REPORT ON ECONOMIC VARIABLE CORRELATION AND PRODUCTIVITY MODEL

INTRODUCTION

In the context of macroeconomic analysis, understanding the interplay between currency valuation, productivity, and economic stability is crucial. This report delves into the intricate relationships among money supply, exchange rates, inflation, and productivity within a given economic framework. By analyzing a dataset that includes these variables, the report aims to establish a productivity model that reflects real-world economic dynamics.

The primary focus of this report is to investigate how changes in money supply influence currency depreciation, stock market appreciation, and inflation, ultimately impacting productivity. Given the scenario of a flat money supply, the analysis seeks to isolate the effects of other economic factors on productivity changes.

To achieve this, we calculate a productivity baseline and analyze real currency devaluation using a reference currency with stable money supply (M1) growth and stable productivity. This approach helps in understanding the extent to which currency value fluctuations and inflation affect the overall productivity of an economy.

Through detailed data analysis and the application of statistical functions, we summarize productivity trends, identify significant spikes and fluctuations, and provide insights into the underlying causes of these changes. The findings of this report are intended to offer a clearer understanding of the economic forces at play and to guide informed decision-making in financial and economic planning.

METHODOLOGY

This section outlines the systematic approach taken to analyze the relationships among money supply, exchange rates, inflation, and productivity. The methodology involves several key steps, including data collection, model formulation, statistical analysis, and visualization.

- Data Collection
- Data Preparation
- Correlation Analysis
- Theoretical Framework
- Productivity Model Formulation
- Productivity baseline
- Currency Devaluation
- Visualization

DATA COLLECTION

The data utilized in this analysis was extracted from different financial and economic data sources to gather the data containing detailed information on money supply (M1), exchange rates, inflation rates, and stock market prices over a specified period. The dataset was carefully reviewed for accuracy and completeness to ensure reliable analysis.

Data Preparation

- **Cleaning and Formatting**: The raw data was cleaned to remove any inconsistencies or missing values. Each variable was organized into columns for easy reference and calculation.
- **Normalization**: To ensure comparability, the data was normalized where necessary, particularly for variables with different scales or units e.g the date being formatted.

M1	M1 growth rate	Lag1M1 Growthrate	exchange rate	exch growth rate	Lag2exchng Grow	Inflation Rate	Inf growth rate	Lag3inf Growthrate	Stock market	stck growth rate	Lag4stck Growthrate
31555882.24	-0.04051964		1,607.00	-0.05		29.9	0.060200669		100,568.60	-0.01	
30277249.26	0.073079919	-0.04051964	1,529.01	-0.03		31.7	0.047318612		100,057.49	-0.01	
32489908.18	0.040907553	0.073079919	1,484.00	-0.06	-0.05	33.2	0.014759036		99,300.62	-0.01	
33818990.81	-0.012902748	0.040907553	1,389.00	-0.06	-0.03	33.69	0.007717424	0.060200669	98,225.63	0.06	
33382632.88	-0.37359441	-0.012902748	1,303.00	0.24	-0.06	33.95	0.007069219	0.047318612	104,562.06	-0.04	-0.01
20911067.86	0.002280758	-0.37359441	1,616.55	-0.26	-0.06	34.19	-0.361801696	0.014759036	99,980.30	0.01	-0.01
20958760.95	0.02103335	0.002280758	1,191.94	-0.26	0.24	21.82	0.004124656	0.007717424	101,154.46	-0.26	-0.01
21399593.91	0.053397044	0.02103335	881.03	-0.10	-0.26	21.91	0.005933364	0.007069219	74,773.85	-0.05	0.06
22542268.96	-0.002522704	0.053397044	790	-0.01	-0.26	22.04	0.008166969	-0.361801696	71,365.25	-0.03	-0.04
22485401.49	0.089370187	-0.002522704	785	-0.02	-0.10	22.22	0.008550855	0.004124656	69,236.19	-0.04	0.01
24494926.03	-0.005181004	0.089370187	768	0.01	-0.01	22.41	0.016956716	0.005933364	66,382.14	0.00	-0.26
24368017.71	0.002896644	-0.005181004	773	-0.02	-0.02	22.79	0.056603774	0.008166969	66,548.99	-0.03	-0.05
24438603.19	0.036066454	0.002896644	758.9	0.00	0.01	24.08	0.071428571	0.008550855	64,337.52	-0.05	-0.03
25320016.94	0.043717728	0.036066454	758.77	-0.39	-0.02	25.8	0.035658915	0.016956716	60,968.27	-0.09	-0.04
26426950.56	-0.005572562	0.043717728	460.6	0.00	0.00	26.72	0.022829341	0.056603774	55,769.28	-0.06	0.00
26279684.73	0.146219568	-0.005572562	459.97	0.00	-0.39	27.33	0.03183315	0.071428571	52,403.51	0.05	-0.03
30122288.89	-0.382859241	0.146219568	459.84	0.00	0.00	28.2	0.025531915	0.035658915	54,857.96	0.02	-0.05
18589692.22	0.016548715	-0.382859241	459.97	0.00	0.00	28.92	-0.460580913	0.022829341	55,806.26	-0.05	-0.09
18897327.74	0.037731742	0.016548715	460.02	-0.03	0.00	15.6	0.006410256	0.03183315	53,238.67	-0.04	-0.06
19610356.83	0.010758149	0.037731742	447.58	-0.01	0.00	15.7	0.014012739	0.025531915	51,251.06	-0.07	0.05

