

Interrelationships and Dynamics of Asian Currencies: A Comprehensive Analysis of Exchange Rate Trends and Implications for Investment

Chengzhang Xiao

Business and Economics, Monash University, Melbourne, VIC3162, Australia

cxia0027@student.monash.edu

Abstract. This study endeavors to offer a profound insight into the dynamics and interrelationships of Asian currencies vis-à-vis the US dollar. The analysis begins by juxtaposing the macroeconomic and trade backdrops of distinct currency pairs: the Chinese Yuan (CNY) and Singapore Dollar (SGD), the Thai Baht (THB) and Philippine Peso (PHP), the Japanese Yen (JPY) and Korean Won (KRW), and finally the Vietnamese Dong (VND) with the Indian Rupee (INR). These juxtapositions, accompanied by recent trade and economic data, outline the fluctuations in exchange rates against the US dollar. Various angles of exploration unravel the relationships of these currencies with their economic partners – China with ASEAN nations, Japan and Korea with their primary trading allies, and Vietnam and India post the 2008 financial crisis. Moreover, the study showcases how global and regional economic factors impact the monetary conditions of these nations. Subsequent correlation analyses uncover the intricate relationships both amongst these currencies and against the US dollar. Specifically, findings highlight the strong positive correlation between the Singapore Dollar and the Chinese Yuan, and the negative correlations of both the Vietnamese Dong and the Indian Rupee with the Chinese Yuan. The conclusion of this study accentuates the importance of understanding the dynamic relationships and macroeconomic settings of these Asian currencies for both investors and policymakers. Such an understanding offers invaluable guidance and insights for future investment decisions. Moreover, these revelations furnish valuable data and observations for further economic studies.

Keywords: Asian Currencies, Exchange Rates, Correlation Analysis, Macroeconomic Background, Investment Guidance.

1. Introduction

In the dynamic sphere of global finance, fluctuations in foreign exchange markets serve as critical indicators of a nation's economic stability and growth potential. Particularly in Asia, a region marked by a diverse collection of economies ranging from emerging and low-income countries to high-income powerhouses, the oscillations in exchange rates, especially against the robust U.S. dollar, bear significant implications for economic policy and financial stability [1]. Thus, examining the volatility trends in the exchange rates of low and middle-income Asian countries against the U.S. dollar emerges as a crucial scholarly pursuit, promising tangible insights that could influence policy formulations and financial strategies.

The economic milieu of lower and middle-income countries in Asia is characterized by dynamic growth trajectories interspersed with inherent vulnerabilities, often accentuated by their dependency on stronger currencies such as the U.S. dollar. The dominant position of the U.S. dollar in international trade and finance casts a significant influence on the exchange rate dynamics in these nations [2]. Consequently, significant repercussions on trade balances, financial markets, and overall economic health become observable, echoing the "too connected to fail" phenomena that gained prominence following the 2008 global financial crisis [1].

Embarking on this research venture is spurred by several considerations. Firstly, elucidating the underlying patterns and determinants of exchange rate volatility furnishes an invaluable perspective for scrutinizing the economic pulse of these nations, thereby informing policy formulation and investment decisions. This exploration transcends mere economic figures, intertwining with geopolitical narratives and regional economic cooperation agendas that frequently influence the forex

markets substantially. Secondly, this research aims to expand upon recent studies that analyzed intricate network connections in the forex markets, offering an avenue to understand the complexity of these markets and potentially fostering innovations in financial risk management and regulatory frameworks [1].

The significance of this research is manifold. As the Asian region continues to be a focal point in global economic dynamics, being a hub of manufacturing and service sectors, a detailed study on the currency volatility trends would foster a richer comprehension of the economic resilience and vulnerabilities of these nations. Moreover, it facilitates a nuanced understanding of the interplay between macroeconomic variables, policy interventions, and exchange rate dynamics, insights that are vital for policymakers, investors, and other market participants in navigating the volatile terrains of forex markets. Furthermore, this study intends to bridge gaps in existing literature by focusing on the roles and impacts of weaker currencies in the global forex network, an area often overshadowed by a predominant focus on major currencies [1].

