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Risk Management and Analysis: A perceptive based on Indices

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Abstract:

Risk management is most important topic in investments. Risk is said to be an uncertainty that could happen in the future. In the vision of investors risk should be minimum and return should be maximum. Risk is not same in a same investment over a period. To avoid that managing risk is a essential thing to be done. Risk varies with respect to various factors. This research aims to study about relationship between stock index, gold and volatility index. And to find the risk of the stock index and gold with respect to volatility index. This research considers Stock and gold which could be easily bought and sold. Stocks are the Emerging investments after covid, and Gold is most popular investments among people. This research is to study the risk of various sectorial index in NSE like (Nifty 50, Nifty IT, Nifty Metal and Nifty Bank) and to study the impact of inflation and Volatility in the sectorial index and to say which sectorial index will have low risk with respect to inflation and volatility.

1. Introduction:

Navigating the intricate dance of maximizing returns while minimizing risk lies at the heart of every investor's pursuit. Within this dynamic, stock indices, gold, and volatility indexes each play a unique role, but their combined impact on the risk profiles of specific sectors remains inadequately explored. This research delves into this very gap, focusing on the NSE sectoral indices (Nifty 50, Nifty IT, Nifty Metal, and Nifty Bank), aiming to provide a comprehensive understanding of their risk dynamics within the interplay of volatility, inflation, and gold.

Previous studies have shed light on individual aspects of this complex relationship. Grobys (2023) and Vatsa et al. (2022) highlight the dynamic nature of risk within equity markets, while Ennis et al. (2023) emphasize the crucial role of risk management in maintaining financial

stability. Al Zobi and Al-Dhaimesh (2021) further demonstrate how internal factors like cash flow activities influence stock volatility.

Beyond equities, Makarenko et al. (2023) suggest that external factors like sustainability disclosure rules impact both stock volatility and returns, emphasizing the interconnectedness of risk across asset classes. Defung et al. (2023) and Bansah and Mohsin (2023) further illustrate the influence of external shocks like COVID-19 and broader economic factors like inflation on risk perception and demand for alternative assets like gold.

The predictive power of volatility indexes for risk assessment is highlighted by Tjandrasa et al. (2020), while Baum et al. (2021) demonstrate the interconnectedness of risk factors through the link between inflation uncertainty and reduced credit availability. Febriandika et al. (2023) further emphasize the global nature of risk transmission by showcasing the influence of major currencies on international indices.

While these studies offer valuable insights into individual relationships, a gap remains in comprehensively analyzing the combined impact of these factors on specific sectors. This research aims to bridge this gap by addressing the following questions:

1. How can the risk of each NSE sectoral index be quantified?
2. To what extent does volatility, measured by a chosen volatility index, impact the risk of each sector?
3. Does inflation moderate the relationship between volatility and risk within each sector?
4. Among the NSE sectoral indices, which one exhibits the lowest risk profile considering both volatility and inflation?

By employing established risk metrics like Value at Risk (VaR) or Conditional Value at Risk (CVaR), combined with econometric modelling and analysis of historical data, this research seeks to provide a **holistic understanding of risk dynamics within specific NSE sectors**. This knowledge will empower investors to make informed decisions based on their risk tolerance and sector preferences, ultimately contributing to a more efficient and stable financial landscape.

2. Literature Review

Grobys (2023) warns of a potential singularity in the US equity market, highlighting the dynamic nature of risk within indices. This aligns with Vatsa et al. (2022) who found correlations between US indices and emerging markets, suggesting interconnected risk profiles.
Ennis et al. (2023) emphasize the role of risk management in financial stability, stressing the need for investors to understand how volatility impacts different assets.
Al Zobi and Al-Dhaimesh (2021) link cash flow activities to stock volatility, showcasing how internal factors can contribute to risk within indices.
Makarenko et al. (2023) suggest that sustainability disclosure rules impact both stock volatility and returns, implying that risk perceptions can be influenced by external factors.
Defung et al. (2023) highlight the negative impact of COVID-19 on firm performance, demonstrating how external shocks can increase risk across diverse sectors.
Bansah and Mohsin (2023) explore the link between inflation and the shadow economy, implying that broader economic factors can influence the perceived risk of gold as a hedge.

