Impact of Exchange Rate Volatility on FDI Inflows: A Study of the UK, Japan, Germany, China and India

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Abstract

This paper aims to analyze the effects of exchange rate volatility on FDI inflows in five major economies: the UK, Japan, Germany, China, and India, with the United States Dollar used as a base currency. The annual data spanning 2000-2023 tries to understand the variations in FDI trends in terms of the effect of fluctuations in exchange rates across the same markets. A simple linear regression model was employed for the quant study, and correlating analysis assisted in examining further the strength and direction of association that exists between them. The evidence suggests that a few countries have exchange rate volatility that influences the level of inflowing FDI. However, its effects vary from developed markets to emerging markets. The investigation further identifies a negative relationship between FDI and exchange rate volatility in China and India, which means that the more unstable the currency, the less the investment into these markets. For developed economies, the scale is more quite moderate for countries like the UK and Germany. These results are useful both for policymakers thinking about promoting FDI inflows through the stabilization of their exchange rate and for international investors seeking to understand how currency risk might vary across economic systems.

Introduction

Foreign Direct Investment plays an important role in the growth and development of developed as well as emerging markets. It is one of the main driving forces for globalization and integration through capital flows, technology transfer, and job creation. However, the exchange rate volatility, which in other words is the uncertainty of currency values, has proven to be one of the most imperative factors affecting FDI decisions. Investment interest in exchange rate stability is relatively motivated because the foreign market exchange rate affects both the profitability and risks of investments. Analysing dynamics regarding volatility in exchange rates and inflows of FDI is important, not only for the policymaker, but also for the investor who aims to realize their investment potential while managing the associated risks.

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In five rather diverse economies, namely the UK, Japan, Germany, China, and India, with the US dollar as the base currency, the impact of exchange rate volatility on FDI inflows is analysed. These represent a combination of developed and emerging markets and can therefore add to a better comparative perspective in how volatilities of exchange rates affect investment behaviour. Developed markets like the UK, Japan, and Germany as a rule generally provide a more stable economic environment whereas emerging markets such as China and India tend to be more sensitive with respect to fluctuations in currency since these markets are dynamic and continuously evolving.

This research helps contribute to deeper understanding of the dynamics of investments in the increasingly globalized economy. Findings will inform policymakers on how to attract FDI through stabilization of the exchange rate and also benefit investors in managing currency risk in diverse economic environments.

Research Objectives

To the trends of exchange rate volatility and FDI inflows in the UK, Japan, Germany, China, and India by using a base currency of USD.

To test the relationship between exchange rate volatility and FDI inflows using a simple linear regression model.

To examine the strength and the direction of correlation between exchange rate volatility and inflows of FDI in all countries.

Literature Review

Blonigen (2005) accounted for a comprehensive review of the determinants of FDI. There was an assertion that increased exchange rate volatility discourages foreign investment, introducing uncertainty. Therefore, investors opt for stable currency markets, where returns are more predictable, thus illustrating the relevance in countries such as India and China, where the rates tend to fluctuate more frequently.

Kiyota and Urata (2004) analyzed the impact of exchange rate fluctuations on FDI using data from the East Asian countries including China and Japan for the period of 1980-2000. The results depicted that the more volatile the exchange rate, the lesser will the inflows of FDI be in developing economies. Investors become more sensitive towards currency riskiness and are kept away from investing in such places. However the impacts do not depict prominently in the developed economies like Japan. This also appears to depict that there is a greater ability to cope up with the risks due to the exchange rates.

In a study on the European Union, Darby, Hughes, and Piscitelli (1999) note that countries with relatively stable exchange rates, such as Germany, attract increased levels of FDI compared to those whose currencies fluctuate constantly. This study therefore affirms that stable exchange rates are essential in attracting foreign direct investments since their stability eliminates uncertainties in investments.

Asiedu 2002, analyzes the determinants of FDI in SSA to find that amongst the negative influences affecting inflows of FDI, there exists unstable volatility of the exchange rate. If exchange stability is one aspect of importance, then so are more factors like political stability and infrastructural development which determine success in attracting foreign investments.

Jayaraman, Choong, and Ramasamy (2010) focused on the BRICS economies that comprises Brazil, Russia, India, China, and South Africa in examining the impact of exchange rate volatility on FDI inflows through annual data from 1990 up to 2007. Their findings revealed a negative association of interest

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between this variable and FDI particularly in China and India. The conclusion of the authors is that higher exchange rate uncertainty tends to discourage foreign direct investment in emerging markets.

Campa (1993) examines how exchange rate volatility affects investment decisions of multinational US firms. It points to the fact that higher risk-aversion levels will be inclined to deter companies from investing into those markets with unstable exchange rates as such instability is likely to adversely affect the profitability of their investments. This evidence further adds to why exchange rate stability is crucial in influencing investment decisions across the developed economies of Germany and Japan.

