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STRUCTURAL EQUATION MODELING OF THE USD/PHP EXCHANGE RATE: AN INTEGRATED ANALYSIS OF GLOBAL RISK AND DOMESTIC FUNDAMENTALS FOR INVESTMENT STRATEGY

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Abstract:
This study evaluates the causes affecting the Philippine currency rate by incorporating global risk and domestic fundamentals into a structural framework. The research, grounded in the Portfolio Balance Approach and the Global Financial Cycle Hypothesis, utilizes Structural Equation Modeling on 252 monthly observations spanning from January 2005 to December 2025. Upon comparison of a saturated primary model with four nested alternatives, Alternative Model 4 was identified as the most robust framework. Empirical findings indicated that the growth rate of Gross International Reserves is the principal determinant of USD/PHP variations, significantly mitigating the influence of the Balance of Payments. The global risk sentiment VIX exerts strong direct pressure, causing peso devaluation during times of heightened market anxiety. The data revealed that the valuation of the Philippine currency is far more responsive to external global mood and central bank reserve management than to domestic liquidity expansion or occasional interest rate changes.

JEL: F31, E52, C38, F32, G15

Keywords: Structural Equation Model (SEM), mediating effects, Portfolio Balance Approach, Global Financial Cycle Hypothesis, USD/PHP, Philippines

1. Introduction

Diversifying an investment portfolio into international currencies and global assets strategically acts as a major safeguard against the depreciation of the Philippine peso (PHP), domestic volatility, and localized geopolitical changes. This strategy improves portfolio resilience by separating wealth from the distinct economic and political risks associated with a singular market or area. While equity performance is the primary long-term driver, foreign exchange fluctuations significantly impact total returns, particularly

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for US dollar-denominated holdings, as they can either enhance or diminish the returns based on the strength of the dollar against other currencies. Between 2015 and 2025, the S&P 500 Index achieved a Compounded Annual Growth Rate (CAGR) of roughly 12.2%, significantly surpassing the PSE Index, which recorded a CAGR of -1.4%. Consequently, this currency tailwind acted as a natural return booster for locally managed portfolios with global holdings, assuming the initial capital was converted from PHP to USD at the start of the investment horizon.

Alongside identifying the primary factors affecting USD/PHP fluctuations, it is essential to analyze the underlying structural connections among these variables. A comprehensive understanding requires more than just monitoring global macroeconomic indicators; it demands an empirical measurement of how these factors interact specifically through mediation. By clarifying these structural paths, the common investor can gain greater conviction in their timing and strategy for currency conversion.

This study is anchored in two foundational theories: the Portfolio Balance Approach (PBA) and the Global Financial Cycle Hypothesis (GFCH).

A. The Portfolio Balance Approach

In contrast to conventional monetary theories that regard domestic and foreign assets as ideal replacements, the PBA asserts that they are imperfect substitutes. This implies that investors do not just look at interest rates but actively balance the specific risks and expected returns associated with holding the Philippine peso versus the US dollar. Although foundational studies validate that the PBA effectively explains exchange rate fluctuations and risk premiums through the active rebalancing of domestic and foreign bonds (Dooley & Isard, 1983; Khan & Abbas, 2015), empirical applications to emerging markets like the Philippine peso reveal that short-term market volatility often overrides these long-term structural equilibriums (Nwafor, 2008).

B. The Global Financial Cycle Hypothesis

Economist Hélène Rey popularized the Global Financial Cycle Hypothesis (GFCH), which asserts that in emerging markets like the Philippines, global risk sentiment frequently supersedes domestic fundamentals. In this view, the monetary policy of center countries like the US creates a "push factor" that can overwhelm local economic conditions. Research demonstrated that US monetary policy dictates global asset pricing and frequently overrides domestic monetary independence (Miranda-Agrippino & Rey, 2020), with these external "push factors" magnifying economic vulnerabilities in emerging markets (Hoek, Kamin, & Yoldas, 2022) and directly driving the cross-border borrowing cycles and risk exposures of Philippine conglomerates (Bagsic, 2024).

This study primarily employs Structural Equation Modeling (SEM) to assess the intricate, multi-channel mechanisms affecting the Philippine currency rate (USD/PHP). The saturated SEM specifies four direct structural paths converging on the USD/PHP, incorporating both direct and indirect effects from the CBOE Volatility Index (VIX), Balance of Payments (BOP), Money Supply 2 (MS2), Inflation Rate (INF), Interest Rate

(INT), and Gross International Reserves (GIR). To facilitate a model-fit evaluation, four alternative nested models were compared against the primary model. The study utilized secondary data spanning from January 2005 to December 2025.

While numerous local studies have explored the relationship between macroeconomic variables and the Philippine exchange rate, few have addressed these complex, interconnected relationships within a comprehensive structural framework.

This study specifically seeks to achieve the following objectives:

1) Examine the immediate effect of global market volatility, as indicated by the CBOE Volatility Index, on the Philippine Balance of Payments.
2) Evaluate the impact of money supply expansion on domestic inflation in the Philippines.
3) Analyze the monetary policy reaction function by assessing the sensitivity of domestic interest rates to variations in the inflation rate.
4) Assess the prediction performance of a saturated Structural Equation Model in comparison to simpler nested alternatives to ascertain whether the incorporation of financial, monetary, and external channels effectively reduces omitted variable bias.