Tjandrasa et al. (2020) investigate the impact of foreign exchange and volatility indexes on stock market indices, suggesting the volatility index holds predictive power for risk assessment.
Baum et al. (2021) link inflation uncertainty to reduced credit, impacting bank efficiency and distorting sectoral stability, further demonstrating the interconnectedness of risk factors.
Febriandika et al. (2023) highlight the influence of major currencies on the Islamic Stock Index (ISSI), emphasizing the global nature of risk transmission.
Makarenko et al. (2023) suggest developed countries exhibit higher sustainability disclosure requirements that impact volatility and returns, implying potential differences in risk profiles across sectors.
Guo and Ryan (2021) develop scenarios incorporating momentum to capture stock return dynamics, offering tools for investors to navigate varying risk levels across sectors.
Orlowski et al. (2023) explore the Universal Equilibrium with Endogenous Risk Premium (UERP) condition, suggesting potential diversification benefits across sectors during financial distress.
Bansah and Mohsin (2023) link inflation to a reduction in the shadow economy, potentially impacting investor demand for gold as a hedge against inflation-driven risk.
Izadi and Noman (2020) present mixed results regarding weekend effects on different industry portfolios, highlighting the complexities of managing risk across sectors with varying sensitivities to external factors.
Stephens et al. (2023) document abnormal returns in various sectors, showcasing how risk and return dynamics can differ based on industry-specific characteristics.

2.1 Gaps and Research Focus:

This review identifies several gaps in the literature. While studies explore individual relationships between these variables, limited research comprehensively analyzes the combined impact of volatility, inflation, and gold on the risk of specific NSE sectoral indices. This research aims to:

1. Quantify the risk of each NSE sectoral index (Nifty 50, Nifty IT, Nifty Metal, and Nifty Bank) using established risk metrics like Value at Risk (VaR) or Conditional Value at Risk (CVaR).
2. Analyse the impact of volatility (measured by the chosen volatility index) on the risk of each sector.
3. Investigate the moderating effect of inflation on the relationship between volatility and risk for each sector.
4. Identify the sector with the lowest risk profile considering both volatility and inflation based on historical data and econometric modeling.

This research contributes by providing a holistic understanding of risk dynamics within specific NSE sectors, aiding investors in making informed decisions based on their risk tolerance and sector preferences.

3. Methodology

This methodology outlines the steps to analyze the relationships between your chosen stock indices, gold prices, the Volatility Index (VIX), and inflation, incorporating both correlation and regression analyses, as well as risk-return assessments.

3.1 Data Collection:

Identify relevant data: Collect historical data for Daily closing prices of Nifty 50, Nifty IT, Nifty Bank, Nifty Metal, gold prices, VIX values and inflation data for past 10 years

Data preprocessing: Check for missing values and handle them appropriately (e.g., imputation, removal).Calculate percentage returns for all assets (stock indices, gold).

3.2 Correlation Analysis:

Analyse correlations between: Nifty 50, Nifty IT, Nifty Bank, Nifty Metal, gold prices, VIX values and inflation data. Interpret correlation values to understand co-movements between variables.

3.3 Regression Analysis:

Multiple linear regression**:** To quantify the impact of multiple independent variables (VIX, inflation, gold return) on dependent variables (stock index returns).

3.4 Compare risk and return:

Plot risk metrics (e.g., standard deviation) against average returns for each asset. Calculate the Sharpe Ratio to compare risk-adjusted returns across assets. Interpret the results to identify assets with better risk-return trade-offs based on your goals.

4. Analysis:

4.1 Correlation

Table 4.1 Correlation of Stock Index, Gold, VIX and Inflation

	Nifty 50	*Nifty IT*	*Nifty Metal*	*Nifty Bank*	*Gold*	*VIX*	*Inflation*
Nifty 50	1						
Nifty IT	0.598008	1					
Nifty Metal	0.697594	0.34385	1				
Nifty Bank	0.886887	0.353859	0.597354	1			
Gold	-0.10039	0.000853	-0.0564	-0.10911	1		
VIX	-0.54514	-0.31283	-0.46202	-0.48038	0.085606	1	
Inflation	0.225035	0.183661	0.190733	0.136773	-0.01157	-0.14396	1

Source: Secondary data is used

All indices (Nifty 50, IT, Metal, Bank) seem to have positive correlations with each other, ranging from moderate (0.3-0.5) to strong (0.5-0.7). This suggests they tend to move in the same direction, meaning good/bad performance in one might be reflected in others. Inflation shows positive correlations with most indices except Gold (weak negative). This aligns with the general understanding that inflation can put upward pressure on asset prices. Gold has negative correlations with Nifty indices and a positive correlation with VIX. This suggests Gold might act as a hedge against market declines (higher VIX) and underperform when markets perform well. VIX exhibits negative correlations with most indices, as

expected, signifying its connection to market volatility. However, the relatively weak correlations suggest limited direct impact.