In pursuit of these objectives, the research undertakes the construction of a methodological framework that harmonizes traditional econometric approaches with emerging techniques in network theory, striving to delineate a comprehensive view of volatility connectedness in the Asian forex markets. Leveraging the capabilities of R language, the research intends to employ visual analytics techniques to discern patterns and trends more effectively, thereby offering a rich and detailed analysis of the subject matter.

Thus, this scholarly endeavor seeks to contribute a seminal work that not only enriches the academic repository but also fosters a constructive dialogue among policymakers, financial analysts, and market practitioners. By exploring the pulsating dynamics of the Asian forex markets through meticulous data visualization and analysis facilitated by R language, the study strives to craft a narrative that is insightful and pragmatic, directing the discourse towards a more informed, resilient, and vibrant financial future.

In conclusion, this research represents a timely and significant venture, aligning with the urgent need to comprehend the complexities and implications of exchange rate volatilities in the evolving landscape of Asian economies. By integrating a robust economic analysis with innovative methodologies, the study aspires to deliver profound insights and transformative implications for the field.

2. Methodology

2.1. Data Sources and Processing

In this study, we leveraged an extensive data set to scrutinize the currency exchange rate trends of selected Asian countries against the US dollar from 2004 to 2022. This dataset was procured from a reliable source available at Kaggle, a popular platform hosting a wide array of data repositories contributed by a global community of data enthusiasts.

The data range chosen for this research encapsulates a significant era in the global economy, including landmark events such as the 2008 global financial crisis and the outset of the COVID-19 pandemic in 2019. This temporal scope enables a nuanced exploration of different economic phases and offers the possibility of identifying recurrent patterns or trends. During these years, several Asian countries have prominently emerged on the global economic stage, making the analysis of their currency trends vis-à-vis the USD especially relevant for prospective investors.

To embark on a precise and insightful analysis, the initial dataset underwent a meticulous preprocessing stage. Firstly, data entries from countries with considerable gaps or missing values were excluded to prevent inconsistencies in the analysis. Thereafter, the data was refined to monthly averages by calculating the mean exchange rate for each month, streamlining the dataset into a more manageable and analyzable format. This method mitigates daily fluctuations and accentuates broader, more meaningful trends.

Subsequently, individual line graphs were constructed for each country to vividly delineate the trends across the years. These graphical representations serve as instrumental tools in pinpointing periods of significant fluctuations, and can be aligned with major global events to infer potential causative factors.

Further, the countries were grouped based on the similarity of their trends, fostering a systematic approach to the ensuing analysis. This categorization will aid in a detailed examination of correlation studies between countries both within and across distinct categories, unraveling the intricate dynamics of the foreign exchange market in the Asian region.

Through this methodological framework, this research endeavors to establish a robust basis for an in-depth analysis of exchange rate trends, thereby facilitating informed investment strategies grounded in historical data and identified patterns.

2.2. Criteria for Country Selection

To establish a comprehensive analysis of the dollar exchange rates in selected Asian countries, this research delineates specific criteria that guided the selection of representative nations. These criteria are influenced by aspects such as economic volume, trade relations, regional representativeness, and variations in economic systems and policies. This section highlights the countries chosen and the rationale behind their selection based on these criteria:

Economic Volume

In an effort to represent substantial economic volumes in the region, the study incorporates data from China (CNY) and Japan (JPY), nations renowned for their significant economic output and influence in the global financial landscape. The inclusion of these countries provides substantial data points for understanding the macroeconomic factors affecting currency fluctuations in sizable economies.

