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ECNOMETRIC ANALYSIS OF STOCK MARKET MOVEMENTS WITH MACROECONOMIC CHANGES IN THE US: A TWO-STAGE LEAST SQUARES APPROACH

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INTRODUCTION

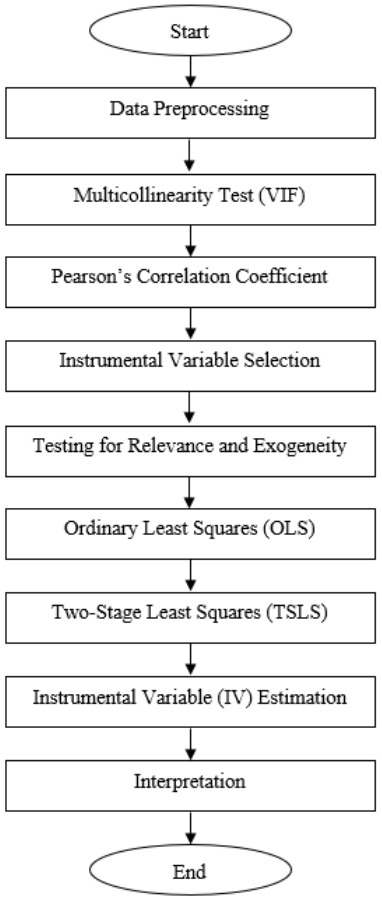
- Financial markets, especially stock markets, play a key role in global economics.
- Stock market movements correspond to the fluctuations in the stock prices over time.
- Various macroeconomic indicators (inflation, GDP, oil prices, US Treasury yields) make the economic analysis introduce endogeneity issues.
- These macroeconomic factors helps investors, policymakers, and economists predict trends and make decision.

OBJECTIVE

- To identify the correlation between the dependent variable and independent variable and determine the appropriate instrumental variables using correlation matrix plot.

- To resolve the endogeneity issues using Two-Stage Least Squares (TSLS).

METHODOLOGY



FLOWCHART OF THE PROCESS

1. Data Preprocessing
2. Multicollinearity Test (VIF)
3. Pearson's Correlation Coefficient
4. Instrumental Variable Selection (IV)
5. Relevance and Exogeneity Testing
6. Ordinary Least Square (OLS)
7. Two-Stage Least Square (TSLS)

METHODOLOGY

1. Data Preprocessing

Independent variable: ***stock price index***

Dependent variable:
inflation rate, oil price, GDP percent, unemployment rate, manufacturing output, trade balance, US Treasury