Elijah Udoh and Festus O. Egwaikhide (2008), This article examines the effect of exchange rate volatility and inflation uncertainty on foreign direct investment in Nigeria. The investigation covers the period between 1970 and 2005. Exchange rate volatility and inflation uncertainty were estimated using the GARCH model. Estimation results indicated that exchange rate volatility and inflation uncertainty exerted significant negative effect on foreign direct investment during the period. In addition, the results show that infrastructural development, appropriate size of the government sector and international competitiveness are crucial determinants of FDI inflow to the country. This enquiry supports the commitment of policymakers to exchange rate and macroeconomic stability as key to FDI boom in Nigeria

Methodology

A descriptive approach would be undertaken involving secondary data where the problem would be treated quantitatively and quantitatively to analyze the chosen variables through a simple linear regression model and correlation analysis.

For the purpose of this study, data was acquired through reliable sources to make the data authentic and reliable. The yearly exchange rate data of these countries in terms of USD was sourced from these countries' central banks, including the Bank of England, Bank of Japan, RBI, PBOC, and the Deutsche Bundesbank among others on the international databases of the World Bank. Each country's annual data on FDI inflows, in terms of USD, was obtained from the World Bank.

The dependent variable includes annual FDI inflows for each country selected. It measures inward investment in terms of USD undertaken by foreign investors during a given year. The independent variable is the volatility of the exchange rate, calculated as yearly movements of the exchange rate against the USD. More exactly, volatility is calculated as the monthly standard deviation of the exchange rate for each year, accounting for the fluctuations in currency values in time. The growth rate of GDP, inflation rate, and interest rate are controlled factors in the analysis. These variables account for other factors besides change in exchange rate that might influence FDI inflows.

The relationship between change in exchange rate volatility and FDI inflows is then investigated using a simple linear regression model for each of the countries. The model used in this case has the following form:

$$\text{FDI}_t = \alpha + \beta(\text{Exchange Rate Volatility}_t) + \varepsilon_t$$

Where FDIt represents FDI inflows in period t, alpha is the intercept term, beta measures the impact of exchange rate volatility on FDI inflows, and εt represents the error term that captures other unexplained fluctuations in FDI inflows. This regression analysis will establish the level to which exchange rate volatility has an influence on FDI inflows and whether said influence holds a positive or negative correlation. The conclusion in the event of a significant negative beta would be that higher volatility in the exchange rate is somehow associated with lower FDI inflows.

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Further to this, Pearson's correlation coefficient was computed in order to assess if the relationship between exchange rate volatility and FDI inflows has a strength and direction. Correlation analysis measures the extent of linear association that can exist between the two variables ranging between -1 (perfect negative correlation) to +1 (perfect positive correlation). A negative correlation coefficient would therefore mean that with higher exchange rate volatility, FDI inflows have a tendency to be lower and vice versa.

The analysis covers 24 years from 2000 to 2023 so that both short-term and long-term trends in exchange rate volatility and FDI inflows can be captured. This time period covers major world economic events, such as the Global Financial Crisis of 2008 and the COVID-19 pandemic, that may have had an impact on currency markets and investment flows.

Data analytics software such as EXCEL is used to perform regression and correlation analyses for the analysis. It has performed data cleaning, calculated volatility of the exchange rate, carried out regressions, and produced charts and graphs that provide a graphical view of trends. The simple linear regression model, as well as the correlations, shall be interpreted with reference to the effect that the volatility of the exchange rate has on FDI inflows. This will compare the results for each country to highlight differences between developed markets (UK, Japan, Germany) and emerging markets (China, India), focusing on whether the regression coefficients are statistically significant, and the direction of the relationships.

Analysis And Interpretation

The aim of the current study is to represent, through graphics, the nature of the interaction between the volatility of the exchange rates with FDI inflows. In the initial stages, the current study presents a graphical comparison of the changes in the different fluctuating trends of the exchange rate and corresponding inflowing trends of FDI into the UK, Japan, Germany, China, and India in the last 24 years of the period 2000-2023, taking the base currency as the USD.

The study proceeds to make a use of simple linear regression analysis to test how average yearly exchange rates, such as USD/INR, USD/JPY, USD/GBP, etc, and average yearly inflow of net FDI for each country under review relates. Further, correlation analysis is carried out for the relation between the volatility of the exchange rate and the inflow of FDI. Appendix, pp. Data used for this analysis cover the period from 2000 to 2023.

Hypothesis

H0: There is no impact of currency fluctuation on FDI.

H1: There is an impact of currency fluctuation on FDI.