CORRELATION ANALYSIS

Immediate Correlation

This is aimed at uncovering the relationships among key economic variables: money supply, exchange rates, inflation, and productivity. The primary objective of this analysis is to identify and quantify the degree of association between variables that are critical to economic stability and growth.
Specifically, the report examines how fluctuations in the money supply impact currency depreciation, stock market appreciation, and inflation rates, and how these, in turn, affect overall productivity. By leveraging a dataset containing detailed economic indicators, we apply correlation coefficients to measure the strength of these relationships.

To understand the correlation between the variables, the correlation coefficient was calculated using the Correl function;

Real Exch/Inflation
0.317153319

Stockprice/Inflation rate
0.252558179

M1/ SP Growth rate
0.295022192

M1/Real Exchange
0.372311897

- Real exchange growth rate Inflation growth rate = 0.3172
- stock market price growth rate and Inflation growth rate =0.2526

- M1 growth rate and stock market price growth rate = 0.2950
- M1 growth rate and Real exchange growth rate = 0.372311897
- M1 growth rate and Inflation growth rate =0.317
- stock market price growth rate and Real exchange growth rate = 0.5218

Analysis

Real Exchange Rate vs. Inflation Rate (0.317153319)

- Interpretation: A moderate positive correlation implies that an appreciating real exchange rate is associated with higher inflation.
- Implications: This could be due to cost-push inflation, where increased costs of imports due to a stronger currency lead to higher domestic prices.

Stock Price Growth Rate vs. Inflation Rate (0.252558179)

- Interpretation: A weak to moderate positive correlation indicates that higher stock prices are somewhat associated with higher inflation.
- Implications: Stock market performance might partly reflect inflationary expectations or economic growth.

M1 Growth Rate vs. Stock Price Growth Rate (0.295022192)

- Interpretation: A moderate positive correlation suggests that as the M1 money supply increases, stock prices tend to increase as well. This could imply that increased liquidity in the economy (M1) supports stock market growth.
- Implications: Policymakers and investors can monitor M1 as an indicator of stock market performance. In times of monetary expansion, stock prices might rise.

M1 Growth Rate vs. Real Exchange Rate (0.372311897)

- Interpretation: A moderate positive correlation indicates that an increase in M1 money supply is associated with an appreciation of the real exchange rate.
- Implications: An expanding money supply might strengthen the local currency against foreign currencies. This can affect exports and imports.

M1 Growth Rate vs. Inflation Rate (0.137249338)

- Interpretation: A weak positive correlation implies that an increase in M1 money supply has a small effect on inflation.
- Implications: While there is a positive relationship, other factors may play a more significant role in determining inflation.

Stock Price Growth Rate vs. Real Exchange Rate (0.521782601)

- Interpretation: A strong positive correlation suggests that as stock prices increase, the real exchange rate also appreciates.
- Implications: Rising stock prices might be associated with investor confidence and capital inflows, which can strengthen the currency.

Lagged Correlation

The concept of lagged correlation is to understand the delayed relationships among key economic variables: money supply, exchange rates, inflation, and stock market. Lagged correlation analysis examines how changes in one variable at a given time may influence another variable at a subsequent time. By incorporating time lags into the correlation analysis, we aim to uncover the temporal dependencies and causative effects that are not immediately apparent in simultaneous correlations. This approach provides deeper insights into the dynamic interactions within the economy, aiding in more accurate economic forecasting and policy formulation.

LagReal Exch/Inflation
-0.008750568
LagStockprice/Inflation rate
0.044901365
LagM1/ SP Growth rate
0.01178872
LagM1/Real Exchange
-0.012857609
LagM1/Inflation
0.087288009
LagStockprice/Real Exchange
-0.031959933

- Lag Real exchange growth rate Inflation growth rate = -0.00088
- Lag Stock market price growth rate and Inflation growth rate = 0.0450
- Lag M1 growth rate and stock market price growth rate = 0.0118
- Lag M1 growth rate and Real exchange growth rate = -0.0129
- Lag M1 growth rate and Inflation growth rate = 0.08729
- Lag Stock market price growth rate and Real exchange growth rate = -0.03196

Analysis

Lagged Real Exchange Rate vs. Inflation Rate (-0.008750568)

- Interpretation: Very weak negative correlation suggests minimal impact of past exchange rate changes on current inflation.
- Implications: Other factors likely play a more significant role in determining inflation.