2. Literature Review

2.1 Global Volatility and BOP Dynamics on Currency

The research conducted by Ginwal (2025) demonstrated that volatility shocks systematically induce reversals in the financial account of the balance of payments when foreign portfolio investments withdraw from the domestic market, thereby depleting foreign exchange reserves. Interestingly, the study of Avdjiev, Hardy, Kalemli-Ozcan and Servén (2019) highlighted that sovereign capital flows remain insulated from VIX shocks, meaning the "fickleness" of a country's BOP is almost entirely driven by the private sector's sensitivity to global risk. The heightened global risk aversion reliably predicts a massive "risk-off" contraction in global capital mobility, compelling diverse economic agents to systematically shed foreign risk exposures and repatriate funds, which significantly shrinks both the gross volume and net direction of cross-border investments (Davis, Valente & van Wincoop, 2019; Hashimoto & Krogstrup, 2019; McQuade & Schmitz, 2019).

Rabin and Yeager (1982) determined that balance of payments deficits or surpluses signify discrepancies between the domestic money supply and demand. The result of this imbalance is a stock-adjustment process where the flow of international reserves dictates the future path of the currency. Makin (2005) also confirmed this in his paper “A Monetary Model of Exchange Rate and Balance of Payment Adjustment”, which demonstrated that structural adjustments within the BOP act as leading indicators for currency trajectory. While short-term surges in foreign capital artificially fortify the BOP and strengthen the domestic currency, this temporary improvement masks underlying structural weaknesses and ultimately exposes the economy to long-term macroeconomic vulnerabilities (Bhaduri, 2003; Omari & Ghabon, 2025).

The VIX, as an indicator of global risk perception, influences capital flows in the Balance of Payments, which is the principal mechanism causing volatility and depreciation of the USD/PHP exchange rate in the Philippine market (Cairns, Ho & McCauley, 2007; Bautista & Cruz, 2013). On the other hand, the studies of Guinigundo (2019) and Gürsoy (2025) suggested that global risk shocks from the VIX do not universally dictate local currency movements, as the transmission through the Balance of Payments can be overshadowed or decoupled by domestic factors such as central bank interventions, local Foreign Exchange (FX) liquidity, and country-specific policy frameworks.

2.2 Money Supply, Inflation and Interest Rate Parity on Currency

Benati (2009) discovered a robust, one-to-one link between money growth and inflation throughout significant inflationary episodes by examining cross-spectral coherence across several countries over two centuries. Empirical evidence from Pakistan, South Africa, Malawi and Jamaica demonstrated that excessive money supply growth is a primary, long-term driver of inflation, though its immediate impact fluctuates significantly based on a country's debt levels, exchange rate stability, and underlying economic regimes (Buthelezi, 2023; Kwon, McFarlane & Robinson, 2006; Simwaka, Kabango & Chikonda, 2012; Stylianou, Nasir, Waqas, 2024).

Endres (2020) employed Vector Autoregression and Granger Causality on 204 monthly data points from 2003 to 2019, establishing a unidirectional causality from inflation to the monetary policy rate in the Philippines. Lee (2009) established a significant positive long-run relationship between nominal interest rates and inflation in Singapore. A similar study in Iran by Mahdi and Masood (2011) found a robust long-run relationship where rising price levels and elevated inflation expectations act as highly reliable predictors for tighter monetary policy and higher nominal interest rates. In the US, inflation shocks and survey-based inflation expectations directly shape real interest rates, serving as highly reliable leading indicators for anticipating Federal Reserve policy hikes and subsequent shifts in dollar-denominated bond markets (Clark & Davig, 2008; Darin & Hetzel, 1995).

The analysis of two centuries of macroeconomic data by Lothian (2016) found that although Uncovered Interest Rate Parity often fails as a short-term trading indicator, it serves as a very reliable forecast in the long term. Another study by Mehl and Cappiello (2007) found that while interest rate differentials react proportionately and accurately predict expected dollar exchange rate movements in mature economies, this predictive power is significantly diminished and less reliable when applied to emerging market currencies. The studies by Aziz (2024), Chaboud and Wright (2003), and Egilsson (2019) explored the divergence between interest rate differentials and exchange rates, revealing distinct similarities in how financial markets process interest rates while contrasting heavily with the time horizons and macroeconomic frictions that cause the parity to fail.

Conversely, Alberto, Casanova, Comia, and Tuazon (2010) asserted that although interest rates and inflation are intrinsically connected, the USD/PHP exchange rate is typically more responsive to acute monetary policy shocks than to long-term inflation differentials. Furthermore, Meese and Rogoff (1983) argued that macroeconomic variables have almost zero predictive power for exchange rates in the short run; even with the benefit of hindsight on fundamentals, the models still failed, while Gould and Kamin (2000) concluded that interest rate differentials are poor predictors of currency changes; in the Philippines and other Asian markets, Granger causality tests often show no statistically significant relationship between interest rates and FX moves.

2.3 Gross International Reserves and Central Bank Intervention on Currency

The study by Parcon-Santos (2018) concentrated on six Asian emerging market nations and examined the motivations for central bank interventions in the foreign exchange market, with a special emphasis on financial stability. The findings indicated that central banks have a significantly higher propensity to intervene and deploy their gross international reserves during capital outflow episodes if domestic residents have high cross-border debt exposures. It illustrated that beyond traditional motives, mitigating financial vulnerabilities tied to external debt is a primary driver of reserve management in the region.