Trade Relations

Trade dynamics are highlighted through the inclusion of Singapore (SGD) and Vietnam (VND), nations integral to Asian trade networks. Singapore stands as a notable hub for global commerce, and Vietnam has been emerging as a significant player in international trade. Analysis of these nations yields insights into the effects of trade relations on currency valuations.

Regional Representativeness

To portray a comprehensive picture of the region's economic landscape, the research encompasses the economic narratives of India (INR) and Thailand (THB). The steady economic growth in India and Thailand's significant role in Southeast Asia assist in understanding the broader regional influences on currency trends.

Economic Systems and Policy Differences

Addressing the diversity in economic systems and policy approaches within Asia, the study includes data from South Korea (KRW) and the Philippines (PHP). South Korea, with its developed economy, and the Philippines, noted for its growing economic influence, serve as cases for understanding how different economic policies and systems influence currency exchange rates over time.

Through the detailed analysis of the selected nations — China, Japan, Singapore, Vietnam, India, Thailand, South Korea, and the Philippines — the study endeavors to craft a narrative that not only depicts the existing trends in currency exchange rates but also seeks to offer valuable insights for investment strategies, focusing on the intricate dynamics of the Asian financial market. This selection promises a diverse and holistic perspective, aiding in the development of strategies aligned with the region's complex economic framework.

3. Comprehensive analysis

3.1. CNY and SGD

In a comparative analysis of exchange rate trends, both the Chinese Renminbi (CNY) and the Singapore Dollar (SGD) exhibited similar trajectories over the early part of the 21st century. From 2004 to 2015, the CNY witnessed a gradual depreciation against the US Dollar, moving from a rate of 8.27 to 6.202. Subsequent to this period, there was a mild appreciation observed. In a parallel trend, the SGD, during the interval of 2004 to 2013, also experienced a subtle decline against the US Dollar, shifting from 1.687 to 1.249. While the SGD remained relatively stable with marginal fluctuations from 2013 to 2015, there was a discernible upward movement in its value towards the end of 2015.

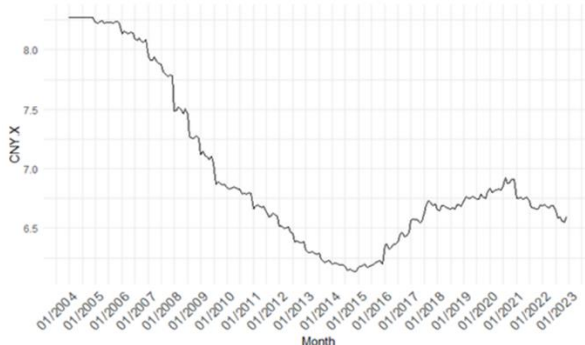


Figure 1. RMB/USD exchange rate 2004-2022

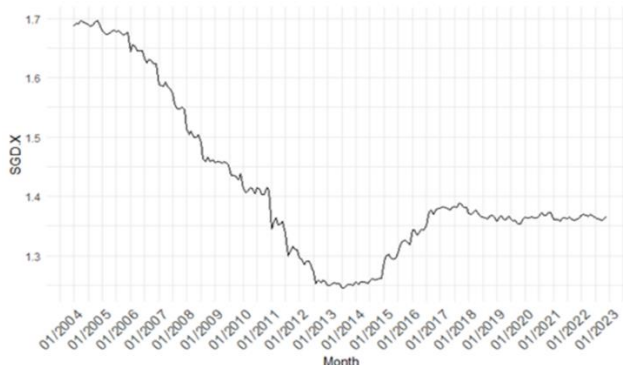


Figure 2. SGD/USD exchange rate 2004-2022

In the timespan between 2001 and 2016, the US-China economic relationship experienced what can be described as its "golden era." This period was characterized by a unique blend of cooperation and competition between the two economic powerhouses. As noted by Peng (2021), during these years, the trade volume between the US and China surged, leading to a tenfold escalation in the trade deficit, reaching an unparalleled state of trade imbalance [3]. This bolstered economic engagement and the resulting trade dynamics are a likely factor in influencing the RMB's appreciation against the USD from 2004 to 2015.