United Kingdom

Graphical representation

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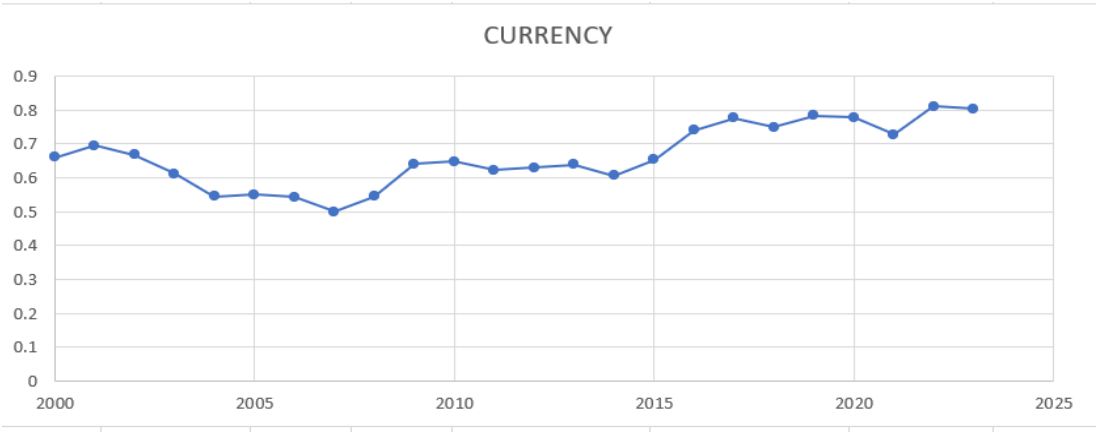

Figure 1

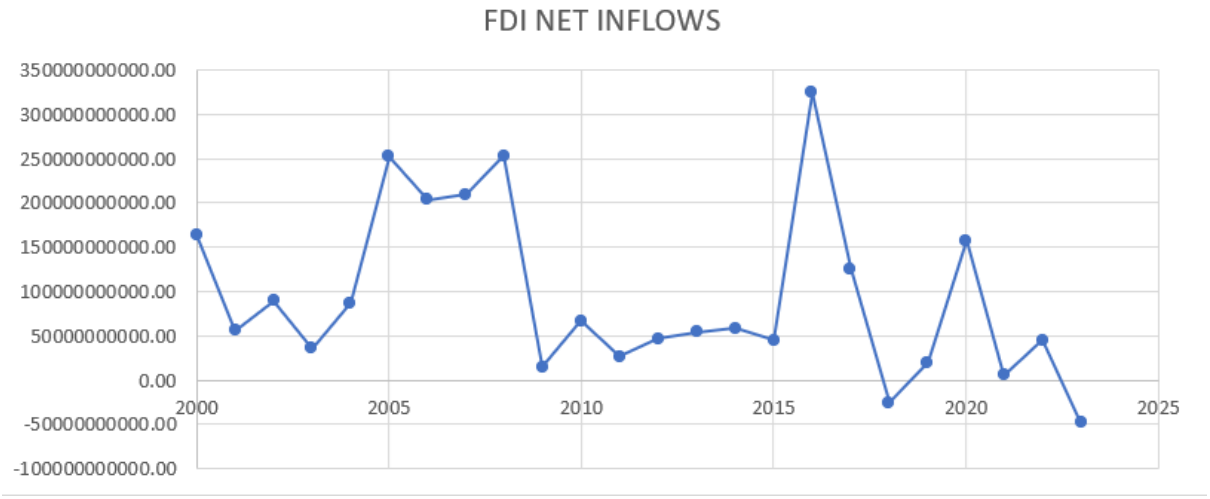

Figure 2

Findings of the Study

Table 1

SUMMARY OUTPUT	
Regression Statistics	
Multiple R	0.396259179
R Square	0.157021337
Adjusted R Square	0.118704125
Standard Error	90337412331
Observations	24

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Table 2

ANOVA					
	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	3.34426E+22	3.34426E+22	4.09793221	0.055244237
Residual	22	1.79539E+23	8.16085E+21		
Total	23	2.12981E+23			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	3.71167E+11	1.37851E+11	2.692514304	0.01330005	85280519892	6.57053E+11	85280519892	6.57053E+11
X Variable 1	-4.16434E+11	2.05714E+11	-2.024335005	0.05524424	-8.4306E+11	10190660547	-8.4306E+11	10190660547

From the regression analysis, it becomes visible that the exchange rates are in moderate positive relation with inflows of FDI, and the value of the Multiple R is 0.396. However, the model can only explain 15.7% variation of inflows of FDI since the R Square value goes up to 0.157. It further suggests that other factors should be affecting FDI to a significant extent. The Adjusted R Square stands at 0.119 with limited explanatory power. A high Standard Error of 90,337,412,331 reflects a high variability around the predictions. In ANOVA, Significance F is at a level of 0.055, which borders the statistical significance at 5%. Coefficient for the X Variable 1 is -4.16434E+11 with a P-value of 0.055, indicating that the variable is negatively associated with the inflow of FDI, but the rather wide intervals of confidence reflect uncertainty. Overall, the model's predictive power is not efficiently maximized; this can be enhanced by including any other variables into the analysis.

Given that your P-value is at 0.055 with the result of the regression analysis, you would thus fail to reject your null hypothesis (H0). You would conclude that there was not enough evidence to support the claim that currency fluctuations actually have an impact on FDI.