Subsequent research uncovered a multifaceted framework: central banks have demonstrated the efficacy of foreign exchange interventions (Adler, Lisack & Johnston, 2015) yet are increasingly contending with the inadvertent repercussions on domestic credit and financial stability (Agénor, Jackson & Pereira da Silva, 2020; Chang, 2018). Research demonstrated that sterilized intervention can transform into an expansionary effect via a bank portfolio channel, given that sterilization bonds are inadequate substitutes for commercial bank loans. This change stimulates domestic credit, fueling a buildup of financial vulnerabilities. Consequently, theoretical proposals are emerging to achieve exchange rate goals without the heavy reliance on hoarding gross international reserves (Basu, 2013).

3. Material and Methods

3.1 Data Presentation and Treatment

This study employed a time-series dataset consisting of 252 monthly observations for each variable, covering the period from January 2005 to December 2025. By incorporating both local factors and external macroeconomic influences, the variables jointly established a strong econometric model adept at capturing bilateral fundamentals and global volatility shocks. Table 1 outlines the specific variable codes, names, units of measurement, and operational definitions employed in this analysis.

Table 1: Variable Identification

Variable Code	Variable Name	Unit of Measurement	Definition
USDPHP	Philippine Exchange Rate	PHP per USD	The monthly average value of one US dollar expressed in Philippine peso.
GIR	Gross International Reserves	USD billion	The total foreign exchange and foreign assets held by the Bangko Sentral ng Pilipinas (BSP).
MS2	Money Supply 2	PHP billion	A broad measure of total readily available cash and checking deposits in the economy, plus savings and time deposits that can be easily converted into cash.
INT	Interest Rate	Percentage	The Target Reverse Repurchase (RRP) is the primary benchmark interest rate representing the rate at which the BSP borrows from commercial banks.
INF	Inflation Rate	Percentage	The year-on-year percentage change in the Consumer Price Index.
BOP	Balance of Payments	USD million	A comprehensive record of all economic transactions (trade, investments, and transfers). between the Philippines and the rest of the world.
VIX	CBOE Volatility Index	Percentage	The monthly average of the market's 30-day forward-looking volatility expectations, derived from S&P 500 Index options and commonly used as a "fear gauge" to measure investor sentiment.

Before performing SEM, an Augmented Dickey-Fuller (ADF) test was conducted to assess the stationarity of the variables. In time-series econometric modeling, the use of non-stationary data can result in spurious regression, yielding deceptive statistical inferences and undermining the model's predictive efficacy. The ADF test serves as a critical preliminary step to determine whether the data series contains a unit root. Furthermore, to appropriately align the datasets and manage the inherent volatility of high-frequency financial market indicators, a specific data treatment was applied. For highly volatile "fast data" specifically the USD/PHP and the VIX, daily observations were aggregated, and the monthly average values were utilized to smooth out short-term market noise. The results of the stationarity tests' initial run were summarized in Table 2.

Table 2: Stationarity Test – Initial Run

Variable	ADF Statistics	p-value	Critical Value 5%	Stationary
USDPHP	-0.8831	0.7935	-2.8732	No
INT	-1.3852	0.5893	-2.8807	No
INF	-2.2415	0.1915	-2.8731	No
BOP	-8.8281	0.0000	-2.8732	Yes
GIR	-1.5848	0.4912	-2.8732	No
MS2	2.5071	0.9991	-2.8737	No
VIX	-2.7193	0.0708	-2.8748	No

The findings of the ADF test initial run revealed a mixed order of integration among the variables. Specifically, the BOP p-value of 0.0000, well below the 0.05 significance level, leads to the rejection of the null hypothesis, confirming that BOP is stationary at raw level, meaning it is integrated of order zero, or $I(0)$.

Table 3: Stationarity Test – Final Run

Variable	ADF Statistics	p-value	Stationary (<0.05)	Post-Treatment
USDPHP	-10.1202	0.0000	Yes	Log difference
INT	-16.8000	0.0000	Yes	First difference
INF	-7.8517	0.0000	Yes	First difference
BOP	-8.8281	0.0000	Yes	Level
GIR	-6.1809	0.0000	Yes	Log difference
MS2	-3.8837	0.0022	Yes	Log difference
VIX	-4.1621	0.0008	Yes	Centered

Subsequent to the preliminary ADF test, particular data treatments were implemented to address non-stationarity. The post-treatment ADF data indicated that all seven variables produced p-values significantly below the stringent 0.05 threshold, so decisively rejecting the null hypothesis of a unit root. Consequently, the dataset is now stationary, which satisfies the core mathematical assumptions of time-series SEM and eliminates the risk of spurious correlations. The results are shown in Table 3.

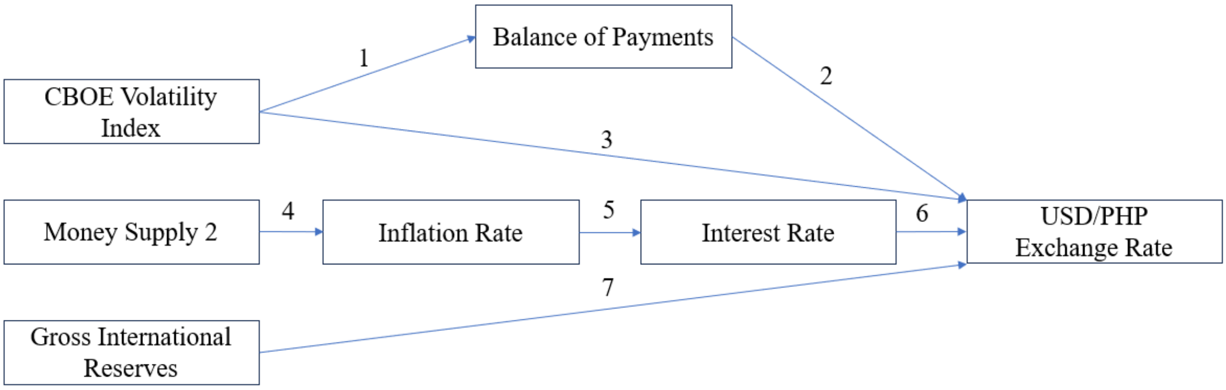
Instead of employing a uniform data transformation, which may lead to excessive differencing and distortion of economic significance, a customized treatment was implemented. Log-differencing was utilized on nominal indicators exhibiting exponential growth patterns (e.g., USD/PHP, GIR, and MS2) to stabilize variance and transform them into month-over-month percentage growth rates. Conversely, standard first-differencing was used for the INT and INF. Since these are already percentage rates and can fall below zero, logarithmic transformation is mathematically invalid; first-differencing smoothly captures their absolute monthly shifts instead.