2. Multicollinearity Test (VIF)

- check VIF value

3. Pearson's Correlation Coefficient

- using Correlation Matrix Plot

4. Instrumental Variable Selection (IV)

- US Treasury

5. Relevance and Exogeneity Testing

- Statistical Test and Data Visualization

6. Ordinary Least Square (OLS)

$$y = \beta_0 + \beta_1 x_1 + \beta_2 x_2 + \ldots + \beta_n x_n$$

7. Two-Stage Least Square (TSLS)

1 $x_i = a_0 + a_1 z_i + \mu_i$

2 $y_i = b_0 + b_1 \hat{x}_i + v_i$

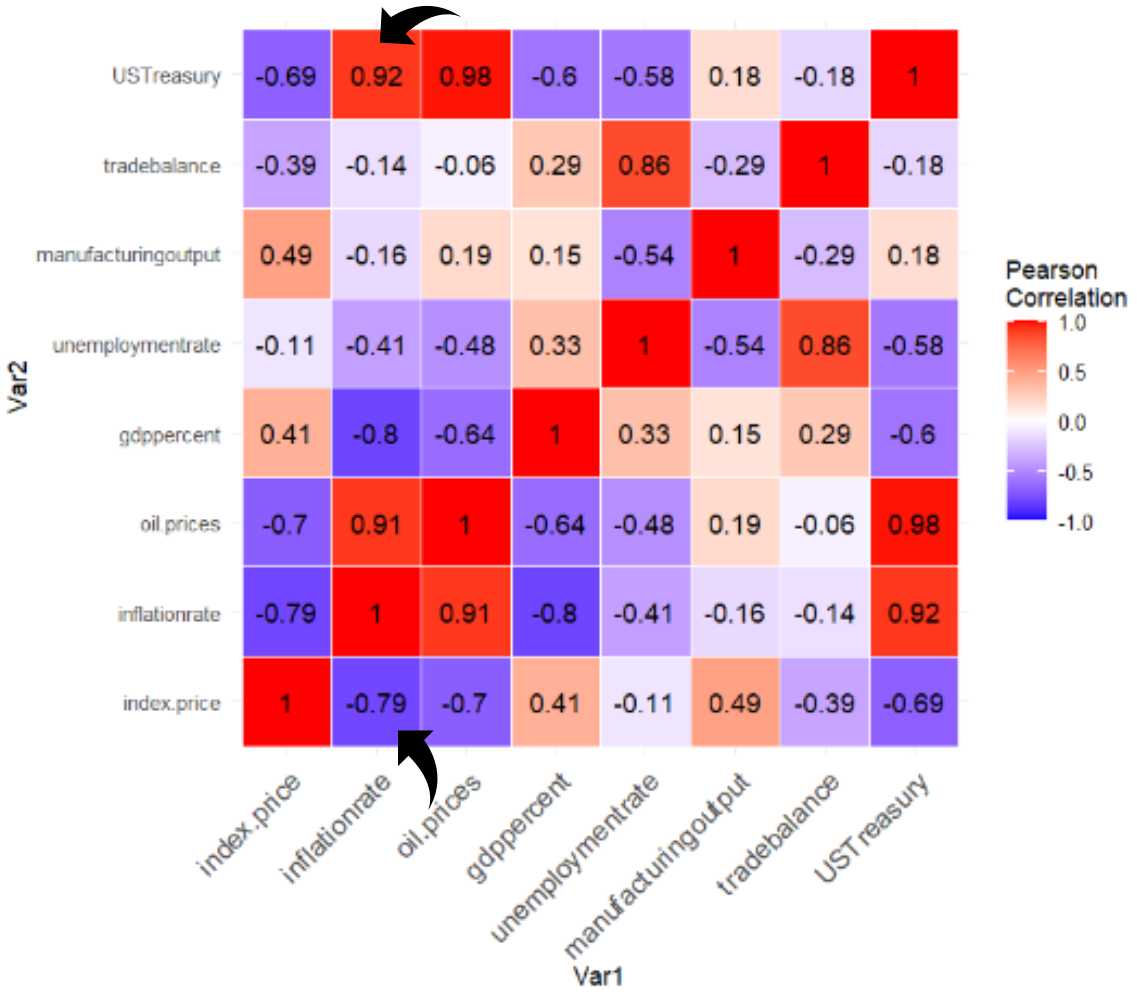
RESULT

Table of VIF Value of the Independent Variables

Variables	VIF Value
Inflation Rate	1.0598
Oil Price	1.0176
GDP Percent	1.0542
Unemployment Rate	1.1099
Manufacturing Output	1.1136
Trade Balance	1.0189
US Treasury	1.0951

- All the independent variable have VIF less than 10
- Multicollinearity issues are absent, all variable remained.

RESULT



Pearson's Correlation Coefficient

Inflation Rate chosen as endogenous variable

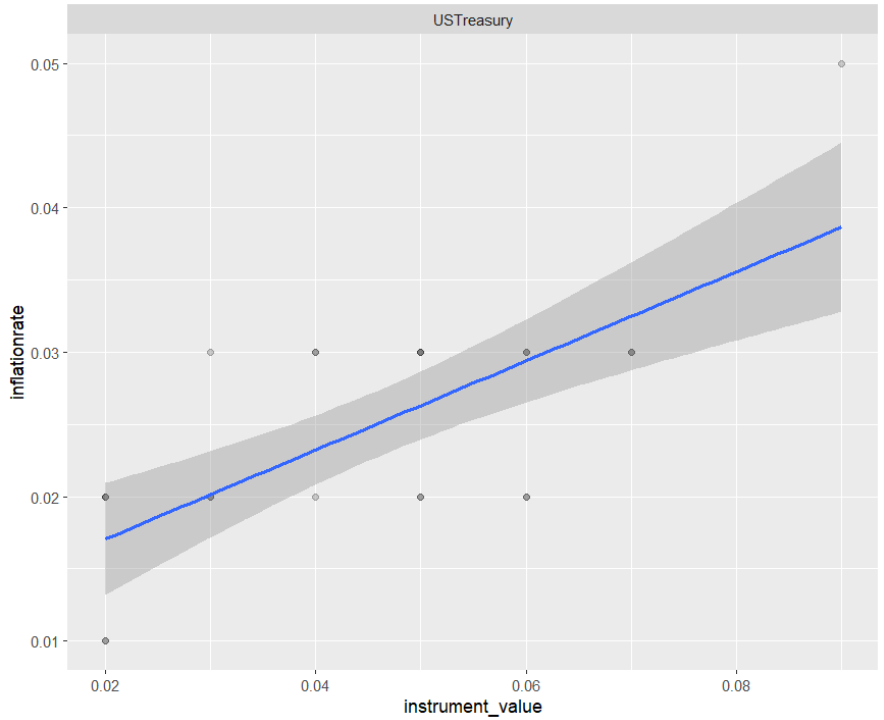
- strong negative correlation with stock index price