Japan

Graphical representation

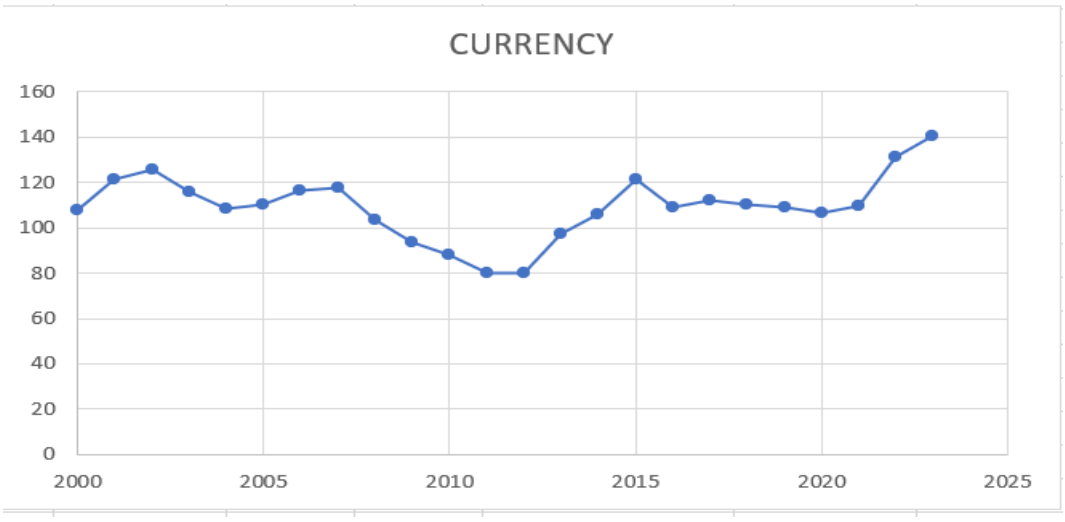

Figure 1

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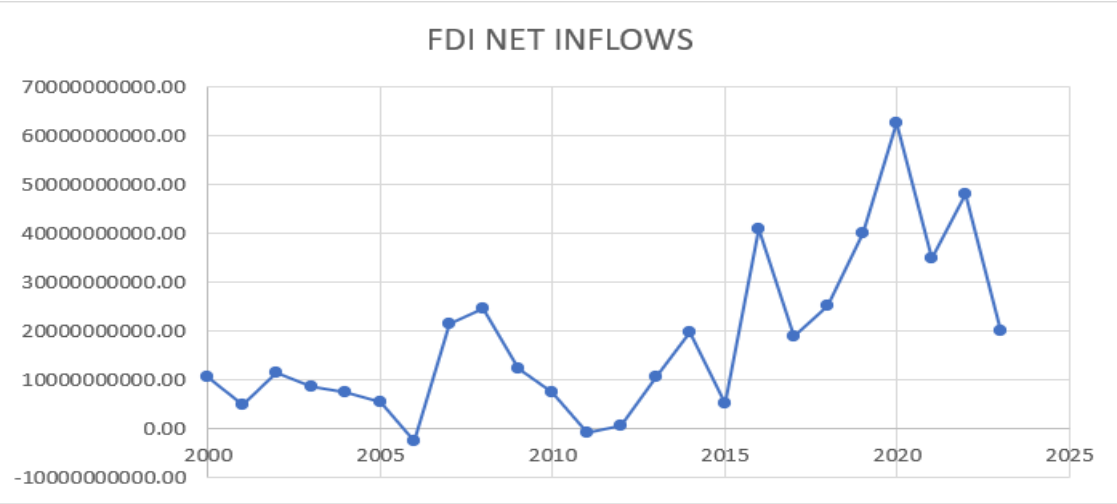

- Findings of the Study

Figure 2

Table 1

SUMMARY OUTPUT	
Regression Statistics	
Multiple R	0.265769045
R Square	0.070633185
Adjusted R Square	0.028389239
Standard Error	16389477913
Observations	24

Table 2

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	4.49133E+20	4.49133E+20	1.672030943	0.209401154
Residual	22	5.90953E+21	2.68615E+20		
Total	23	6.35866E+21			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	-15051323064	25983269634	-0.579269787	0.568291823	-68937326175	38834680046	-68937326175	38834680046
X Variable 1	305122010.6	235967060.5	1.293070355	0.209401154	-184243721	794487742.3	-184243721	794487742.3

The regression suggests that the independent variable, currency fluctuations, is weakly positive related with FDI inflows because the Multiple R value is only at 0.266. The R Square is 0.071. It implies that only 7.1% of the variation in FDI inflows by the model is explained, so there might be other factors more so involved. The Adjusted R Square of 0.028 also reinforces the conclusion. A Standard Error of 16,389,477,913 would reflect important variability around the fitted values. ANOVA results yield a Significance F of 0.209, meaning that the relationship is not statistically significant at 5%. The

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coefficient on the X Variable 1, which represents currency fluctuations, is 305,122,010.6, with a P-value of 0.209, meaning there is not enough evidence to argue that currency fluctuations affect FDI inflows. Overall, the results fail to indicate that there is reasonable evidence for an impact related to currency fluctuations as being probable in the FDI inflows of this analysis.

Based on the regression analysis and the P-value of 0.209 for the coefficient of currency fluctuations, you will fail to reject the null hypothesis (H0). This, therefore, concludes that there is not enough evidence to support the claim that currency fluctuations have significant effects on FDI (H1).