Finally, the BOP was maintained at its absolute level, as it safely fluctuates around zero between surpluses and deficits. The VIX was mean-centered to a baseline of zero to effectively prevent severe multicollinearity when estimating interaction and moderation effects within the structural paths.

3.2 Primary Model Construction and Structural Paths

This model incorporates the financial channel, wherein global risk sentiment (VIX) and capital flows (BOP) exert external pressure, alongside a local monetary channel that monitors the transfer of liquidity (MS2) through inflation to interest rate policy. Complementing these is the external channel, which positions Gross International Reserves (GIR) as a critical liquidity buffer. By mapping these interconnected paths, the model provides a holistic view of how the USD/PHP exchange rate functions as the ultimate pressure valve, balancing international market shocks against internal policy defenses. The conceptual framework of the primary model is presented in Figure 1.

Figure 1: Conceptual Framework (Primary Model)



For Path 1, the BOP_t is the balance of payments at time t; $\overline{VIX}$ is the sample mean of the VIX, centering ensures that the intercept α_1 represents the expected value of the BOP when global volatility is at average level; β_1 is the path coefficient for Path 1; and ϵ_{1t} for the stochastic error term. The econometric specification is shown in Equation 1:

$$BOP_t = \alpha_1 + \beta_1(VIX_t - \overline{VIX}) + \epsilon_{1t} \quad (1)$$

For Path 4, the ΔINF_t is the first difference of inflation rate at time t; α_2 is the intercept or constant term; β_4 is the coefficient for Path 4; $\Delta ln(MS2_t)$ is the log difference of the money supply at time t; and ϵ_{2t} is the stochastic error term. The econometric specification is shown in Equation 2:

$$\Delta INF_t = \alpha_2 + \beta_4 \Delta ln(MS2_t) + \epsilon_{2t} \quad (2)$$

For Path 5 (Policy Reaction), the ΔINT_t is the first difference of the interest rate at time t; α_3 is the intercept or constant term; β_5 is the coefficient for Path 5; (ΔINF_t) is the first difference of the inflation rate at time t; and ϵ_{3t} is the stochastic error term. The econometric specification is shown in Equation 3:

$$\Delta INT_t = \alpha_3 + \beta_5(\Delta INF_t) + \epsilon_{3t} \quad (3)$$

For Paths 2, 3, 6 and 7, the $\Delta \ln(USDPHP_t)$ is the log difference of the exchange rate at time t which is the ultimate endogenous variable calculated as $\ln(USDPHP_t) - \ln(USDPHP_{t-1})$ representing the period-on-period appreciation or depreciation of the peso; β_2, β_3, and β_6, represent the coefficients for balance of the balance of payments, global market sentiment, and interest rate, respectively; $\Delta ln(GIR_t)$ is the log difference of the gross international reserves at time t; β_7 is the direct effect coefficient for Path 7, representing the central bank's reserve buffer; α_4 is the intercept; and ϵ_{4t} is the stochastic error term. The final econometric specification is shown in Equation 4.

$$\Delta \ln(USDPHP_t) = \alpha_4 + \beta_2(BOP_t) + \beta_3(VIX_t - \overline{VIX}) + \beta_6(\Delta INT_t) + \beta_7 \Delta ln(GIR_t) + \epsilon_{4t} \quad (4)$$

4. Results and Discussion

4.1 The Primary Model

The review systematically followed the conceptual framework to assess the influence of global volatility on the balance of payments, analyzed domestic monetary dynamics from money supply expansion to policy responses, and integrated these factors into the ultimate determinants of the USD/PHP exchange rate.

4.1.1 The Effect of Global Volatility on the Balance of Payments

Presented in Table 4 are the econometric results for Path 1, which evaluated the direct impact of VIX on BOP. The model yielded an $R^2 = 0.000$, F-statistic = 0.015, indicating that standalone fluctuations in VIX account for no discernible proportion of the variance in BOP. The estimated path coefficient for VIX is negative -0.379 but entirely lacks statistical significance, $p = 0.901$. Consequently, the hypothesis that elevated global risk sentiment systematically deteriorates the aggregate Philippine balance of payments is not supported by the data at any standard significance level.