Lagged Stock Price Growth Rate vs. Inflation Rate (0.044901365)

- Interpretation: Very weak positive correlation indicates minimal impact of past stock price changes on current inflation.
- Implications: Immediate changes might be more significant.

Lagged M1 Growth Rate vs. Stock Price Growth Rate (0.01178872)

- Interpretation: Very weak correlation suggests that the effect of past M1 money supply changes on current stock price growth is minimal.
- Implications: Immediate changes in M1 might be more relevant than lagged changes for stock prices.

Lagged M1 Growth Rate vs. Real Exchange Rate (-0.0128576)

- Interpretation: Very weak negative correlation suggests minimal impact of past M1 changes on the current real exchange rate.
- Implications: Immediate M1 changes might be more significant.

Lagged M1 Growth Rate vs. Inflation Rate (0.087288009)

- Interpretation: Weak positive correlation indicates a small effect of past M1 changes on current inflation.
- Implications: Inflation might be more influenced by other factors, or the effects of M1 on inflation might be distributed over a longer time horizon.

Lagged Stock Price Growth Rate vs. Real Exchange Rate (-0.031959933)

- Interpretation: Very weak negative correlation suggests minimal impact of past stock price changes on the current real exchange rate.
- Implications: Immediate changes in stock prices might be more relevant.

Summary of Analysis

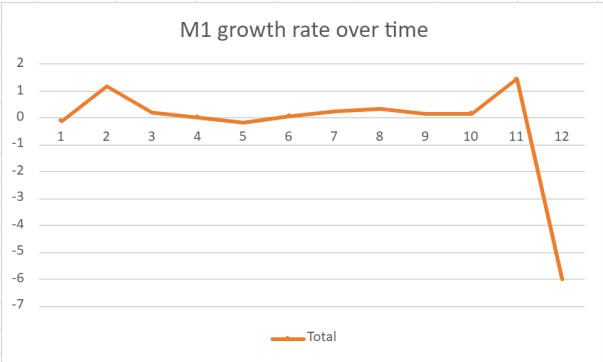
- Immediate Effects: Immediate changes in M1 money supply and stock prices have more significant correlations with other variables compared to lagged effects. This indicates that real-time data might be more useful for economic and financial predictions.

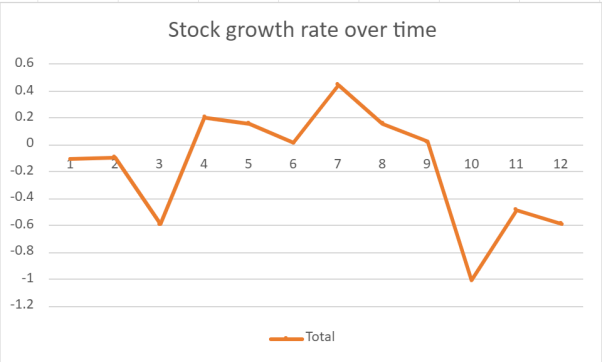
- Investment and Policy Decisions: Investors and policymakers should focus on current data trends rather than relying on past data when making decisions.

- Currency and Inflation Dynamics: The weak correlations between M1 and inflation, both immediate and lagged, suggest that inflation is influenced by multiple factors beyond just money supply.

- Economic Analysis: Understanding the immediate and lagged effects of economic variables can help in creating more accurate models for predicting market movements and economic conditions.