In the context of regional economic dynamics, the interdependence between the Chinese Yuan (CNY) and the currencies of major ASEAN nations is a topic of paramount importance. ASEAN, with a collective economic clout, stands as a primary partner for China in advancing the Belt and Road (B&R) Initiative. An analysis of the trade volume statistics from January 1995 to June 2018 reveals that six of the top ten largest trade partners of China along the Belt and Road were from the ASEAN bloc, including pivotal economies like Vietnam, Malaysia, Thailand, Singapore, Indonesia, and the Philippines [4]. These countries collectively contributed to 46% of the total trade volume between China and the B&R nations by the end of June 2018.

Such extensive economic ties, particularly with Singapore as a major trading partner, could account for the analogous trends observed in the exchange rates of the CNY and the Singapore Dollar (SGD) against the US Dollar. The essence of this interdependence not only offers insights into

currency co-movements but is also instrumental for risk management strategies and central bank interventions, fostering a stable financial milieu conducive for seamless trade and integration. Furthermore, understanding the nuanced shifts in the relationship between the CNY and ASEAN currencies pre and post the initiation of the B&R Initiative provides a clearer perspective on the evolving stature of the RMB in regional currency markets, thereby offering insights to steer regional collaboration towards sustainable and mutually beneficial avenues [4].

3.2. THB and PHP

The Thai Baht (THB) and the Philippine Peso (PHP) also exhibit analogous trends, as depicted in Figure 3 and Figure 4. Over the span from 2004 to 2014, both currencies witnessed a gradual depreciation against the US Dollar. However, a pivotal turning point can be discerned post-2014, which may be intricately linked to the contemporaneous decline in oil prices.

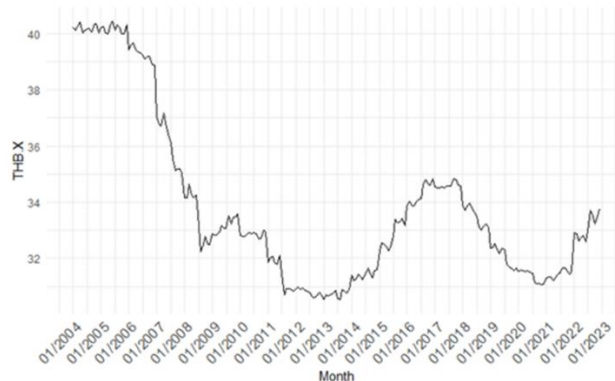


Figure 3. THB/USD exchange rate 2004-2022

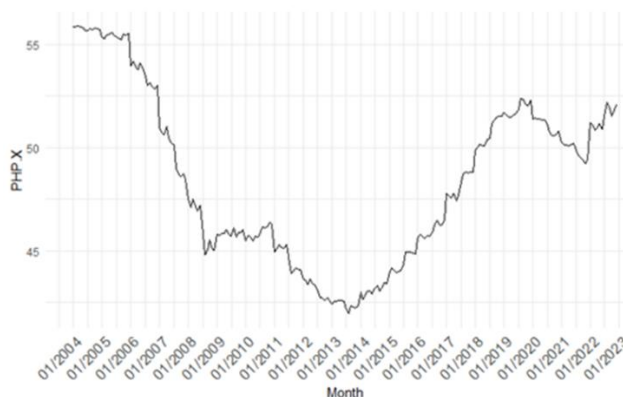


Figure 4. PHP/USD exchange rate 2004-2022

In the latter half of 2014, the global oil market underwent a significant drop in crude oil prices. The West Texas Intermediate (WTI), an essential benchmark for oil pricing, saw its value decrease from 106.2 US dollars per barrel on July 1, 2014, to 53.7 US dollars by the end of December in the same year [5]. Over the next two years, this figure fluctuated between 27.6 and 60.7 US dollars per barrel. Such a stark decline in oil prices coincided with a slight deceleration in worldwide economic growth, from 2.69% in 2014 down to 2.63% in 2015, accompanied by a contraction in the world trade as a percentage of the global GDP.