Table 4: Maximum Likelihood Estimates for Path 1 (BOP)

Independent Variable	Coefficient (Standard Error)	Critical Ratio	p-value
Constant	***89.621	3.580	0.000
	(25.033)		
VIX	-0.379	-0.124	0.901
	(3.049)		
Observations	252		
R-squared	0.000		
Adjusted R-squared	-0.004		
F-statistic	0.015		

*** Significance at the 0.01 level; ** Significance at the 0.05 level; * Significance at the 0.10 level.

However, the model's α is highly significant at 89.621, $p = 0.000$. which indicates that when global market volatility operates exactly at its historical average, the expected natural level for the Philippine balance of payments is a baseline surplus of approximately USD 89.62 million. The stationary nature of the BOP at level implies that it remains anchored to this structural mean surplus independently of immediate global risk sentiment shocks. These findings satisfy the first objective of the study.

4.1.2 The Effect of Money Supply Growth on Inflation Rate

Table 5 details the econometric results for Path 4, which modeled the transmission of money supply expansion into domestic inflation dynamics. The estimated model yielded a negligible $R^2 = 0.000$, implying that the logarithmic first difference of MS2 has no explanatory power over the variance in the first-difference of INF. The path coefficient for money supply growth is negative -0.545 but lacks statistical significance, $p = 0.747$.

Table 5: Maximum Likelihood Estimates for Path 4 (INF)

Independent Variable	Coefficient (Standard Error)	Critical Ratio	p-value
Constant	-0.020	-0.516	0.606
	(0.039)		
MS2	-0.545	-0.323	0.747
	(1.689)		
Observations	252		
R-squared	0.000		
Adjusted	-0.004		
F-statistic	0.104		

*** Significance at the 0.01 level; ** Significance at the 0.05 level; * Significance at the 0.10 level.

Furthermore, the model's α is insignificant at -0.020, $p = 0.606$, suggesting that when money supply growth is held at zero, there is no underlying baseline drift or autonomous acceleration in INF. Consequently, at the standard 5% significance level, the data fails to support the hypothesis that expansions in MS2 exert a systematic, contemporaneous impact on the changes in general price levels. The findings satisfy the second objective of the study.

4.1.3 The Policy Reaction Function

Table 6 details the estimates for Path 5, which models the response of interest rates to inflation dynamics. Because both variables were rendered stationary at their first differences, the model specifically evaluates how the change in the inflation rate influences adjustments in the interest rate. The estimated model yielded an $R^2 = 0.012$, F-statistic = 3.094, indicating that shifts in INF account for a marginal 1.2% of the variance in INT changes. However, the path coefficient for INF is positive 0.044 and statistically significant at the 10% level, $p = 0.079$. This suggests a weak but statistically discernible reaction: as INF accelerates, INT are adjusted marginally upward. This dynamic aligns with standard contractionary monetary principles, where rising inflation prompts tightening measures.

Table 6: Maximum Likelihood Estimates for Path 5 (INT)

Independent Variable	**Coefficient (Standard Error)**	**Critical Ratio**	**p-value**
Constant	-0.015	-1.050	0.294
	(0.014)		
INF	*0.044	1.759	0.079
	(0.025)		
Observations	252		
R-squared	0.012		
Adjusted	0.008		
F-statistic	*3.094		

*** Significance at the 0.01 level; ** Significance at the 0.05 level; * Significance at the 0.10 level.

Furthermore, the model's α is statistically insignificant at 0.015, $p = 0.294$. In the context of first-differenced variables, this implies that when INF is stable (i.e., its period-over-period change is zero), there is no autonomous baseline drift or structural tendency for INT to move up or down. Consequently, at the 10% significance level, the data supports the hypothesis that changes in INF exert a positive, albeit modest, systematic impact on INT adjustments. The findings satisfy the third objective of the study.

4.1.4 Determinants of the USD/PHP Exchange Rate

Table 7 presents the estimation results for the capstone structural equation (Equation 4), identifying the core macroeconomic determinants of the USD/PHP exchange rate movements. The overall model is highly significant with an Adjusted $R^2 = 0.163$, $p = 0.000$, indicating that the combined direct effects of BOP, VIX, INT and GIR explain approximately 16.3% of the variance in the percentage change of USD/PHP.

Table 7: SEM Final Equation – Primary Model (USD/PHP)

Independent Variable	Coefficient (Standard Error)	Critical Ratio	p-value
Constant	***0.003	3.005	0.000
	(0.001)		
BOP	0.0000	-1.576	0.115
	(0.000)		
VIX	***0.000	2.831	0.005
	(0.000)		
INT	*0.006	1.879	0.060
	(0.003)		
GIR	***-0.267	-6.510	0.000
	(0.062)		
Observations	252		
R-squared	0.176		
Adjusted	0.163		
F-statistic	***13.189		

