

Purchasing Power Parity and International Fisher Effect Hypothesis Test: Evidence from Vietnam and 12 Major Trading Partners (2000 – 2022)

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Abstract: Amidst the expansion of the global economy and Vietnam's growing integration into the international arena, the country has formed substantial trade relations with a diverse range of nations across the globe. As a result, it is crucial to comprehend and study the dynamics of exchange rates, relying on the well-established theoretical frameworks of the Purchasing Power Parity (PPP) theory and the International Fisher Effect (IFE). Given the longstanding nature of these theories, the main purpose of this study is to assess the validity and applicability of the PPP theory and IFE in explaining the changes in exchange rates between Vietnam and its various trading partners. Employing a multiple linear regression approach, we investigated quarterly historical data comprising interest rates, inflation rates, and exchange rates of 12 trading partners, including the ASEAN-5, China, the U.S., Japan, South Korea, France, Canada, and Germany from Q1 2002 to Q4 2022. The results unequivocally show that neither the PPP theory nor the IFE can adequately explain the variations in the Vietnam Dong's exchange rate with respect to those of its trade partners, underlining the existence of significant theoretical deviations. Given these observations, policymakers and investors are strongly encouraged to adopt a holistic viewpoint, including a variety of indicators, and conducting additional research to make informed decisions that support long-term economic stability and growth.

Keywords: Purchasing Power Parity, International Fisher Effect, Hypothesis Testing, Exchange Rate, Inflation Rate, Interest Rate

1. Introduction

1.1. Problem Statement

With an average annual growth rate of 6.8% over the last ten years, Vietnam's economy is among the fastest growing in the world [1]. Its economic expansion and growing integration into the world economy have resulted in substantial trade and investment ties with 12 other nations, including China, the US, Japan, South Korea, Germany, Canada, and France, as well as the ASEAN-5 (Indonesia, Malaysia, Philippines, Singapore, and Thailand). Regarding Vietnam's expanding economic relations with these nations, it is critical to determine whether PPP and IFE theories are applicable in this larger setting. Vietnamese policymakers

must comprehend the factors affecting changes in exchange rates with these nations to maintain the competitiveness of Vietnamese exports and draw in foreign investment. The greater scholarly debate on the effectiveness of these theories in explaining exchange rate movements in poor countries can benefit from a deeper understanding of the applicability of PPP and IFE theories in the context of Vietnam's trading partners.

Since these theories have been developed for a century, it is essential to assess their applicability. Using the information on exchange rates, inflation rates, and nominal interest rates between Vietnam and 12 trading partners, this study aims to empirically examine the PPP and IFE theories. Particularly,

we will use linear regression method with secondary data of quarterly Vietnam and 12 selected nations' exchange rates, interest rates, inflation rate from 2000 to 2022. Our investigation will shed light on the validity of the PPP and IFE theories when applied to the case of Vietnam and its trade companions, as well as shed light on the underlying causes of changes in these nations' exchange rates.

1.2. Research Objective and Research Questions

1.2.1. Research Objective

1. Define the relationship between the exchange rate differential and inflation rate differential.
2. Define the relationship between the exchange rate differential and nominal interest rate differential.
3. Evaluate which PPP and IFE hold true for the case of the 12 countries' exchange rate.
4. Propose suggestions and recommendations to handle the exchange rate in Vietnam.

1.2.2. Research Questions

1. Does the inflation rate positively or negatively impact the exchange rate of 12 countries?
2. Does the nominal interest rate impact positively or negatively the exchange rate of research nations?
3. Are PPP and IFE still true for Vietnam – trading nations case?
4. What should the Vietnam government do to handle the exchange rate in its country?

2. Literature Review

2.1. Purchasing Power Parity (PPP)

International macroeconomic literature has devoted a lot of study to the idea of purchasing power parity (PPP). According to PPP, the ratio of two currencies' respective price levels should determine the exchange rate between them [2]. According to empirical studies, there is conflicting evidence about the applicability of PPP in various nations and regions.

Despite the ongoing debate about the validity of PPP and IFE theories, there is evidence to support their application in certain contexts. Bahmani-Oskooee and Saha found that PPP between India and the US holds [3]. PPP is stated to be stable for many industrialized nations over a long period of time, and deviations from PPP typically follow a mean-reverting pattern [4]. In addition, some studies have discovered evidence that the use of PPP in particular regions or between countries is justified. For instance, some research has revealed PPP holding in the European Union [5], as well as in the case of the United States and Canada [6].