4.2 Regression of Nifty 50

Table 4.2 Regression of Nifty 50 with Gold, VIX and Inflation.

Regression Statistics	
Multiple R	0.567476
R Square	0.322029
Adjusted R Square	0.321205
Standard Error	0.008557
Observations	2471

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	3	0.085803	0.028601	390.6	1.4165E-207
Residual	2467	0.180642	7.32E-05		
Total	2470	0.266445			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	0.000697	0.000172	4.044378	5.41E-05	0.000359072	0.001035	0.000359	0.001035
Gold	-0.06493	0.01992	-3.25944	0.001131	-0.103987489	-0.02587	-0.10399	-0.02587
VIX	-0.1029	0.003334	-30.8663	3.5E-177	-0.10943587	-0.09636	-0.10944	-0.09636
Inflation	0.072879	0.008155	8.936213	7.7E-19	0.056886436	0.088871	0.056886	0.088871

Source: Secondary data is used

Multiple R: 0.567 implies a moderate positive relationship between the independent variables (Gold, VIX, Inflation) and the dependent variable (Nifty 50). R_Squared: 0.322 indicates the model explains 32.2% of the variance in the dependent variable. This is relatively low, suggesting other factors might be important in explaining the outcome. Adjusted R-squared: 0.321 is similar to R-squared and further reflects the explanatory power adjusted for the number of independent variables. Standard Error: 0.00856 represents the average distance between predicted and actual values of the dependent variable, indicating the level of prediction error. Intercept: 0.000697 is statistically significant (p-value < 0.05), but its low value suggests it might not be practically meaningful. Gold: -0.065 coefficient with a p-value of 0.0011 indicates a statistically significant negative relationship. This suggests a 1% increase in Gold returns is associated with a 0.065% decrease in the dependent variable (on average). VIX: -0.103 coefficient with a very low p-value suggests a strong negative relationship. A 1% increase in VIX is associated with a 0.103% decrease in the dependent variable. Inflation: 0.073 coefficient with a p-value of 7.7E-19 implies a strong positive relationship. A 1% increase in inflation is associated with a 0.073% increase in the dependent variable.

4.3 Regression of Nifty IT

Table 4.3 Regression of Nifty IT with Gold, VIX and Inflation.

Regression Statistics	
Multiple R	0.343879
R Square	0.118253
Adjusted R Square	0.11718
Standard Error	0.012139
Observations	2471

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	3	0.048755	0.016252	110.2844	5.223E-67
Residual	2467	0.363543	0.000147		
Total	2470	0.412299			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	0.000681	0.000244	2.784246	0.005406	0.0002013	0.00116	0.000201	0.00116
Gold	0.041298	0.028258	1.461429	0.144025	-0.014115	0.09671	-0.01412	0.09671
VIX	-0.07272	0.004729	-15.377	5.03E-51	-0.081996	-0.06345	-0.082	-0.06345
Inflation	0.085714	0.01157	7.408633	1.74E-13	0.0630274	0.108401	0.063027	0.108401

Source: Secondary data is used

Multiple R: 0.3438 indicates a weak positive relationship between the independent variables (Gold, VIX, Inflation) and the dependent variable (Nifty IT). R_squared: 0.1182 suggests the model explains only 11.82% of the variance in the dependent variable. This is a very low value, indicating the model has limited explanatory power. Adjusted R-squared: 0.1171 is similar to R-squared, further highlighting the model's limited ability to explain the data. Standard Error: 0.01214 represents the average distance between predicted and actual values of the dependent variable, indicating a moderate level of prediction error. Intercept: 0.000681 is statistically significant (p-value < 0.05), but its low value suggests it might not be practically meaningful. Gold: 0.0413 coefficient with a p-value of 0.144 indicates a statistically insignificant positive relationship. The magnitude of the coefficient is also small, suggesting a weak effect. VIX: -0.0727 coefficient with a very low p-value suggests a statistically significant negative relationship. However, the R-squared value being low casts doubt on the practical significance of this relationship. Inflation: 0.0857 coefficient with a p-value of 1.74E-13 implies a statistically significant positive relationship. However, the low R-squared value again raises concerns about its practical significance.