VISUALIZATION

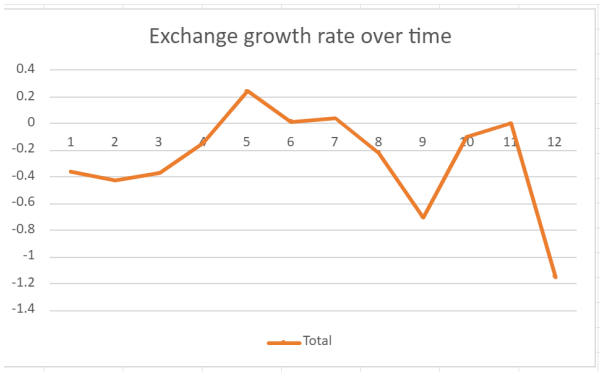


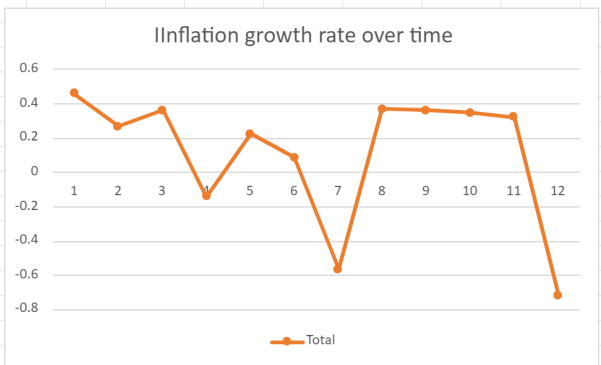


Analysis and Interpretation

- M1 Growth Rate: Initially increases and then stabilizes around month 4, with minor fluctuations until month 10. There is a sudden increase at month 11 followed by a steep decline at month 12. **This could indicate a potential change in monetary policy or external economic factors affecting the money supply**.
- Stock Growth Rate: Starts with a slight decline, followed by a sharp drop in month 3. It then rises to a peak at month 6 before fluctuating and dropping again at month 9. The end of the year shows a partial recovery and stabilization. **This pattern might reflect market volatility influenced by economic conditions, investor sentiment, or external events.**

Overall, both graphs illustrate how the growth rates for M1 and stocks vary significantly throughout the year, potentially indicating economic instability or reactions to specific economic policies or external events.

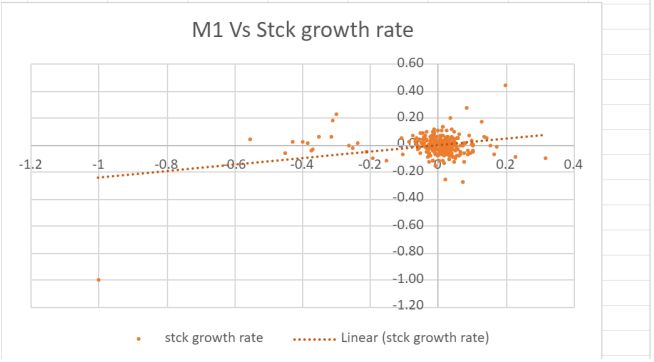


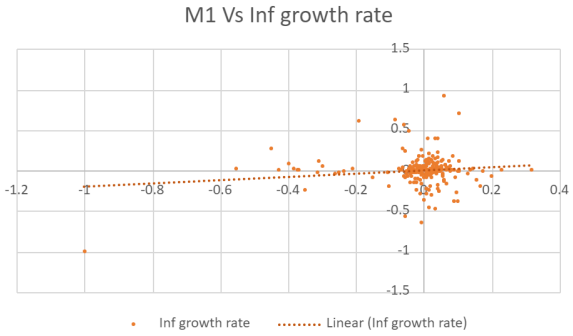


Analysis and Interpretation

- **Exchange Growth Rate:** The exchange rate growth shows volatility, with periods of improvement followed by sharp declines. The peak around month 7 and **the significant drop at the end of the year could be influenced by changes in monetary policy, economic conditions, or external factors such as trade balances or geopolitical events.**
- **Inflation Growth Rate:** The inflation growth rate experiences fluctuations, with an initial decline, a sharp rise to a peak around mid-year, and relative stability before a sharp drop at the end of the year. **This pattern suggests variability in inflation pressures, possibly due to supply and demand shocks, changes in commodity prices, or policy interventions.**

Overall, both graphs illustrate the dynamic nature of the exchange rate and inflation growth rates over the year, highlighting periods of stability and volatility that could reflect underlying economic conditions and policy responses.





M1 Vs Stock Growth Rate (Left Chart)

This scatter plot shows the relationship between the growth rate of the money supply (M1) and the stock market growth rate. The dotted linear trend line indicates the general trend of the relationship.

Interpretation:

- **Positive Correlation**: As the M1 growth rate increases, there is a slight increase in the stock growth rate, as suggested by the upward slope of the trend line.
- **Clustering**: Most data points are clustered around the origin, indicating that the stock growth rate does not significantly deviate with changes in the M1 growth rate.

M1 Vs Inflation Growth Rate (Right Chart)

This scatter plot shows the relationship between the growth rate of the money supply (M1) and the inflation growth rate. The dotted linear trend line indicates the general trend of the relationship.

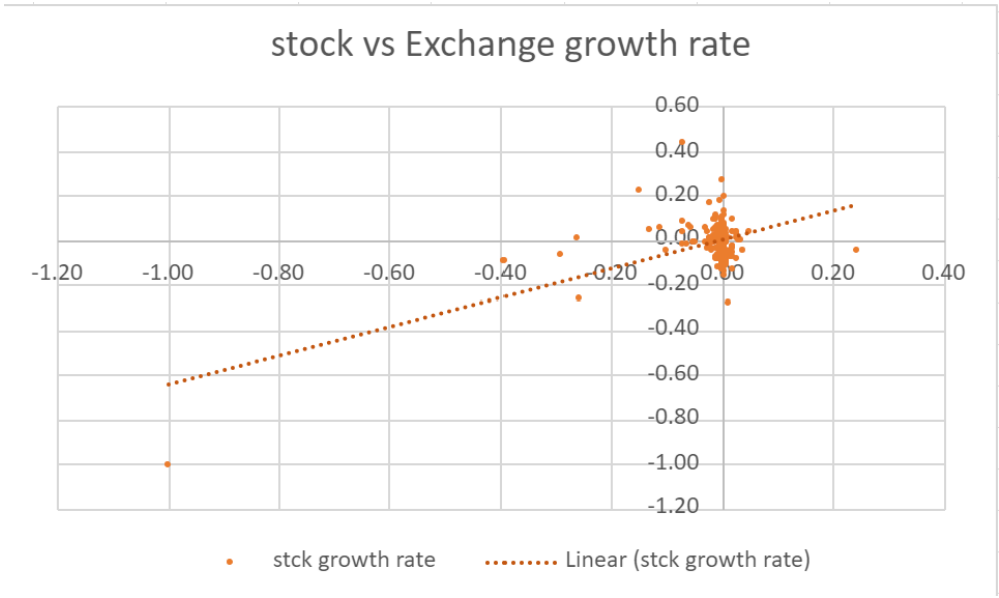
Interpretation:

