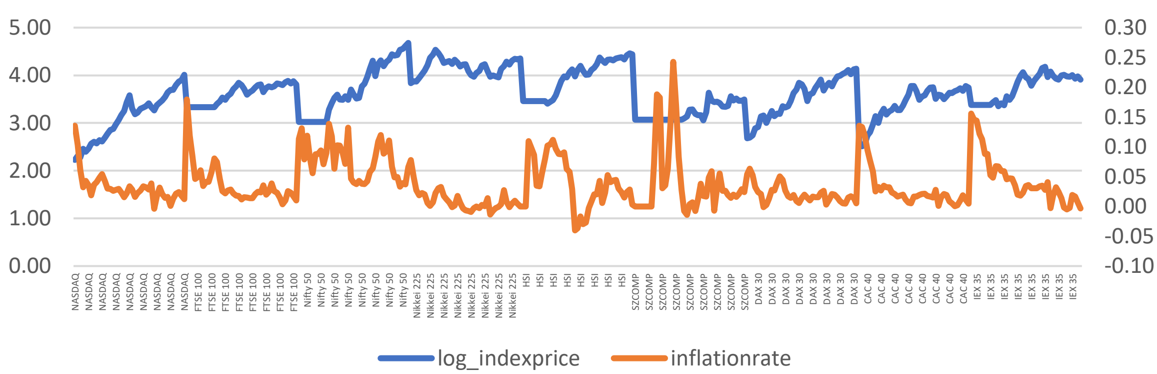


Figure 0.1 Variation of Stock Prices & Inflation (1980-2020)

Conclusion

The process to test the model started with simple regression technique which gave a negative coefficient which justified the negative correlation we observed in the research papers we referred to at the start. But the bias of other factors affecting stock prices and inflation was a major factor which was reduced with multiple regression by adding other 15 variables which captured the effect of many macro-economic variables on the stock prices, the problem here was a positive coefficient of inflation, this gave the purpose to go on to perform fixed effects and random effects test on the model.

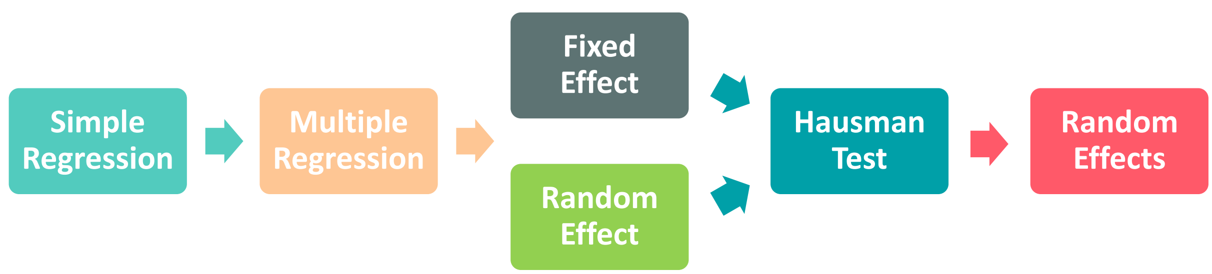


Figure 0.1 Project Process

The results of both fixed effects and random effects were similar justifying all the variables as significant with a P value less than 0.05, so we performed the Hausman Test, which regressed the fixed effects model's and random effects model's difference of coefficients with null hypothesis preferring random effects model and alternate hypothesis preferring fixed effects model, as the P value was more than 0.05 for the Hausman test we went on with the fact that we cannot reject the null hypothesis hence the random effects model is the best fit for this inflation and stock price model.

Way Forward

One of the striking conclusions we came to while performing regressions were that inflation was coming out as an insignificant variable for3 of the tests, which is not a good sign for the model to go in to prediction of stock prices, moving forward if we get to work on the project in advanced financial econometrics we will aim to remove the statistically insignificant variables or improve the data in terms of quantity so as to make the variables statistically significant, so as to build a model which could be efficient in predicting the stock prices at any situation of the economy.

References

AboulSoud, S. (2018). *The associations between stock prices, inflation rates, interest rates are still persistent.* Cairo: School of Business Studies, Arab Open University Egypt, Cairo, Egypt.

Limpanithiwat, K., & Rungsombudpornkul, L. (2010). *Relationship between Inflation and Stock Prices in Thailand.* Sweden: Umeå School of Business.

Pisani, B. (2022, February 22). *Here's why stock investors are watching inflation so closely*. Retrieved from CNBC: https://www.cnbc.com/2021/05/13/heres-why-stock-investors-are-watching-inflation-so-closely.html