Germany

- Graphical representation

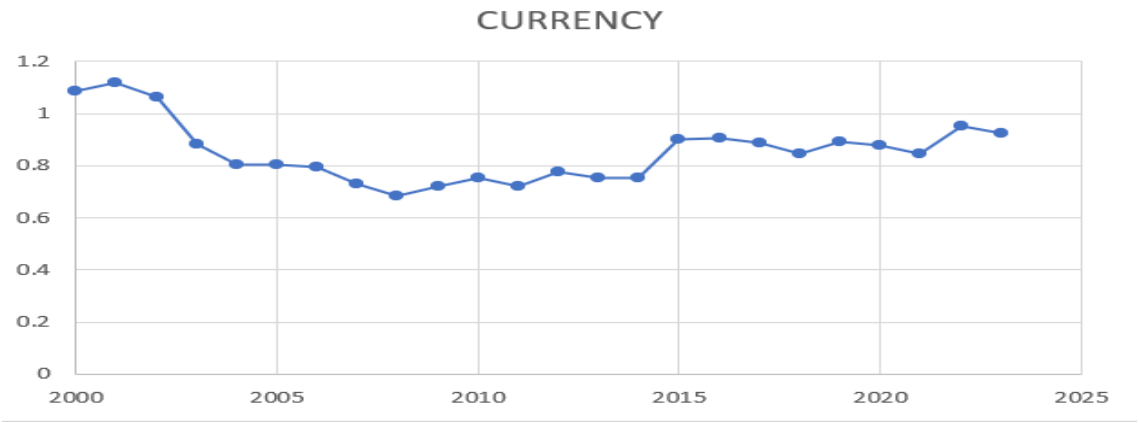

Figure 1

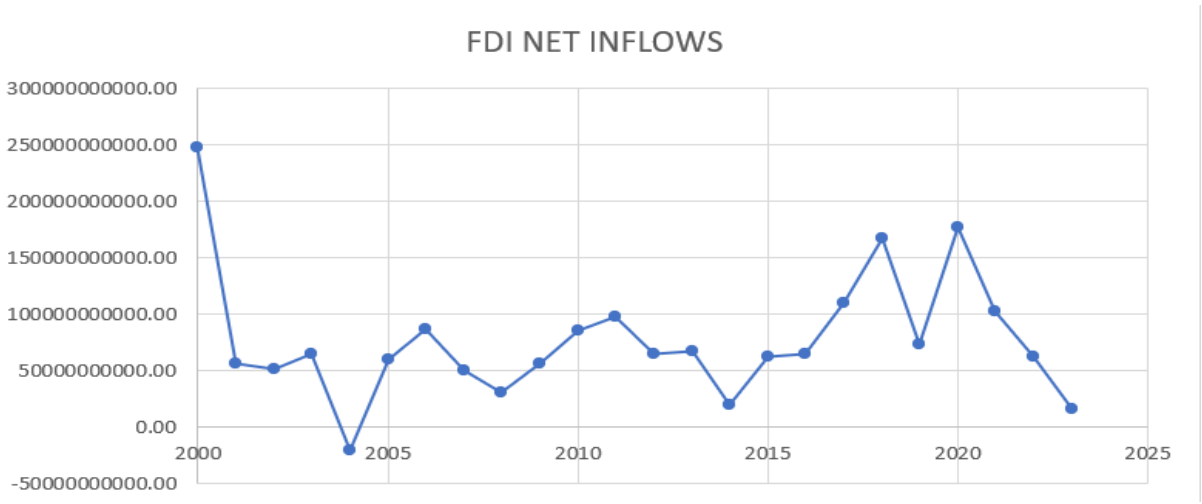

Figure 2

- Findings of the Study

Table 1

SUMMARY OUTPUT	
Regression Statistics	
Multiple R	0.312639341
R Square	0.097743357
Adjusted R Square	0.056731692
Standard Error	54184244885
Observations	24

Table 2

ANOVA					
	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	6.99723E+21	6.99723E+21	2.383306215	0.136901333
Residual	22	6.45905E+22	2.93593E+21		
Total	23	7.15877E+22			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	-49655618990	83061649894	-0.59781643	0.556066916	-2.21915E+11	1.22604E+11	-2.21915E+11	1.22604E+11
X Variable 1	1.48942E+11	96477944131	1.543796041	0.136901333	-51140741819	3.49025E+11	-51140741819	3.49025E+11

The regression analysis further shows a weak positive correlation between currency fluctuations and FDI inflows with a Multiple R-value of 0.313. The R Square value of 0.098 further indicates that only 9.8% of the variability in FDI inflows is explained by currency fluctuations, meaning other factors may have a far more significant influence on FDI. P-value of coefficient of independent variable X Variable 1= 0.137> significance level at 0.05. This therefore implies that the relationship is not statistically significant. It would thus accept the null hypothesis H0 meaning there is inadequate evidence supporting the claim that fluctuations in currencies significantly affect FDI inflows H1. These results would thus require further research with more variables added to enable one to better understand the factors influencing FDI.