The PPP theory has been proved to be false for many countries, especially emerging nations, [7]. Bahmani-Oskooee and Niroomand indicated Vietnam's bilateral trade with the US, Japan, and South Korea does not support the PPP theory

[8]. There is little doubt that the Balassa-Samuelson effect on Chinese economies and the consequent productivity gaps between Vietnam and China may influence the PPP's applicability. The Balassa-Samuelson effect is the discovery that the difference in productivity between tradeable and non-tradeable industries affects prices in the latter, potentially causing deviations from PPP. Furthermore, the PPP theory was proved to be invalid for the ASEAN-5 countries over the long-term [9]. The results of these research offer compelling evidence that, in the situation of Vietnam with 12 countries, the PPP hypothesis may not hold true.

From the above perspective, we develop the first hypothesis.

H1: Inflation rate differential may not affect exchange rate differential as indicating in Purchasing Power Parity theory for the case of Vietnam and 12 research nations.

2.2. International Fisher Effect (IFE)

The International Fisher Effect is a different concept that has drawn a lot of interest in global macroeconomic literature (IFE). IFE claims that the disparity between the real interest rates in the two countries is equivalent to the expected movement of the respective exchange rates [10]. Empirical studies have revealed inconsistent findings regarding the application of IFE in different countries and regions.

IFE theory has been proven to be valid in certain circumstances. A study by Lee and Siklos discovered that IFE corresponds for the US and Canada, with the variation in short-term interest rates playing a significant role in exchange rate volatility [11]. Huang and Wang also discovered that IFE relates to the situation in China and the US, with the real interest rate disparity dictating changes in exchange rates [12].

Contrarily, the invalidity has been looked at in several research. Using monthly data from 2001 to 2018 to analyze the IFE hypothesis between Vietnam and South Korea, Lee and Chiu found that the IFE did not hold true for the two nations over the study period [13]. Similarly, Pham and Nguyen used monthly data from 2001 to 2015, the Johansen co-integration test, and the Vector Error Correction Model (VECM) to discover that IFE did not hold true for Vietnam, Canada, France, and Germany. The research stated that variations in monetary policies, exchange rate regimes, and financial market integration could all be contributing causes to IFE discrepancies [14]. Regarding the applicability of IFE in the Vietnam-Japan setting, contradicting information has been found [15, 16].

Therefore, we proposed the following hypothesis.

H2: Interest rate differential may not affect exchange rate differential as indicating in International Fisher Effect for the case of Vietnam and 12 research nations.

From the two hypotheses, our research team develops the following conceptual framework.

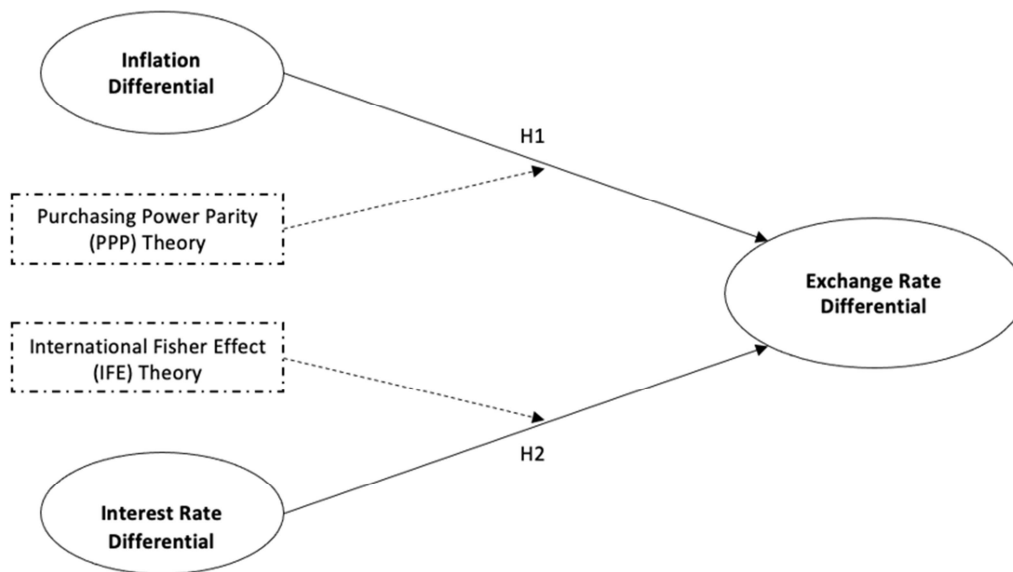


Figure 1. Conceptual Framework.

3. Methodology

3.1. Data Collection

The two most popular research methodologies are quantitative and qualitative. To generate perspectives and hypotheses, qualitative research makes use of focus groups, in-depth interviews, group interviews, observation, and secondary research. The precise and objective measurements produced by quantitative research, in contrast, are utilized to quantify hypotheses through numerical and statistical analysis [17].