4.4 Regression of Nifty Metal

Table 4.4 Regression of Nifty Metal with Gold, VIX and Inflation.

Regression Statistics	
Multiple R	0.479067
R Square	0.229505
Adjusted R Square	0.228568
Standard Error	0.015751
Observations	2471

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	3	0.182306	0.060769	244.946	4.1E-139
Residual	2467	0.612038	0.000248		
Total	2470	0.794344			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	0.000819	0.000317	2.580909	0.009911	0.000197	0.001441	0.000197	0.001441
Gold	-0.03529	0.036666	-0.96243	0.335926	-0.10719	0.03661	-0.10719	0.03661
VIX	-0.15142	0.006136	-24.677	2.4E-120	-0.16346	-0.13939	-0.16346	-0.13939
Inflation	0.106638	0.015012	7.103722	1.58E-12	0.077202	0.136075	0.077202	0.136075

Source: Secondary data is used

Multiple R: 0.4791 indicates a moderate positive relationship between the independent variables (Gold, VIX, Inflation) and the dependent variable (Nifty Metal). This is an improvement compared to the previous models. R-squared: 0.2295 suggests the model explains 22.95% of the variance in the dependent variable. While still not ideal, it represents a moderate improvement. Adjusted R-squared: 0.2286 is close to R-squared, suggesting the improvement might not be solely due to the number of variables. Standard Error: 0.01575 represents the average distance between predicted and actual values of the dependent variable, indicating a slightly higher level of prediction error compared to the previous model. Intercept: 0.000819 is statistically significant (p-value < 0.05), but its low value suggests it might not be practically meaningful. Gold: -0.0353 coefficient with a p-value of 0.3359 indicates a statistically insignificant negative relationship. This suggests Gold's impact on the dependent variable is uncertain. VIX: -0.1514 coefficient with a very low p-value suggests a statistically significant negative relationship. However, the R-squared value still raises concerns about its practical significance. Inflation: 0.1066 coefficient with a very low p-value implies a statistically significant positive relationship.

4.5 Regression of Nifty Bank

Table 4.5 Regression of Nifty Bank with Gold, VIX and Inflation.

Regression Statistics	
Multiple R	0.489992
R Square	0.240092
Adjusted R Square	0.239168
Standard Error	0.012472
Observations	2471

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	3	0.121248	0.040416	259.8156	1.6E-146
Residual	2467	0.383759	0.000156		
Total	2470	0.505007			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	0.000883	0.000251	3.514885	0.000448	0.00039	0.001376	0.00039	0.001376
Gold	-0.11296	0.029034	-3.8907	0.000103	-0.16989	-0.05603	-0.16989	-0.05603
VIX	-0.12682	0.004859	-26.0994	8.4E-133	-0.13634	-0.11729	-0.13634	-0.11729
Inflation	0.046314	0.011887	3.896228	0.0001	0.023005	0.069623	0.023005	0.069623

Source: Secondary data is used

Multiple R: 0.49 suggests a moderate positive relationship between independent variables (Gold, VIX, Inflation) and the dependent variable (Nifty Bank). This improvement indicates the model explains a slightly larger portion of the variance. R_squared: 0.24 implies the model explains 24% of the variance in the dependent variable, representing a moderate improvement over previous models. Adjusted R-squared: 0.2391 is close to R-squared, again suggesting the improvement may not be solely due to the number of variables. Standard Error: 0.01247 represents a slightly lower average prediction error compared to the previous model. Intercept: 0.000883 is still statistically significant (p-value < 0.05), but its low value suggests it might not be practically meaningful. Gold: -0.113 coefficient with a p-value of 0.0001 indicates a statistically significant negative relationship. The larger coefficient compared to previous models suggests a somewhat stronger impact. VIX: -0.1268 coefficient with a very low p-value maintains the statistically significant negative relationship. However, the R-squared value still raises concerns about its practical significance. Inflation: 0.0463 coefficient with a p-value of 0.0001 shows a statistically significant positive relationship.