China

- Graphical representation

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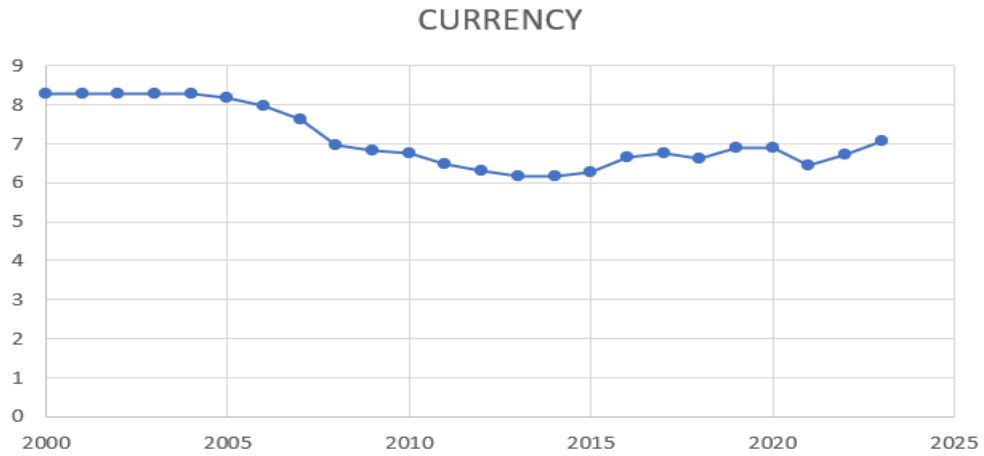

Figure 1

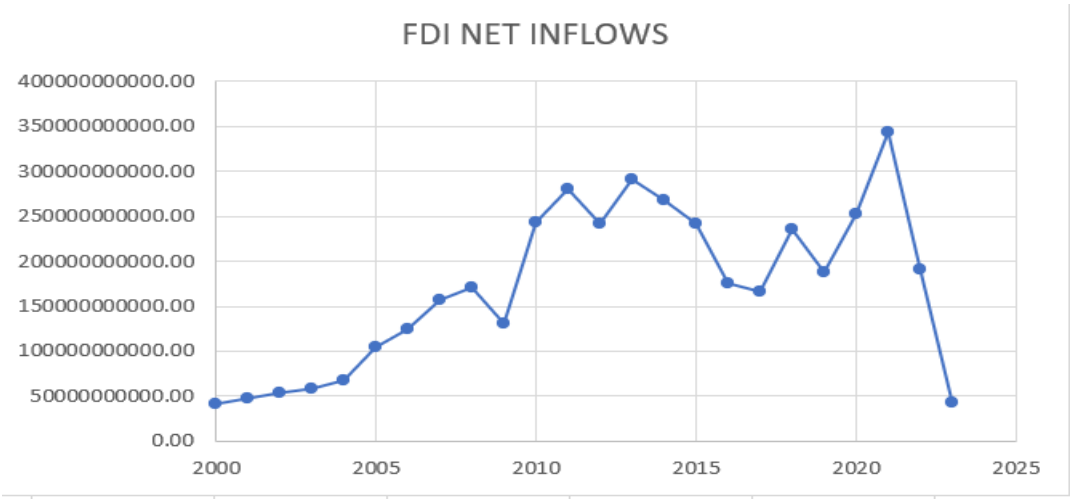

Figure 2

Findings of the Study

Table 1

SUMMARY OUTPUT	
Regression Statistics	
Multiple R	0.854021059
R Square	0.729351968
Adjusted R Square	0.717049785
Standard Error	47930213692
Observations	24

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Table 2

The

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	1.36199E+23	1.36199E+23	59.28638464	1.10736E-07
Residual	22	5.05407E+22	2.29731E+21		
Total	23	1.8674E+23			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	8.74994E+11	91892007872	9.521978942	2.92088E-09	6.84421E+11	1.06557E+12	6.84421E+11	1.06557E+12
X Variable 1	-98638913437	12810639085	-7.699765233	1.10736E-07	-1.25207E+11	-72071274055	-1.25207E+11	-72071274055