Both qualitative and quantitative research methodologies are used in this study. Prior research and theoretical underpinnings are used as a starting point for information gathering, subsequently followed by the creation of a conceptual framework and the gathering of real-world data from dependable sources like the World Bank and Macro Trends. In qualitative research, hypotheses are developed considering all data that have been gathered, including secondary data from earlier studies and theoretical underpinnings. The links between the variables are then illustrated through a conceptual framework. Overall, all hypotheses are tested using the quantitative approach. Before making final judgments and suggestions, the raw data is reviewed and evaluated. These findings and recommendations

might be useful tools for further study and comprehension.

This study uses secondary data sources, specifically the inflation and interest rates in 12 trading partners and Vietnam, which were obtained from the websites of the World Bank (WB) and the State Bank of Vietnam (SBV), respectively, at www.worldbank.org and www.sbv.gov.vn. The notion of purchasing power parity and the global Fisher effect is more accurate when examined over a long period of time, which is why the study includes historical data from the exchange rates, inflation rates, and interest rates in Vietnam with research nations. The historical data on the quarterly currency rates, inflation rates, and interest rates from January 2000 to December 2022 thus make up the sample population for this study. To evaluate the relationship between the interest rates, inflation rates, and exchange rates in these two nations as well as to assess the applicability of PPP and IFE theories in the context of Vietnam and 12 trading companions, the study used multiple linear regression analysis techniques.

3.2. Research Design

This study focuses on three variables, namely the inflation differential and interest rate differential between China and Vietnam, serving as independent variables (X_1 and X_2), and the percentage change in the value of Chinese Yuan relative to Vietnamese Dong on a quarterly basis, serving as a dependent variable (Y).

Table 1. Variable, Concepts, and Measurements.

Variable	Concept	Measurements	Denotion
Exchange rate Differential (Y)	The rate at which one currency is valued in relation to another. (Moffett et al., 2009)	$Y = \frac{e_n - e_{n-1}}{e_{n-1}}$	e_n = exchange rate of Vietnam with each country in period n e_{n-1} = exchange rate of Vietnam with each country in period $n-1$
Inflation Rate Differential (X_1)	The country's higher price of a particular group of goods (Mankiw, 2006)	$X_1 = I_h - I_f$	I_h = Inflation rate of Vietnam – home country I_f = Inflation rate of foreign country
Interest rate Differential (X_2)	Real interest rates, risk premiums, transaction expenses associated with credit payments, and inflation premiums are all types of interest rates (Madura, 2020)	$X_2 = i_h - i_f$	i_h = Interest rate of Vietnam – home country i_f = Interest rate of foreign country

Theory	Statistical Formula	Denotion
Purchasing Power Parity	$Y = a_0 + a_1(X_1) + \mu$	a_0 : constant; a_1 : slope coefficient; μ : error term
International Fisher Effect	$Y = a_0 + a_1(X_2) + \mu$	

3.3. Analytical Process

The objective of this research is to test the PPP theory and IFE theory by analyzing three variables, namely the inflation differential and interest rate differential between 12 nations and Vietnam as independent variables (X_1 and X_2), and the percentage change in the value of Chinese Yuan relative to Vietnamese Dong on a quarterly basis as the dependent variable (Y). To ensure the accuracy and reliability of our analysis, we have adopted a series of steps.

Initially, we perform classic assumption tests to verify the normality of our data, which is a critical step to ensure that our data meets the prerequisites for further analysis. Subsequently, we examine multicollinearity, which denotes high correlation between independent variables, a condition that can cause unstable estimates and unreliable results, if present.

We also evaluate heteroskedasticity and autocorrelation, which are issues related to unequal variance of errors and correlation between errors, respectively. These issues can lead to biased and inefficient estimates, and can compromise the accuracy of our regression results, thus necessitating their examination and remediation if detected.

Finally, we conduct a multiple linear regression analysis, including the t-test to establish the significance of the coefficients of the independent variables and their impact on the dependent variable. This is a critical step in testing the PPP theory and IFE theory, which predict the relationship between exchange rates and inflation and interest rate differentials.

4. Data Analysis and Findings

4.1. Classic Assumption Test Results of Normality Test

If a normality test produces a plot of data that follows diagonal lines, it indicates that the regression model of the data conforms to a normal distribution. Thus, the normality test results, which depict the spread of plotted data following diagonal lines, suggest that this regression model conforms to a normal distribution, as expected. It is important to note that a normality test is a crucial step in statistical analysis as it enables the assessment of whether a given data set is normally distributed or not, which is essential for drawing meaningful conclusions from the data.