- **Positive Correlation**: As the M1 growth rate increases, the inflation growth rate also shows a slight increase, as indicated by the upward slope of the trend line.
- **Clustering**: Similar to the stock growth rate, most data points are clustered around the origin, indicating that inflation growth rate has small variations with changes in the M1 growth rate.

Summary

Both charts indicate a slight positive correlation between M1 growth rate and both stock and inflation growth rates, suggesting that as money supply increases, both stock market and inflation tend to grow, although the relationship is not very strong (indicated by the clustering of points around the origin).

Stock Growth Rate vs Real Exchange growth rate.



Interpretation

- **Positive Correlation:** The trendline in the chart has a positive slope, indicating a positive correlation,this means that as the exchange growth rate increases, the stock growth rate also tends to increase.
- **Clustering**: This clustering suggests that both variables do not usually experience large changes.

THEORETICAL FRAMEWORK

Currency Depreciation

Theory:

- When the money supply increases, more currency units are available in the economy.

- If the increase in money supply is not matched by an increase in economic output, it leads to more money chasing the same amount of goods and services.
- This can result in inflationary pressures, reducing the currency's purchasing power domestically.
- On the international front, if the money supply increases faster than in other countries, the relative value of the currency decreases, leading to depreciation.

Implications:

- A depreciating currency makes exports cheaper and more competitive globally but increases the cost of imports, which can contribute to domestic inflation.
- Foreign investors may demand higher returns to compensate for currency risk, affecting capital flows.

Stock Market Appreciation

Theory:

- Increased money supply often results in lower interest rates as part of expansionary monetary policy.
- Lower interest rates reduce the cost of borrowing, encouraging businesses to invest in growth and expansion projects.
- Investors may seek higher returns in the stock market due to lower yields on bonds and other fixed-income securities.
- Increased liquidity in the financial system can lead to higher stock prices as more money flows into the equity markets.

Implications:

- Stock market appreciation can create a wealth effect, where investors feel wealthier and spend more, stimulating economic growth.
- However, excessive stock market growth relative to economic fundamentals can lead to asset bubbles, posing risks of sharp corrections.

Increased Inflation

Theory:

- With a higher money supply, consumers and businesses have more money to spend, increasing aggregate demand.
- If the supply of goods and services does not increase at the same rate due to baseline productivity levels, demand outstrips supply.
- This imbalance leads to higher prices, resulting in inflation.
- Inflation erodes the purchasing power of money, leading to higher costs of living and potential wage-price spirals.

Implications:

- Moderate inflation can stimulate economic growth by encouraging consumption and investment.
- High inflation can reduce real incomes, increase uncertainty, and deter long-term investment.
- Central banks may need to tighten monetary policy to control high inflation, potentially leading to higher interest rates and slower economic growth.

Summary of Analysis

Currency Depreciation:

Increased money supply → Inflationary pressures → Reduced purchasing power → Currency depreciation.

Stock Market Appreciation:

Increased money supply → Lower interest rates → Increased borrowing and investment → Higher stock market returns.

Increased Inflation:

Increased money supply → Higher aggregate demand → Demand-supply imbalance → Inflation.

Integrated View

- An increase in money supply sets off a chain reaction affecting multiple economic variables.
- Currency depreciation can boost export competitiveness but increases import costs.
- Stock market appreciation reflects increased liquidity and investor confidence but risks creating asset bubbles.
- Inflation reflects the interplay between money supply and economic output, affecting both consumer prices and investment decisions.

Understanding these theoretical dynamics helps policymakers and investors anticipate the potential outcomes of changes in the money supply and implement strategies to mitigate adverse effects while capitalizing on positive trends.