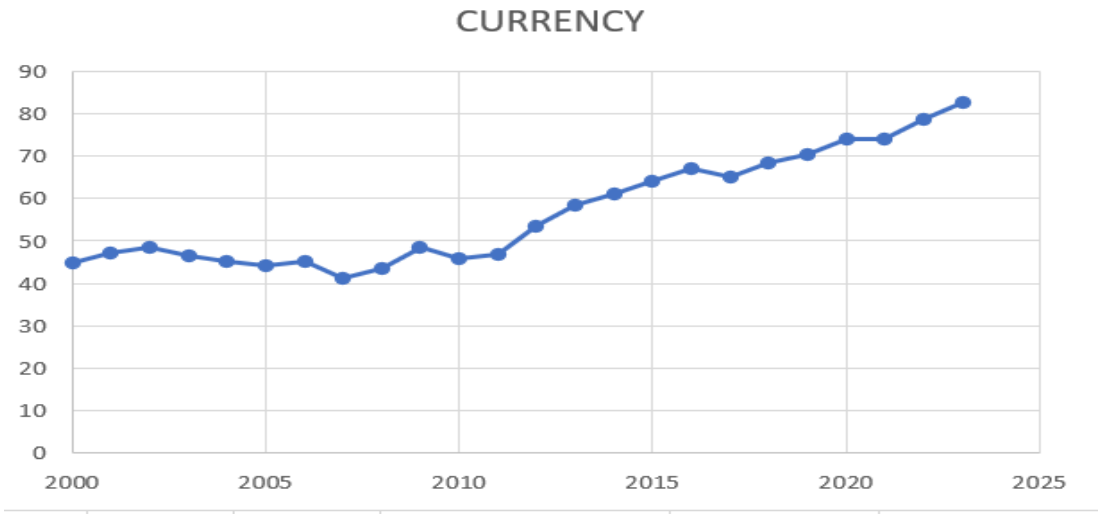
Multiple R-values stands at 0.854; regression analysis clearly indicates a strong negative correlation between currency fluctuations and FDI inflows. An R Square value of 0.729 means that currency fluctuations explain about 72.9% of the variability in FDI inflows, and thus the two variables strongly relate to each other. The P-value for the coefficient of the independent variable is 1.10736E-07, extremely low in comparison to the conventional significance level set at 0.05. Thus, this strongly indicates that there exist statistically significant effects of currency fluctuations on FDI inflows.

You would thus reject the null hypothesis, H0, and conclude that significant evidence made the claim tenable in the event of currency fluctuations as being a major influencer of FDI inflows, H1. It would then be further shown through the results that policymakers and investors must consider currency stability as a major factor in the decisioning-making process in terms of foreign investments.

India

- Graphical representation

Figure 1



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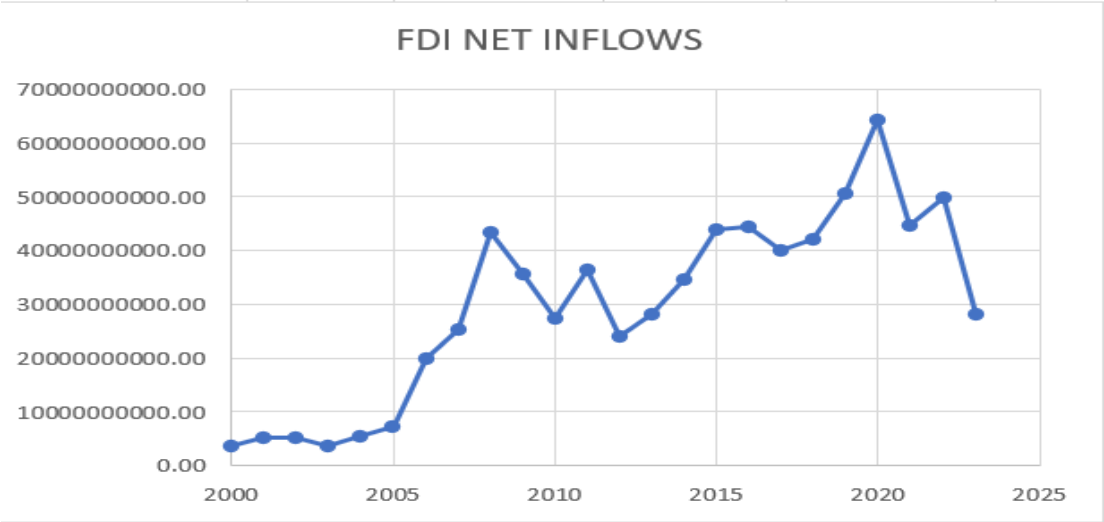

Figure 2

- Findings of the Study

Table 1

SUMMARY OUTPUT	
Regression Statistics	
Multiple R	0.679728182
R Square	0.462030402
Adjusted R Square	0.437577239
Standard Error	13139233622
Observations	24

Table 2

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	3.26194E+21	3.26194E+21	18.8945	0.000258627
Residual	22	3.79807E+21	1.72639E+20		
Total	23	7.06001E+21			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	-2.2581E+10	12328768732	-1.831551075	0.08059	-4.8149E+10	2.988E+09	-4.8149E+10	2987531815
X Variable 1	919513741.9	211539012.9	4.346780905	0.00026	480808680.2	1.358E+09	480808680.2	1358218804

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The regression analysis indicates a fair positive relationship between currency fluctuations and inflows of FDI, with Multiple R at 0.680. A value of 0.462 for R Square reveals that about 46.2% of FDI inflows variability could be explained by currency fluctuations, which means a strong relationship exists between currency fluctuations and FDI inflows. The P-value for the independent variable coefficient of the X Variable 1 is 0.00026, remarkably lower than the conventional level of significance at 0.05. It, therefore, means that an independent relationship considerably exists between currency fluctuations and FDI inflows.

You would thus reject the null hypothesis, H0, and conclude that the evidence of "significant affects FDI inflows" strongly supports the claim, H1. These results would imply that, to attract and maintain foreign investment, one needs to understand and manage currency volatility.