Normal P-P Plot of Regression Standardized Residual
Dependent Variable: Exchange Rate Differential

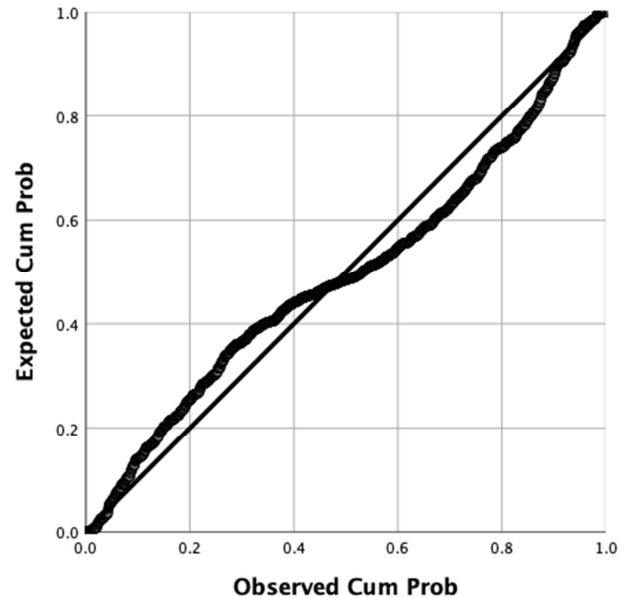


Figure 2. Normality Test Results.

4.2. Multicollinearity Test

The multicollinearity test is a vital step in assessing the correlation between independent variables in regression models. When conducting this test, a tolerance value greater than 0.1 and a VIF value smaller than 10.0 indicates the absence of multicollinearity in the regression model. As seen in Table 2, the tolerance value for X_1 and X_2 is 0.760, which is above the minimum threshold of 0.1. Furthermore, the VIF value for both variables is 1.316, which is below the maximum threshold of 10.0. Based on these findings, it can be concluded that there is no multicollinearity in the regression model. This means that each independent variable is contributing unique and valuable information to the model, rather than duplicating or overlapping with the other variables. Consequently, the research findings and conclusions drawn from the regression analysis are likely to be more accurate, reliable, and valid. It is crucial to interpret the results of the multicollinearity test accurately, as this helps to ensure the reliability and validity of the regression analysis.

Table 2. Multicollinearity Test Results.

Multicollinearity				
Model	t	Sig.	Collinearity Statistics	
			Tolerance	VIF
1 (Constant)	3.474	.001		
Inflation Differential	2.381	.017	.760	1.316
Interest Rate Differential	-2.313	.021	.760	1.316

4.3. Heteroskedasticity Test

When performing the heteroskedasticity test, Figure 2

shows that most data points are located around the point (0,0) with little departure, it suggests there is relatively little heteroskedasticity in the data, indicating a constant variability

of errors across independent variables. However, it is still necessary to conduct a formal heteroskedasticity test to confirm the presence or absence of heteroskedasticity. In this study, the Breusch-Pagan test is used, and the resulting p-value of 0.063 (see Table 2) is greater than the chosen

significance level of 0.05. This indicates the absence of heteroskedasticity in the data, meaning that the variability of the errors in the regression model is constant across all levels of the independent variables, and thus the regression coefficients and standard errors are unbiased.

Table 3. Simultaneous Significance Test Results.

ANOVA ^a					
Model	Sum of Squares	df	Mean Square	F	Sig.
Regression	146.637	2	73.318	3.700	.063 ^b
Residual	21818.436	1101	19.817		
Total	21965.072	1103			

a. Dependent Variable: Exchange Rate Differential

b. Predictors: (Constant), Inflation Rate Differential, Interest Rate Differential

4.4. Autocorrelation Test

Table 4. Autocorrelation Test Results.

Model Summary					
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.082 ^a	.007	.005	4.45162%	2.272

a. Dependent Variable: Exchange Rate Differential

b. Predictors: (Constant), Inflation Rate Differential, Interest Rate Differential

The Durbin-Watson test is a statistical test used to detect the presence of autocorrelation, which is the correlation between successive residuals in a time series or regression model. The test produces a test statistic, "d," that ranges from 0 to 4. A value of 2 indicates no autocorrelation, values less than 2 indicate positive autocorrelation, and values greater than 2 indicate negative autocorrelation.

The Durbin-Watson test statistic value of 2.272 in Table

3 indicates that there is little negative to no autocorrelation present in the data. This result is acceptable as the value is close to 2. Consequently, the ordinary least squares (OLS) regression model can be considered reliable and valid for making accurate statistical inferences about the relationship between the dependent and independent variables.