*** Significance at the 0.01 level; ** Significance at the 0.05 level; * Significance at the 0.10 level.

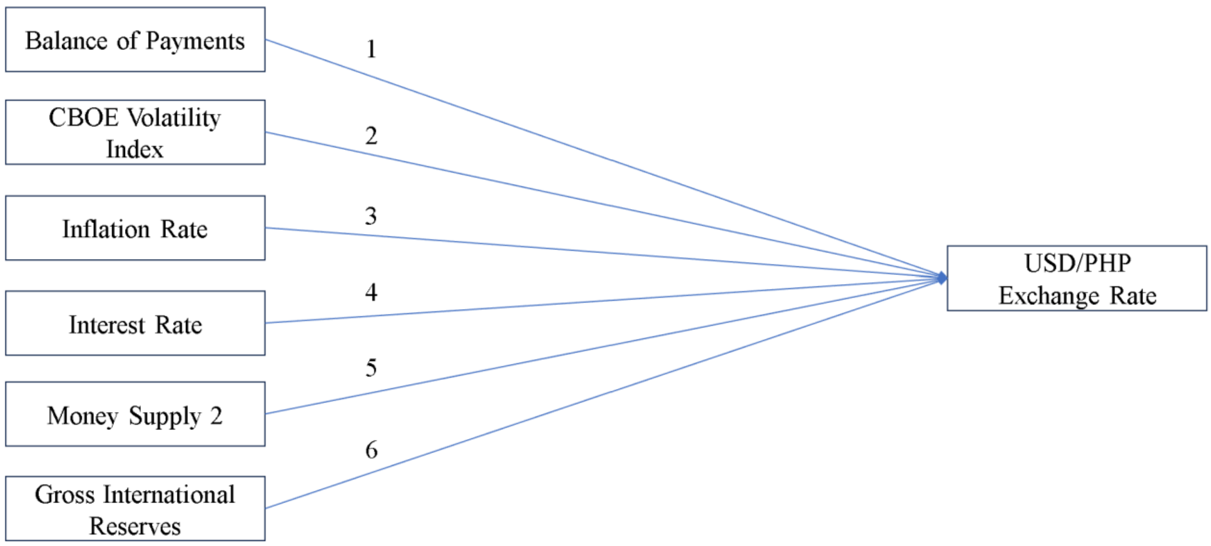
An examination of the individual pathways revealed distinctly varied macroeconomic transmission effects. The direct effect of VIX on USD/PHP (Path 3) is positive and statistically significant $p = 0.005$. Because the VIX was mean-centered prior to estimation, this mathematically validates the prevailing theoretical literature: when VIX rises above its historical average, it directly accelerates the percentage depreciation of the peso (an increase in the USD/PHP rate) as international capital seeks safe-haven liquidity. Conversely, the central bank's reserve buffer (Path 7) exerts a profound, statistically significant negative effect on the exchange rate $p = 0.000$. Given that the GIR variable is expressed in log-differences, this indicates that the growth or accumulation of reserves by the BSP serves as a critical defense mechanism, successfully inducing peso appreciation and mitigating depreciation pressure.

Interestingly, the remaining direct mechanisms (Path 2 and Path 6) exhibit weaker impacts. The BOP failed to show statistical significance $p = 0.115$, indicating that the absolute level of the BOP does not systematically drive the peso's immediate percentage changes. The INT pathway, while missing the standard 5% alpha level, is marginally significant at the 10% level, $p = 0.060$, which suggests that contemporaneous rate hikes often occur alongside peso depreciation, likely capturing the central bank's reactive monetary tightening to defend the currency rather than yield-seeking capital inflows. Finally, the model's intercept is highly significant and positive $\alpha = 0.003, p = 0.000$, which signifies a baseline intrinsic depreciating drift for the PHP against the USD when all underlying explanatory variables are held constant. The findings partially satisfy the fourth objective of the study.

4.2 The Alternative Model 1

Figure 2 illustrates the SEM framework for the Alternative Model 1 that evaluates the simultaneous impact of six key macroeconomic and global sentiment indicators on the USD/PHP exchange rate.

Figure 2: Alternative Model 1



The model indicates that GIR and VIX are the most potent drivers of the USD/PHP exchange rate. A negative log difference in GIR with $p = 0.000$ suggests that a 1% increase in reserve buffers leads to a 0.252% appreciation of the peso, reinforcing the importance of central bank liquidity in maintaining currency confidence. Conversely, the centered VIX exerts a highly significant positive pressure with $p = 0.002$, confirming that as VIX rises above its mean, capital flight toward safe-haven assets triggers a depreciation of the peso.

Table 8: Maximum Likelihood Estimates – Alternative Model 1 (USD/PHP)

Independent Variable	Coefficient (Standard Error)	Critical Ratio	p-value
Constant	**0.002	2.440	0.015
	(0.001)		
INT	*0.007	1.848	0.065
	(0.004)		
INF	*0.003	1.947	0.052

	(0.001)		
BOP	*0.000	-1.680	0.093
	(0.000)		
GIR	***-0.252	-5.883	0.000
	(0.043)		
MS2	0.370	0.995	0.320
	(0.037)		
VIX	***0.000	3.106	0.002
	(0.000)		
Observations	252		
R-squared	0.211		
Adjusted	0.192		
F-statistic	***10.28		

*** Significance at the 0.01 level; ** Significance at the 0.05 level; * Significance at the 0.10 level.

Beyond these primary drivers, the model shows that changes in INF and INT are marginally significant at the 10% level, with rising inflation expectedly eroding the peso's purchasing power. While the BOP level shows a slight supportive effect on the currency, the MS2 growth was found to be statistically insignificant $p = 0.320$ in this model. Overall, with an Adjusted $R^2 = 0.192$, the model successfully explains approximately 19% of the variance in USD/PHP returns, highlighting that Philippine currency movements are currently more sensitive to external sentiment and reserve management than to domestic liquidity expansion.

4.3 The Alternative Model 2

Figure 3 illustrates the Alternative Model 2, a mediation model proposing that the impact of the BOP on the USD/PHP operates both directly and indirectly through the intervening variable of GIR.

Figure 3: Alternative Model 2

The SEM results demonstrated a significant transmission mechanism where the BOP influences the USD/PHP exchange rate growth primarily through the mediation of GIR. Specifically, the path from BOP to GIR is highly significant $p = 0.000$, indicating that capital inflows and trade surpluses directly bolster the nation's dollar reserves. Thus, a 1% increase in GIR growth is associated with a 0.269% appreciation of the Philippine peso (a decrease in the USD/PHP rate). Notably, the direct path from BOP to the exchange rate is statistically insignificant with $p = 0.102$, suggesting that the market reacts more to the BSP actual reserves than to broader BOP headlines.