4.6 Descriptive Statistics

Table 4.6 Descriptive statistics

	Nifty 50	*Nifty IT*	*Nifty Metal*	*Nifty Bank*	*Gold*	*VIX*	*Inflation*
Mean	0.0555%	0.0619%	0.0632%	0.0688%	0.0361%	0.1290%	0.0201%
Standard Error	0.000209	0.00026	0.000361	0.000288	0.000175	0.001054	0.000429182
Median	0.000791	0.000621	0.000995	0.000796	0.00038	-0.00334	0
Mode	0	0	0	0	0	0	0
Standard Deviation	1.039%	1.292%	1.793%	1.430%	0.868%	5.238%	2.133%
Sample Variance	0.000108	0.000167	0.000322	0.000204	7.53E-05	0.002744	0.00045515
Kurtosis	17.84027	5.618418	2.859169	13.30009	8.302454	14.1466	142.5037591
Skewness	-1.07348	-0.31488	-0.29913	-0.63002	-0.41726	1.574103	4.36418987
Range	0.217437	0.186005	0.214439	0.272457	0.143363	0.982837	0.744274809
Minimum	-0.1298	-0.09575	-0.11602	-0.16734	-0.08671	-0.33925	-0.244274809
Maximum	0.087632	0.090251	0.098422	0.105117	0.056656	0.643587	0.5
Sum	1.372548	1.529662	1.561841	1.699624	0.892639	3.187785	0.496259138
Count	2471	2471	2471	2471	2471	2471	2471
Confidence Level(95.0 %)	0.00041	0.00051	0.000707	0.000564	0.000342	0.002066	0.000841593

Source: Secondary data is used

Nifty 50 & Nifty Bank: Both indices have similar average returns and high standard deviations, suggesting comparable overall performance with significant daily movements. Nifty IT & Nifty Metal: While their average returns are close, Nifty Metal exhibits substantially higher variability, implying potentially riskier investment compared to Nifty IT. Gold: Though having the highest average return, Gold also possesses significant volatility, as reflected in its high standard deviation. VIX: As a volatility index, its negative mean and lower standard deviation align with its purpose of measuring market volatility. However, its high kurtosis suggests potential for occasional large fluctuations. Inflation: With a very high kurtosis and positive skewness, inflation data might exhibit outliers and a tendency for larger positive changes.