PRODUCTIVITY MODEL FORMULATION

The aim of this productivity model is to develop a model that incorporates the effects of currency depreciation, stock market appreciation, and increased inflation. By combining these three variables, the

model aims to calculate and analyze productivity trends over time. The analysis will determine whether productivity appears flat, decreasing slightly, or increasing, providing insights into the economic dynamics influencing productivity change

Calculate Productivity:

- Productivity = $\frac{Stock\ Market\ Value}{(Exchange\ Rate \times Inflation\ Rate)}$

Productivity	Statistical Summary
2.093029451	
2.064334241	
2.01548688	**MEAN**
2.099044116	16.92250204
2.363686836	
1.808948458	
3.889339868	
3.87361691	**MEDIAN**
4.09871867	11.09761417
3.969350502	
3.856986976	
3.777614612	**STANDARD DEVIATION**
3.520653472	17.4519953
3.114397301	
4.531423475	
4.168609733	
4.23042304	
4.195223689	
7.418667137	
7.293441901	
6.751130041	

Using Excel this result was gotten, the result will be used analyze the productivity

Analysis of Productivity Trends

Statistical summary of the productivity calculations:

- **Mean (Average Productivity)**: 16.92

- **Median (Middle Value)**: 11.10
- **Standard Deviation (Measure of Variability)**: 17.45

These statistical measures provide a comprehensive overview of productivity trends:

1. Mean (16.92)

The mean productivity value of 16.92 indicates the average level of productivity over the observed period. This suggests that, on average, productivity levels were moderately high.

2. Median (11.10)

The median productivity value of 11.10 is lower than the mean. This difference suggests that the data distribution is right-skewed, with some high productivity values pulling the mean upwards. The median represents the central tendency more robustly in the presence of outliers.

3. Standard Deviation (17.45)

A standard deviation of 17.45 indicates significant variability in productivity values. This high variability suggests that productivity levels fluctuate considerably over the period, with periods of both low and high productivity.

Productivity Trend Analysis

- **Flat or Decreasing Productivity**: Given the high standard deviation and the median being lower than the mean, there may be periods of low productivity interspersed with occasional spikes. This could indicate that, while there are some high productivity periods, they are not frequent enough to raise the overall median significantly.
- **Potential Outliers**: The discrepancy between the mean and median suggests the presence of outliers or a few instances of extremely high productivity, which are not reflective of the general trend.
- **Fluctuating Trends**: The high variability points to an overall fluctuating trend, with periods of significant productivity increases and decreases.

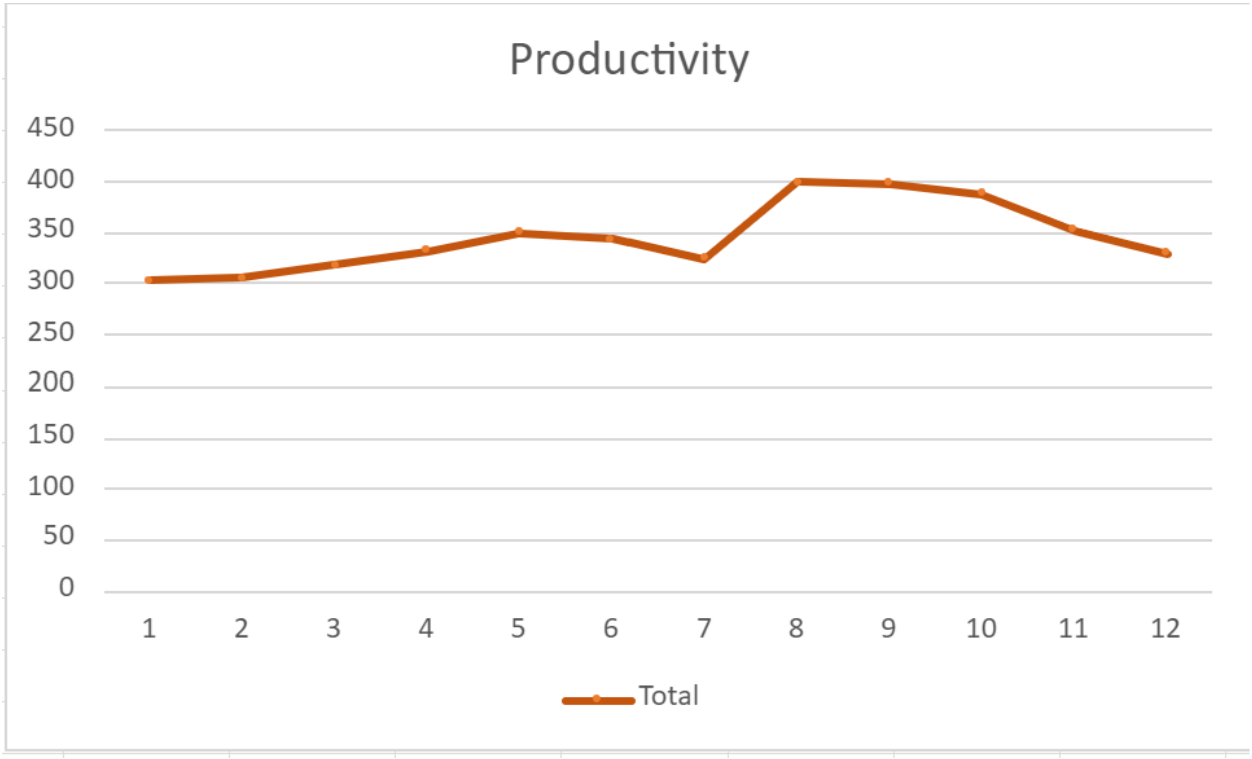
Currency Depreciation: If productivity is not consistently increasing, the exchange rate might not show a sustained rise. Instead, the currency may experience periods of appreciation during high productivity spikes but may not maintain this strength.