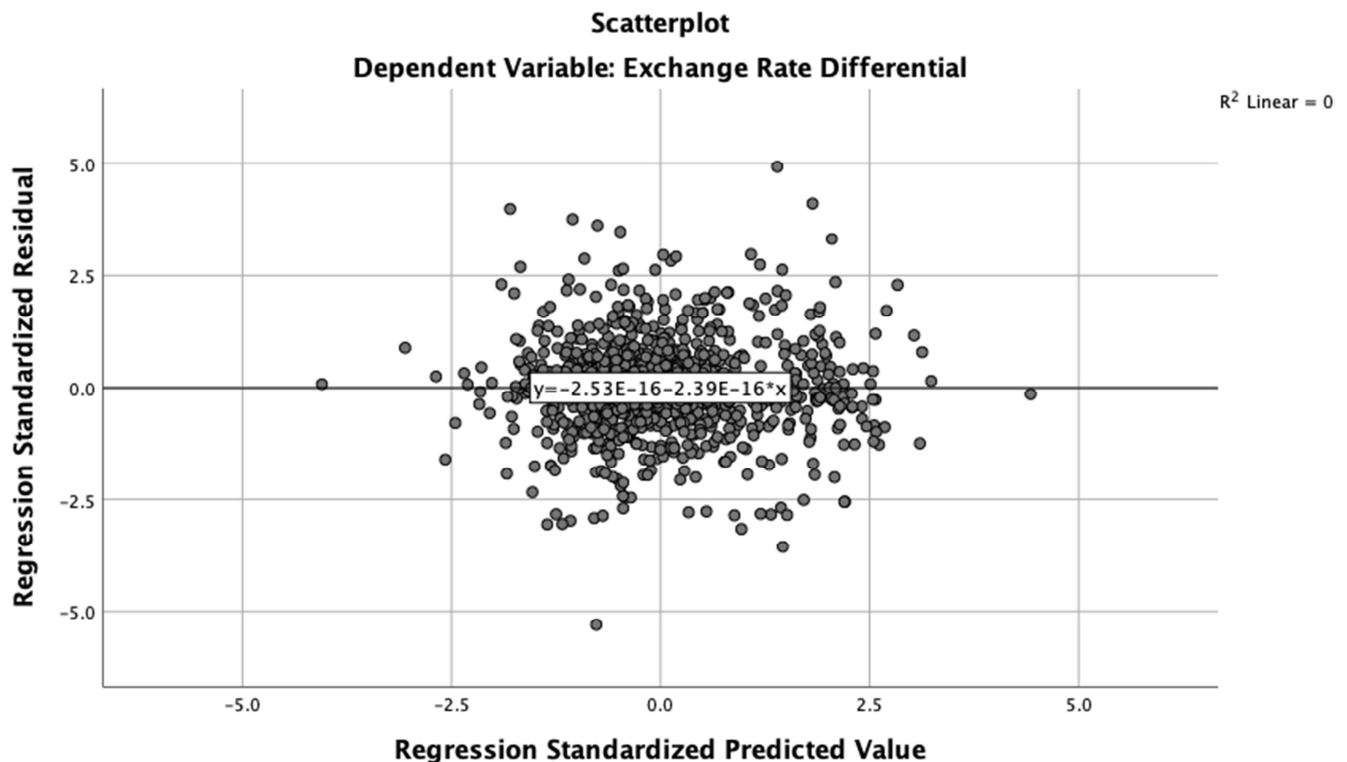


Figure 3. Scatterplot Results for Heteroskedasticity Test.

4.5. Multiple Linear Regression Analysis Results t-Test (Partial Significance Test)

The multiple linear regression analysis results present the relationship between the dependent variable and two independent variables, namely, inflation differential and interest rate differential. The unstandardized coefficients show the change in the dependent variable for a one-unit change in each of the independent variables, holding other variables constant. The results in Table 4 indicate that neither the inflation differential nor the interest rate differential has a significant effect on the dependent variable, as both their p-values are greater than the chosen level of significance (0.05). The coefficients for both

independent variables are not significantly different from zero, and thus, there is little evidence to suggest that the independent variables have a significant effect on the dependent variable. Additionally, the standardized coefficients (Beta) for both independent variables are small, indicating that they have a relatively weak relationship with the dependent variable.

Overall, the results of this multiple linear regression analysis suggest that the independent variables (inflation differential and interest rate differential) do not have a significant relationship with the dependent variable (exchange rate differential), which is supported by the partial regression plots as shown in Figure 4 below.

Table 5. Partial Significance Test Result Coefficients.