Table 9: Maximum Likelihood Estimates – Alternative Model 2 (USD/PHP)

Path	Coefficient (Standard Error)	Critical Ratio	p-value
GIR ← BOP	***0.000	3.611	0.000
	(0.000)		
USDPHP ← GIR	***-0.269	-6.287	0.000
	(0.043)		
USDPHP ← BOP	0.000	-1.638	0.102
	(0.000)		
Observations	252		
R-squared	0.164		
Adjusted	0.157		
F-statistic	***24.42		

*** Significance at the 0.01 level; ** Significance at the 0.05 level; * Significance at the 0.10 level.

From a macro perspective, this full mediation effect underscores the central role of reserve management in maintaining local currency stability amidst global volatility. The model's Adjusted $R^2 = 0.157$, $p = 0.000$ suggesting that while other factors are constant, GIR remains the most potent fundamental driver for navigating the USD/PHP trajectory.

4.4 The Alternative Model 3

Figure 4 illustrates the Alternative Model 3, a mediation framework that examines both the direct influence of the VIX on the USD/PHP exchange rate and its indirect effect through the mediating variable, GIR.

Figure 4: Alternative Model 3

With an Adjusted R^2 = 0.171, $p = 0.000$, the combined effects of GIR and VIX explain approximately 17.1% of the variance in the exchange rate's movements. The model revealed a highly significant positive relationship between VIX and USD/PHP, $p = 0.009$, which indicates that when global volatility spikes above its historical mean, the log difference of USD/PHP increases, reflecting a classic "flight to safety" where capital flows toward the USD and depreciates emerging market currencies. Conversely, macroeconomic buffers exert a highly significant negative influence $p = 0.000$, which translates that a 1% increase in GIR is associated with an approximate 0.293% decrease in the USD/PHP exchange rate. As reserve growth accelerates, it signals stronger external liquidity and enhances the central bank's capacity to defend the local currency, effectively easing upward pressure on the pair.

Table 10: Maximum Likelihood Estimates – Alternative Model 3 (USD/PHP)

Path	Coefficient (Standard Error)	Critical Ratio	p-value
GIR ← VIX	***0.000	1.326	0.185
	(0.000)		
USDPHP ← GIR	***-0.293	-7.073	0.000
	(0.041)		
USDPHP ← VIX	***0.000	2.626	0.009
	(0.000)		
Observations	252		
R-squared	0.178		
Adjusted	0.171		
F-statistic	***26.96		

*** Significance at the 0.01 level; ** Significance at the 0.05 level; * Significance at the 0.10 level.

However, the pathway testing whether deviations from average global volatility predict the growth rate of international reserves (GIR ← VIX) is not statistically significant, $p = 0.185$. This lack of significance suggests that global market fear does not have a direct, immediate impact on how the Philippines' reserves fluctuate within the observed periods. Instead, GIR levels are likely driven more by structurally embedded macroeconomic factors such as OFW remittances, BPO revenues, and foreign direct investments. Consequently, GIR does not act as a significant mediating variable between the VIX and the USD/PHP exchange rate in this specific framework. Rather, global volatility and international reserves exert their own independent and direct effects on the currency's valuation.

4.5 The Alternative Model 4

The Alternative Model 4 presents a streamlined structural framework suggesting that the USD/PHP exchange rate is driven by the direct influence of INT, alongside the indirect effect of the BOP as mediated by GIR.

Figure 5: Alternative Model 4

The structural equation model reveals that GIR is the primary significant driver of fluctuations in the USD/PHP exchange rate; thus, a 1% acceleration in international reserve accumulation corresponds to a highly significant 0.273% appreciation of the Philippine peso against the US dollar, $p = 0.000$. Conversely, while the framework tests the direct impact of absolute changes in INT on USD/PHP, this path yields a marginal positive coefficient of 0.005 that lacks statistical significance, $p = 0.119$. This indicates that within this specific structural context, periodic shifts in interest rate policy do not exert a statistically reliable direct influence on the percentage movements of the currency pair.

Table 11: Maximum Likelihood Estimates – Alternative Model 4 (USD/PHP)

Path	Coefficient (Standard Error)	Critical Ratio	p-value
GIR ← BOP	***0.000	3.611	0.000
	(0.000)		
USDPHP ← INT	0.005	1.560	0.119
	(0.004)		
USDPHP ← GIR	***-0.273	-6.557	0.000
	(0.042)		
Observations	252		
R-squared	0.154		
Adjusted	0.147		
F-statistic	***22.66		

*** Significance at the 0.01 level; ** Significance at the 0.05 level; * Significance at the 0.10 level.

Supporting this primary currency dynamic, the model establishes a highly significant antecedent pathway from BOP to GIR $p = 0.000$. Although the unstandardized coefficient approaches zero due to the stark scale difference between nominal BOP figures and percentage growth rates, the strong critical ratio confirms that absolute surpluses in BOP act as a fundamental catalyst for reserve accumulation. The model's Adjusted R^2=0.147, $p = 0.000$, confirming that the indirect transmission mechanism from the BOP, mediated through GIR, provides a robust explanation for Philippine peso valuation dynamics. Overall, this structural framework successfully explains 14.7% of the variance in the USD/PHP exchange rate fluctuations.