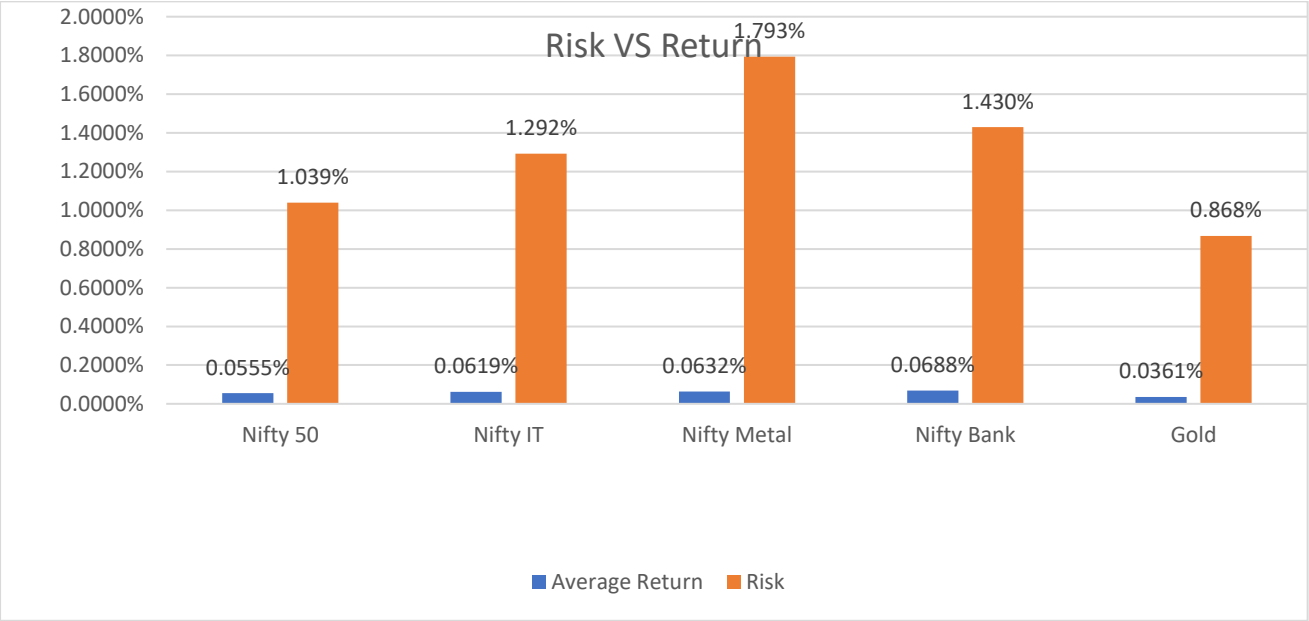
4.7 Risk Vs Return

Table 4.7 Risk Vs Return.

	Nifty 50	*Nifty IT*	*Nifty Metal*	*Nifty Bank*	*Gold*	*VIX*	*Inflation*
Average Return	0.0555%	0.0619%	0.0632%	0.0688%	0.0361%	0.1290%	0.0201%
Risk	1.039%	1.292%	1.793%	1.430%	0.868%	5.238%	2.133%

Source: Secondary data is used

Chart 4.1 Risk vs Return.



Source: Secondary data is used

Nifty Bank: Offers the highest average return (0.0688%) but also carries the second-highest risk (1.430%). Nifty IT: Provides a moderate balance between return (0.0619%) and risk (1.292%). Gold: Exhibits a lower average return (0.0361%) compared to equity indices but also has a considerably lower risk (0.868%).

4.8 Sharp Ratio

Table 4.8 Sharp Ratio for Different Investments.

	Nifty 50	Nifty IT	Nifty Metal	Nifty Bank	Gold
sharp ratio	0.026064	0.025874	0.019367	0.028189	0.008816

Source: Secondary data is used

Nifty Bank: Has the highest Sharp Ratio (0.028189), suggesting it generated the highest excess return per unit of risk compared to the other assets. Nifty 50 & Nifty IT: Have similar Sharp Ratios (around 0.026), indicating comparable risk-adjusted performance. Nifty Metal: Has a lower Sharp Ratio (0.019367), suggesting its risk-adjusted return was less attractive compared to the others. Gold: Has the lowest Sharp Ratio (0.008816), implying its return barely compensated for the risk taken, according to this metric.

5. Key Findings:

- All Nifty indices exhibit positive correlations with each other, suggesting they tend to move in the same direction.
- Gold has negative correlations with Nifty indices and a positive correlation with VIX, potentially acting as a hedge against market declines.
- VIX exhibits negative correlations with most indices, signifying its connection to market volatility.
- Regression analysis suggests:
    - VIX has a statistically significant negative impact on all Nifty indices, implying higher volatility leads to lower returns.
    - Inflation has a statistically significant positive impact on most Nifty indices, indicating inflation might push up asset prices.
    - Gold's impact on Nifty indices is mixed and statistically insignificant in some cases.
- Nifty Bank offers the highest average return but also carries the second-highest risk.
- Nifty IT provides a moderate balance between return and risk.
- Gold exhibits a lower average return but also has considerably lower risk.
- Nifty Bank has the highest Sharp Ratio, suggesting it generated the highest excess return per unit of risk.

6. Conclusion:

This research provides valuable insights into the relationships between volatility, inflation, gold prices, and risk profiles of NSE sectoral indices. While the models offer some statistically significant results, the moderate R-squared values suggest the need for further investigation and potentially incorporating additional factors. The practical significance of some relationships, particularly regarding gold and VIX, needs further exploration to assess their real-world impact on risk management. The differing risk profiles of each index and the potential impact of inflation highlight the importance of considering sector-specific factors when making investment decisions.

6.1 Further Exploration:

Explore alternative risk metrics beyond standard deviation to capture different aspects of risk. Investigate other potential explanatory variables, such as sector-specific news, economic indicators, or investor sentiment. Analyse the performance of different risk management strategies in different market conditions across sectors. Develop more sophisticated models that can better capture the complex relationships between risk factors and sectoral risk profiles.

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