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
(Constant)	.753	.217		3.474	.001
1 Inflation Differential	.076	.032	.082	2.381	.017
Interest Rate Differential	-.080	.035	-.080	-2.313	.021

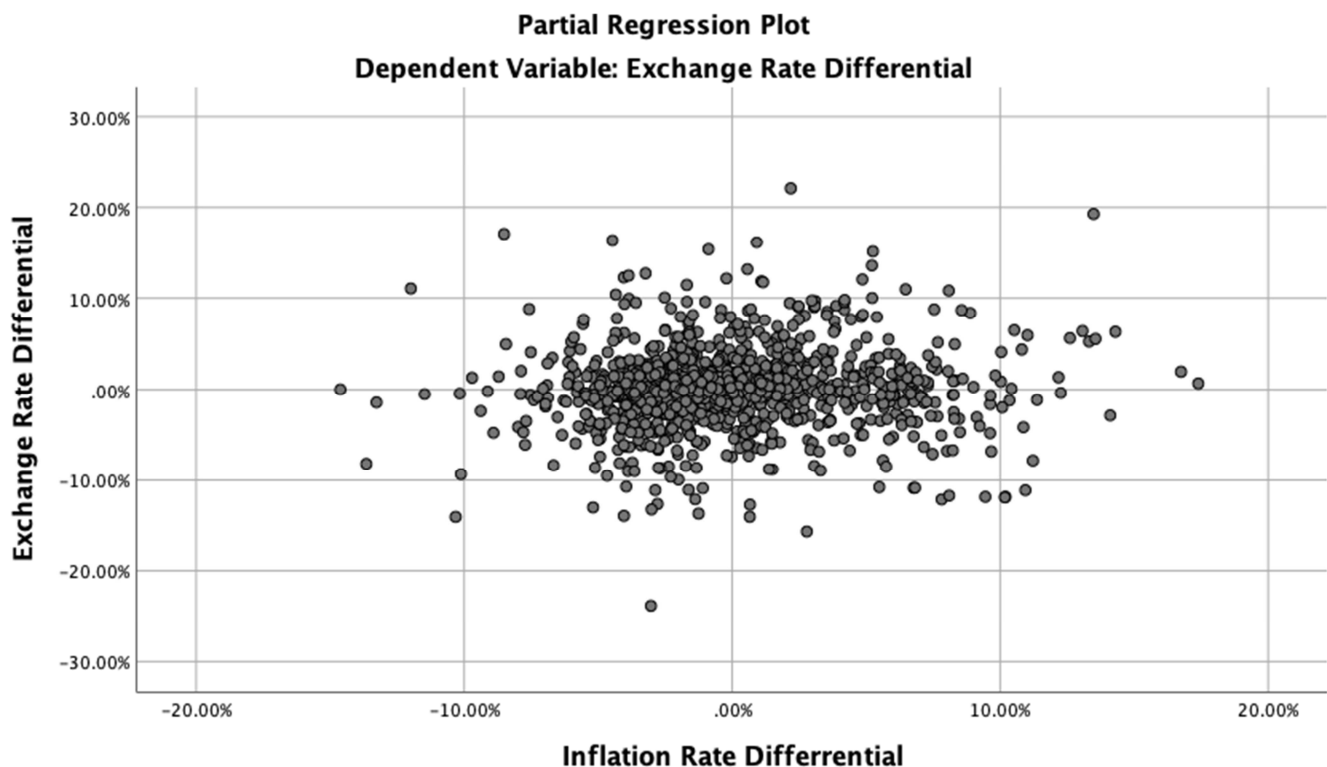


Figure 4. Partial Regression Plot for PPP Theory.

4.5.1. Coefficient of Determination

The results presented in Table 3 also indicate that the coefficient of determination in the regression model is 0.007, meaning that only 0.7% of the variation in the dependent variable (Y) can be attributed to changes in the independent variables (X1 and X2), which represent the

inflation rate differential and interest rate differential, respectively. It can be concluded that a small percentage of the movement in the value of the other currencies relative to the Vietnamese Dong can be explained by changes in these two variables, while the remaining 99.3% is influenced by other factors.