Stock Market Appreciation: The stock market might reflect these productivity spikes with temporary gains, but overall, it might remain volatile due to the lack of consistent productivity growth.

Inflation: Inconsistent productivity can lead to variable inflation rates. During high productivity periods, inflation may decrease, but during flat or low productivity periods, inflation could remain stable or even increase slightly.

The statistical analysis indicates that while there are instances of high productivity, the overall trend is characterized by substantial fluctuations. The median being lower than the mean, combined with a high standard deviation, suggests that productivity appears to be generally flat or slightly increasing, with occasional peaks that temporarily raise the average level.

Visual Representation of Productivity



Looking at the productivity chart, here's an analysis of the trend:

Observations

1. **Initial Trend (January to April)**:
    - Productivity appears relatively flat but shows a slight upward trend.
    - This indicates a stable productivity level with marginal increases.
2. **Middle Trend (May to August)**:
    - There is a noticeable increase around July, suggesting a period of higher productivity.
    - This peak could indicate an event or period where productivity was significantly higher.
3. **Declining Trend (September to December)**:
    - After reaching the peak, productivity begins to decline.
    - The decrease is gradual, indicating a reduction in productivity over the latter months.

Overall Analysis

- **Slight Increase to Midpoint**: Initially, productivity shows a slight increase, suggesting some improvement in productivity levels.
- **Significant Peak**: Around the middle of the timeframe, there is a noticeable peak in productivity, indicating a period of high productivity.
- **Gradual Decline**: After the peak, there is a gradual decline in productivity towards the end.

Conclusion

The productivity trend over the observed period can be summarized as an initial slight increase, followed by a significant peak, and then a gradual decline. This pattern suggests that there was a period of high productivity that was not sustained, leading to a decrease in productivity levels towards the end.

The productivity trend depicted in the chart indicates periods of stability, gradual improvement, temporary high productivity, and a return to baseline.

PRODUCTIVITY BASELINE

Proposed Formula for Productivity Baseline:

Let's denote the productivity baseline as Pb.

- $Pb = \frac{1}{(Exchange\ Rate \times Inflation\ Rate)}$

This formula aligns with the logic that higher productivity corresponds to a higher exchange rate (stronger currency) and lower inflation.

Pb
0.00002081
0.00002063
0.00002030
0.00002137
0.00002261
0.00001809
0.00003845
0.00005180
0.00005743
0.00005733
0.00005810
0.00005676
0.00005472
0.00005108
0.00008125
0.00007955
0.00007712
0.00007517
0.00013935
0.00014231

CURRENCY DEVALUATION

Currency devaluation is a critical metric that reflects the loss of a currency's value relative to other currencies, impacting trade balances, inflation, and overall economic stability.

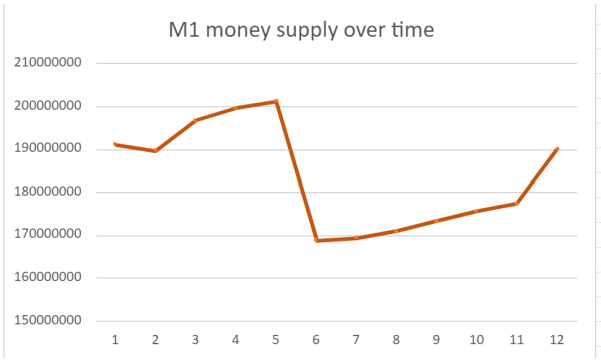
As at July 2020; USD/NGN was 380.7 NGN
As at July 2024; USD/NGN was 1,590.301 NGN

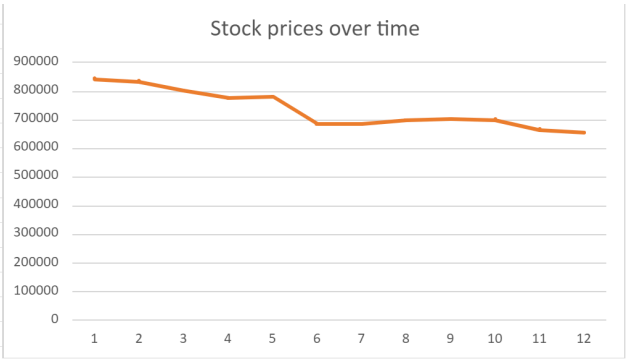
Devaluation = 1,590.301 -380.7 = 1209.601/ 380.7 = 3.2