Conclusion

The study demonstrated a rich inter-linkage between currency fluctuations and FDI patterns across diverse economies, with graphical representation, simple linear regressions, and correlation analysis. This would signify that the volatility of exchange rates has a considerable impact on FDI inflows, but with differing impacts between developed and emerging markets. In particular, greater volatility of the exchange rate has been correlated with lower FDI inflows in emerging markets, such as China and India, implying investors are more responsive to currency risks within these countries. In contrast, developed economies, for instance, the UK, Japan, and Germany, evidenced less of an effect to exchange rate changes, which was typical of an ability to absorb more currency risk.

Since these insights underscore the need for currency stability to attract foreign investments, given that emerging markets rely heavily on FDI for economic growth and development, policymakers ought to explore strategies that reduce exchange rate volatility as a means to promote the investment climate through fostering economic stability and growth.

Overall, the study contributes to the already large literature on the interaction of the exchange rates with the FDI while providing an in-depth analysis that can be used for further research and giving a basis to policymakers in proposing the best ways to attract foreign investments within an increasingly interdependent global economy.

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Appendix

YEAR	UK		Japan		Germany		China		India	
	EX RATE	FDI	EX RATE	FDI	EX RATE	FDI	EX RATE	FDI	EX RATE	FDI
2000	0.66141	164130000000.00	107.797888	10688168325.61	1.085947	248007397121.86	8.27868	42095300000.00	44.9401	3584217307.19
2001	0.694595	56090924809.00	121.449114	4926033619.18	1.117082	56948542386.91	8.27887	47053000000.00	47.1857	5128093561.63
2002	0.667971	89760582753.00	125.471332	11557373873.94	1.064385	51268214890.63	8.27688	53073618897.40	48.5993	5208967106.28
2003	0.612069	36011240473.00	115.813429	8771535612.32	0.883383	65401516009.25	8.27718	57900937467.39	46.5819	3681984671.43
2004	0.545861	87059621382.00	108.110713	7527948175.22	0.80471	-20408419557.14	8.27368	68117272181.22	45.3165	5429250989.86
2005	0.550022	252653000000.00	110.018656	5459618342.94	0.803857	59835195025.19	8.19495	104108693867.09	44.1	7269407225.61
2006	0.543416	203636000000.00	116.321732	-2396909736.31	0.796727	87444159239.06	7.9729	124082035618.51	45.307	20029119267.14
2007	0.499806	209515000000.00	117.788794	21631204435.68	0.730785	50847183837.01	7.61324	156249335203.20	41.3485	25227740886.68
2008	0.544573	253454000000.00	103.495694	24624845329.56	0.683075	30954735498.03	6.95276	171534650311.57	43.5049	43406277075.81
2009	0.641169	14547108445.00	93.588693	12226471578.74	0.719039	56701916794.97	6.83094	131057052869.50	48.4049	35581372929.66
2010	0.647491	66734551294.00	87.806972	7440979284.16	0.754908	86037502102.16	6.76996	243703434558.18	45.7262	27396885033.78
2011	0.623629	27012050072.00	79.829741	-850717035.07	0.718836	97535403952.55	6.46553	280072219149.94	46.6723	36498654597.86
2012	0.631109	46750789728.00	79.843166	546962692.19	0.778296	65443087632.27	6.31047	241213868161.42	53.4376	23995685014.21
2013	0.63955	54473175400.00	97.589811	10648441636.21	0.753045	67199694458.94	6.15229	290928431467.00	58.5978	28153031270.32
2014	0.607353	58890445253.00	105.858149	19752249424.09	0.753602	19532082849.08	6.15813	268097181064.34	61.0295	34576643694.14
2015	0.654441	45333483122.00	121.055814	5252218412.39	0.901699	62475577277.80	6.28363	242489331627.40	64.1519	44009492129.53
2016	0.740559	324813000000.00	108.80427	40954181468.55	0.904179	64744235790.21	6.64306	174749584584.05	67.1953	44458571545.80
2017	0.776691	125359000000.00	112.149301	18802251208.11	0.886758	109485971372.51	6.75681	166083755721.65	65.1216	39966091358.74
2018	0.750148	-25055440307.00	110.430067	25289367857.85	0.847541	166915563991.37	6.6199	235365050036.34	68.3895	42117450737.26
2019	0.783652	19790761929.00	109.007953	39960544340.01	0.892882	73974461220.62	6.90979	187169822364.76	70.42034	50610647353.59
2020	0.779494	157186000000.00	106.72534	62584719398.09	0.876819	176867343557.22	6.90007	253095616058.58	74.09957	64362364994.38
2021	0.727434	5922252759.00	109.816885	35027163875.72	0.845662	102155425721.65	6.45168	344074977062.48	73.91801	44727277562.88
2022	0.811347	44897919401.00	131.453859	48004621740.76	0.951098	62728998896.00	6.72983	190203789092.51	78.604491	49940258404.27
2023	0.804368	-48148523075.00	140.510745	19983856530.00	0.924224	16289401442.57	7.07468	42727679407.24	82.5993	28070213530.40

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