4.6 Model Fit Indices Comparison

This table presents a comparative summary of key model fit indices, including CFI, RMSEA, and AIC, across the primary and four alternative structural models to evaluate and identify the optimal framework for the data.

The Comparative Fit Index (CFI) measures the model against a baseline, where values approaching 0.90 or higher indicate acceptable fit, while the Minimum Discrepancy Function (FMIN) assesses absolute fit, with lower values being preferred. To penalize unnecessary complexity, the Root Mean Square Error of Approximation (RMSEA) evaluates the discrepancy per degree of freedom. Furthermore, information criteria such as AIC, BCC, and ECVI rank non-nested models by rewarding parsimony and predictive validity, meaning strictly lower scores are better.

Table 12: Model Fit Comparison: Primary vs. Alternative Models

	CFI	FMIN	RMSEA	AIC	BCC	ECVI
Primary Model	0.601	0.181	0.112	93.490	95.070	0.372
Alternative Model 1	1.000	0.000	0.128	70.000	72.305	0.279
Alternative Model 2	1.000	0.000	0.269	18.000	18.291	0.072
Alternative Model 3	1.000	0.000	0.252	18.000	18.291	0.072
Alternative Model 4	0.891	0.035	0.115	32.693	33.181	0.130

The Primary Model and Alternative Models 1, 2, and 3 demonstrated significant structural flaws, with the Primary Model yielding the weakest theoretical fit, evidenced by a poor CFI of 0.601 and the highest information criteria across the board (AIC = 93.490, ECVI = 0.372). Conversely, Alternative Models 1, 2, and 3 display a CFI of exactly 1.000 and an FMIN of 0.000, which in structural equation modeling typically indicates a saturated or just-identified model with zero degrees of freedom. This artificial perfection is exposed by their severe RMSEA values reaching 0.269 and 0.252 for Models 2 and 3, respectively, revealing a complete lack of parsimony and severe overfitting to the sample data.

Alternative Model 4 emerged as the most robust framework due to the balance of theoretical fit and structural simplicity. It avoided the saturation trap of the other alternatives while delivering a strong CFI of 0.891, representing a massive improvement over the Primary Model. Coupled with a very low FMIN of 0.035 and substantially reduced information criteria (AIC = 32.693; BCC = 33.181), this model demonstrated superior predictive validity and a robust structural fit, making it the optimal choice despite a marginally elevated RMSEA of 0.115. The findings fully satisfy the fourth objective of the study.

5. Conclusion and Recommendation

This study thoroughly assessed the causes affecting the Philippine exchange rate (USD/PHP) by incorporating global risk and domestic fundamentals into a Structural Equation Modeling framework. Through the comparative examination of a saturated primary model and four nested alternatives, Alternative Model 4 emerged as the most robust framework, effectively balancing theoretical fit with structural parsimony. The empirical findings indicate that the value of the Philippine peso is mostly dependent on external liquidity reserves rather than domestic monetary changes. The growth rate of Gross International Reserves is the principal and most influential factor in USD/PHP variations; a 1% increase in reserve accumulation results in a notable 0.273% appreciation of the peso. The analysis revealed a significant indirect transmission mechanism: the Balance of Payments does not directly cause immediate exchange rate fluctuations but serves as a crucial stimulus for GIR accumulation, which in turn stabilizes the currency. Increased global anxiety systematically encourages capital flight to safe-haven assets, resulting in peso devaluation. In contrast, domestic monetary instruments were relatively ineffective in this structural framework; increases in the broad money supply showed no consistent effect on inflation, and occasional changes in domestic interest rates did not produce a statistically significant direct impact on the percentage fluctuations of the exchange rate. The Philippine peso is predominantly influenced by external global sentiment and the BSP's reserve management, significantly overshadowing internal liquidity and interest rate parity considerations.

Furthermore, concentrating a portfolio exclusively in Philippine peso introduces significant systemic risk. Because the peso often devalues during periods of global "risk-off" sentiment or capital flight to safe-haven assets, a peso-focused investor faces a contraction in real purchasing power and heightened volatility that local interest rate adjustments cannot effectively mitigate. Therefore, a strategic diversification into US dollar-denominated assets such as global fixed income or equities is essential. It serves as a critical hedge that offsets the long-term weakness of the peso, preserves global purchasing power against imported inflation, and provides a "negative correlation" buffer that stabilizes the total portfolio value during domestic or regional market downturns.

The subsequent ideas provide pragmatic insights for diverse economic players. Filipino investors and portfolio managers ought to employ the VIX as a primary signal for timing currency conversions, thereby optimizing purchasing power during low volatility times, while prioritizing the observation of global risk cycles and BSP reserve levels over short-term interest rate arbitrage. Regulators and central bank policymakers should prioritize the accumulation of gross international reserves rather than implementing aggressive domestic interest rate hikes as the principal mechanism for exchange rate defense, thereby safeguarding structural dollar inflows such as BPO revenues, OFW remittances, and foreign direct investments. In the corporate sector, importers encounter considerable risks during VIX spikes and should proactively hedge USD payables when the balance of payments is in deficit, and GIR growth decelerates, while exporters ought to scrutinize reserve reports to enhance the conversion of USD receivables prior to abrupt peso appreciation. Future academic research should build upon these structural frameworks by examining specific domestic antecedents to GIR and exploring nonlinear threshold models to determine critical levels of global volatility or reserve depletion that could precipitate exponential peso depreciation.

Conflict of Interest Statement
The author declares no conflicts of interest.

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