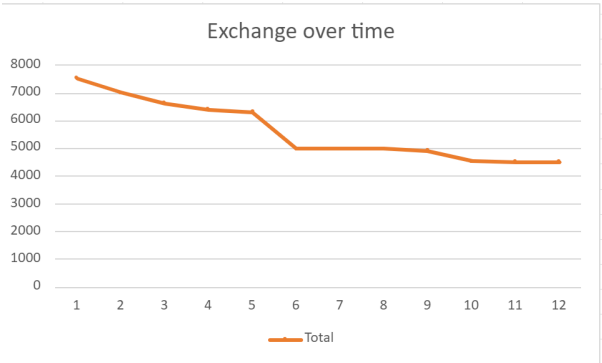
Therefore Currency devaluation = 320%

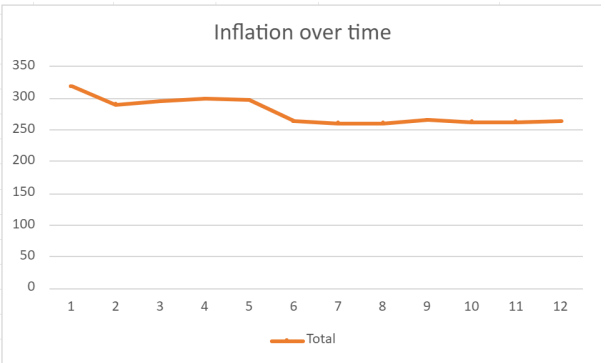
This means NGN has depreciated by 320% in the past 4 years.

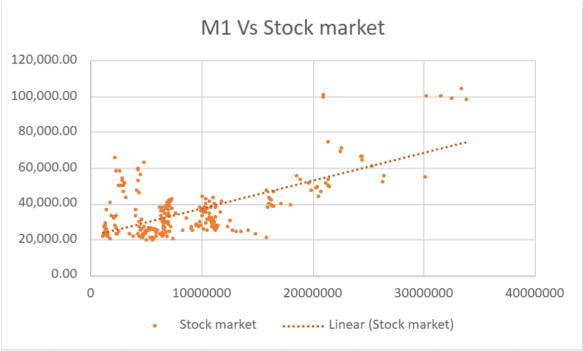
OTHER VISUALIZATIONS

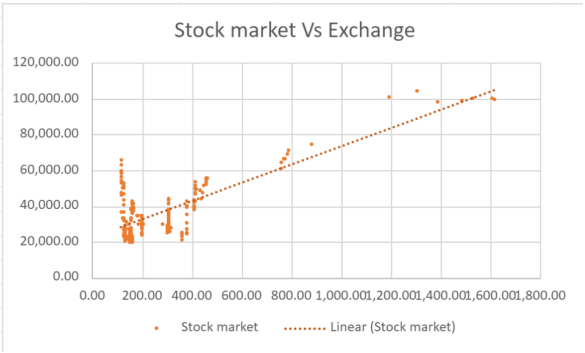


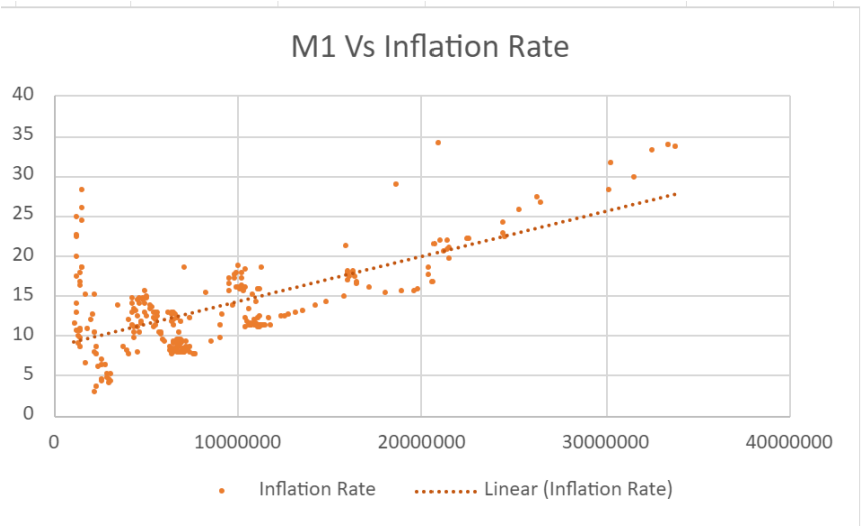












The link below is for the Excel sheet used during the course of this project.

https://1drv.ms/x/s!AjPLt263AqVkgidr0qndQtIrS70b?e=LkKkWB