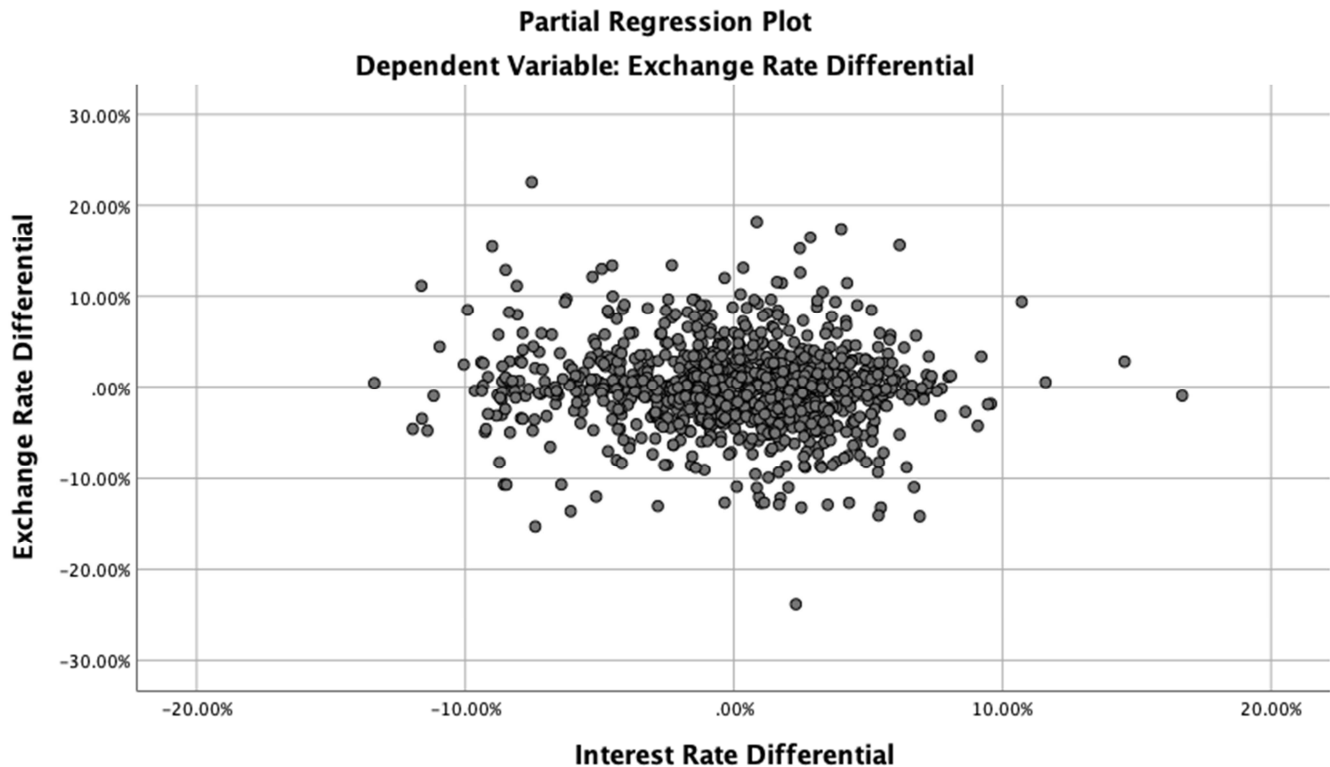


Figure 5. Partial Regression Plot for IFE Theory.

4.5.2. A Multiple Linear Regression Model

The findings presented in Table 5 depict the results of the multiple linear regression equation utilized in this study, which is represented as $Y = 0.753 + 0.076X_1 - 0.080X_2 + \mu$. The output suggests that a 7.53% increase in the percentage change of the Chinese Yuan exchange rate relative to the

Vietnamese Dong (variable Y) is expected if there are no alterations in the inflation differential and interest rate differential (variables X1 and X2). And, a unit increase in the inflation differential and a unit decrease in the interest rate differential are associated with a 7.6% and 8.0% change in the exchange rate differential, respectively.

Table 6. Multiple Linear Regression Model Result.

Coefficients			
Model	Unstandardized Coefficients		Standardized Coefficients
	B	Std. Error	Beta
(Constant)	.753	.217	
1 Inflation Differential	.076	.032	.082
Interest Rate Differential	-0.080	.035	-.080

Therefore, H1 and H2 is supported. However, it is important to note that the analysis is only as good as the data and assumptions underlying it, so further investigation and potential modifications to the model may be necessary to fully understand the relationship between these variables.

4.6. Discussion

4.6.1. PPP Theory Does Not Hold True in the Case of Vietnam

Based on the analysis, it was discovered that the ratio of Vietnam's inflation rate to its 12 partner nations' inflation rates throughout the interest period had no effect on the exchange rate from Vietnamese Dong to those countries' currencies. It means that it is not probable that the purchasing power parity theory is applicable in these cases of exchange rate. Only if the domestic-to-international inflation ratio is

significant and positively directional can the purchasing power parity principle be used.

The conclusion that the notion of purchasing power parity (PPP) does not hold in this context may be drawn from the analysis of the exchange rates, inflation rates, and interest rates between these countries. The structural discontinuities in the data may have impacted the viability of the PPP theory, which is in line with the conclusions of the study by Bahmani-Oskooee and Saha on the US [3]. Furthermore, while the results of the Lo and Rogoff studied on the US and China supported the PPP's long-term validity, they also acknowledged the theory's short-term aberrations [18]. The same is accurate for this scenario, where the discrepancy in inflation rates between countries does not significantly affect the exchange rate between 2000 and 2022.

The concept of purchasing power parity may not always

hold because there are other variables that can influence the exchange rate [19]. These variables include the level of national income, the relative interest rate, and governmental control. Even when inflation is higher than desired, relative interest rates can influence currency demand, leading to an increase in value. The level of national revenue in a nation can also have an impact on the value of its currency. Exchange rates may be subject to government regulation, which would prevent excessive inflation from having much of an impact on them. Although the idea of purchasing power parity concentrates on the connection between inflation and exchange rates, excessive spending can also be a cause of inflation.