US Treasury identified as instrumental variable

- correlated with the inflation rate but minimally correlated with the stock index price

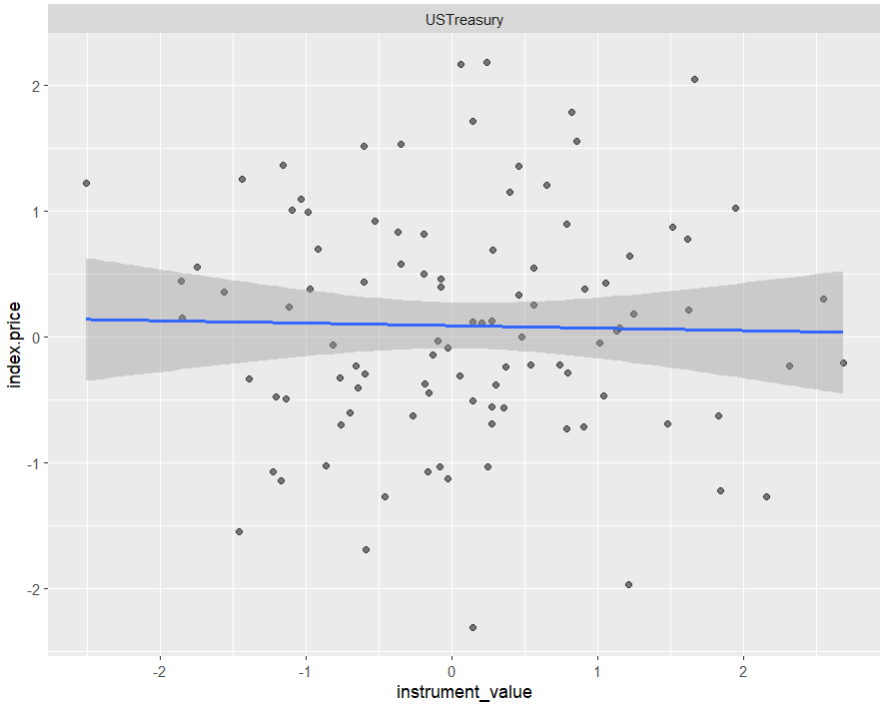
RESULT

Relevance and Exogeneity Test



Relationship between US Treasury and Inflation Rate

- US Treasury and Inflation Rate showing strong correlation (relevance)



Relationship between US Treasury and Stock Index Price

- US Treasury does not directly influence the stock index price (exogeneity)

RESULT

- **Relevance** refers to the strength of the relationship between the instrumental variable (IV) and the endogenous explanatory variable in a regression model.

US Treasury and Inflation Rate showing strong correlation

- **Exogeneity** refers to the instrument being uncorrelated with the error term in the regression model.

US Treasury does not directly influence the stock index price, US Treasury effect on the stock index price is only through its influence on the inflation rate.

- **Relevance** and **Exogeneity** confirmed.

RESULT

Ordinary Least Square Equation

Stock index price = 0.08538 – 0.04676 inflation rate

- When 1 unit of the **inflation rate** increases, the **stock price index** will decrease by 0.04676 units.
- The p-value of variable inflation rate is less than 0.05 which indicates the variables is statistically significant in the model.

RESULT

First Stage Equation

	Estimate	Std. Error	t-value	p-value
Intercept	0.010875	0.002918	3.726	0.00105
US Treasury	0.308621	0.058959	5.234	2.3e-05

Inflation rate = 0.010875 + 0.308621 US Treasury + u_i

- The coefficient of 0.308621 indicates that a one unit increase in the **US Treasury** results in an average increase of 0.3 units in the **inflation rate**.
- Both intercept term and the coefficient for the US Treasury had p-values less than 0.05, suggesting their significance.

RESULT

Second Stage Equation

	Estimate	Std. Error	t-value	p-value
Intercept	8898	1743	5.105	3.18e-05
Inflation rate	-246723	67907	-3.633	0.00132

Stock index price = 8898 – 246723 inflation rate_hat + v_i

- The coefficient for the inflation rate indicates that a one unit increase in the **inflation rate** leads to a decrease of 246723 units in the **stock price index**, by considering the instrumental variable (**US Treasury**).
- Both the intercept term and the coefficient for the inflation rate had p-values less than 0.05, indicating their significance.

DISCUSSION AND CONCLUSION

- No missing data and influential observation after data cleaning.
- US Treasury as a potential IV variables due to its significant correlation with inflation rate.
- Further investigation into the policy implications of using instrumental variables such as the US Treasury in economic forecasting and decision-making processes could guide effective policy interventions and economic management strategies.

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Thank you