4.6.2. IFE Does Not Hold True in the Case of Vietnam

The Fisher effect theory, which contends that variations in interest rates between two nations have an impact on currency rates, is disproved, according to the study's research of Vietnam - China exchange rates from 2000 to 2022. As a corollary, the interest rate parity model is ineffective as a primary predictor of exchange rates. The analysis refutes Adam's earlier findings, which claimed that interest rate ratios had a favorable impact on the exchange rate between countries. Yet it is vital to remember that variations from the International Fisher effect might endure because of things like transaction costs, political risks, and governmental regulations [20].

The International Fisher Effect (IFE) is frequently used to forecast changes in exchange rates [21]. They did point out, though, that there are two key reasons why the IFE might not always be trustworthy. The interest rate during arbitrage transactions, which reflects the difference between the buying and selling rates, is often larger when borrowing than when lending. The foreign exchange market also features different purchasing and selling rates, which drives arbitrageurs to buy currency at a higher selling rate and sell it at a lower buying rate. Second, the IFE hypothesis can also deviate due to capital controls implemented by the government. For a multitude of macroeconomic reasons, governments might impose capital flow restrictions, which could cause exchange rates to move contrary to what IFE forecasts.

5. Limitations and Future Studies

5.1. Limitations

Our study has some drawbacks. First and foremost, this study uses a quantitative research approach and only uses secondary data that was gathered from trustworthy websites. The accuracy and completeness of the data cannot be guaranteed, even though these data providers have a great reputation. As this analysis is based on historical data from the years 2000 to 2020, it might not be appropriate to the current or future state of the market. Additionally, the study excludes other potential influences on the exchange rate, such as political and economic developments, and instead only considers how inflation and interest rates affect the exchange rate between Vietnam and other countries. Finally, the study

makes no attempt to analyze how exchange rate swings affect other economic measures like exports, imports, and foreign direct investments, which may be important for comprehending the overall economic situation among nations.

5.2. Future Studies

To acquire a more thorough understanding of the exchange rate behavior between Vietnam and different countries, future studies may think about extending the scope of the research by considering additional factors including trade flows, political stability, and exchange rate volatility. By evaluating the subjective opinions and experiences of market participants, policymakers, and other important stakeholders regarding the exchange rate movements in this region, a qualitative study may also supplement the conclusions of this quantitative analysis. Future research may also examine the applicability of various theoretical frameworks to shed light on the behavior of the exchange rates, such as the monetary model or the balance of payments model. Advanced econometric methods, including time-varying parameter models and machine learning algorithms, may also be used by researchers to identify potential nonlinearities and intricate correlations between the variables of interest.

6. Managerial Implications and Conclusion

In conclusion, this report aimed to investigate whether the Purchasing Power Parity (PPP) theory and the International Fisher Effect (IFE) hold between Vietnam and 12 partner countries. Our analysis of exchange rates, inflation rates, and nominal interest rates over 92 quarterly data points suggests that neither the PPP theory nor the IFE holds in this case.

Our findings indicate that there are factors beyond inflation rates and nominal interest rates that influence exchange rates, such as political stability, economic growth, and trade policies. Furthermore, our analysis suggests that the real exchange rate between Vietnam and listed nations are affected by factors such as productivity and wage differentials.

It is important for policymakers and investors to be aware of the limitations of relying solely on PPP and IFE theories when making decisions related to exchange rates and international investments. Further research could be conducted to investigate the factors that influence exchange rates between countries, and to explore the implications of these findings for economic policy and investment decisions.

The findings of this report have important implications for policymakers and investors who rely on the Purchasing Power Parity (PPP) theory and the International Fisher Effect (IFE) to predict exchange rates and make investment decisions. The results suggest that these theories may not hold in all cases and that other factors, such as political stability, economic growth, and trade policies, may also influence exchange rates.

Therefore, it is important for policymakers and investors to consider a wide range of factors when making decisions related to international investments and exchange rates. This

includes analyzing economic indicators beyond just inflation rates and nominal interest rates, as well as considering factors such as productivity, wage differentials, and political stability.

Additionally, further research could be conducted to explore the implications of these findings for economic policy and investment decisions and to identify alternative theories and approaches to predicting exchange rates. By taking a more comprehensive and nuanced approach to analyze exchange rates, policymakers, and investors can make more informed and effective decisions, ultimately contributing to the overall economic stability and growth of their respective countries.

Overall, this report contributes to the ongoing debate regarding the validity of PPP and IFE theories in predicting exchange rates and highlights the importance of considering multiple factors when making economic and investment decisions.

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