Within Southeast Asia, particularly in countries like the Philippines and Thailand—integral components of the Association of Southeast Asian Nations (ASEAN)—noteworthy economic shifts became apparent during this period. The Philippines observed a mild decline in its GDP growth from 6.2% in 2014 to 5.9% in 2015, though its foreign trade as a percentage of GDP increased by 1.7% in 2015. In contrast, Thailand's economic growth surged to 2.8% in 2015 from a mere 0.8% in 2014, but its foreign trade relative to GDP dropped by 5.2% when compared year over year [5]. These economic changes, especially when considered against the backdrop of plummeting oil prices, underscore the

complex confluence of global and regional economic factors impacting the monetary conditions of these nations.

3.3. JPY and KRW

The trends observed in the Japanese Yen (JPY) and the Korean Won (KRW) display notable parallels, characterized by sharp depreciations followed by equally pronounced appreciations against the US Dollar. However, the timing of these pronounced V-shaped trajectories in the two currencies differ. The nadir of the JPY to USD exchange rate was reached around 2013, whereas for the KRW, this trough was discerned in 2018.

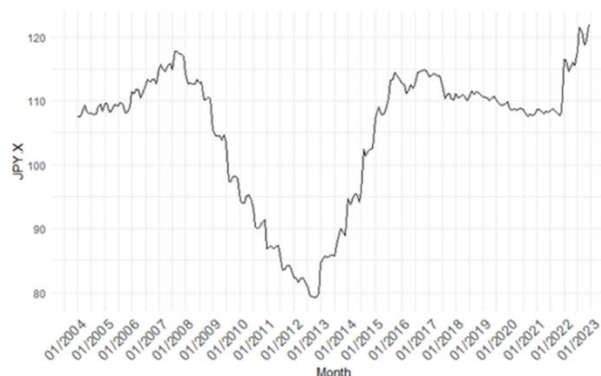


Figure 5. JPY/USD exchange rate 2004-2022



Figure 6. KRW/USD exchange rate 2004-2022

Following the advent of 'Abenomics', the Japanese yen underwent a profound shift, culminating in a rapid depreciation from late 2012 onwards. Theoretically, such a currency devaluation was anticipated to enhance Japan's trade balance. However, contrary to expectations, the country's trade balance didn't exhibit notable improvement even a year post-depreciation onset, stirring concerns about potential erosion of Japanese firms' export competitiveness in global markets [6].

Additionally, while fluctuations in the yen's exchange rate might be anticipated to prompt proportional alterations in export prices, a close inspection divulges a non-linear relationship. For instance, post the Lehman Brothers collapse, Japanese firms heightened their exchange rate pass-through during yen appreciation, yet they adopted pricing-to-market (PTM) behaviors in the face of the yen's depreciation post-2012. This strategic response implies that despite the yen's depreciation, export prices in destination markets remained relatively stable, thereby diluting the positive implications of a weaker yen on trade balances [6].

The substantial depreciation of the South Korean won against the US dollar post-2008 can be attributed to a confluence of economic factors, chief among them being significant capital outflows from the country. Empirical analyses undertaken by Ineichen (2010) provide robust evidence underscoring the pivotal role of capital movements in influencing the won/dollar exchange rate. Specifically, the net outflows in debt securities, predominantly short-term in nature, coupled with net loan reductions and net trade credit flows, were instrumental in exacerbating the depreciation

trajectory of the won. In tandem with these capital flow dynamics, certain domestic financial indicators also played their part. A surge in Korea's money supply, delineated as M2, consistently exerted downward pressure on the won, leading to its depreciation. Conversely, a burgeoning accumulation of foreign exchange reserves tended to counterbalance this trend to some extent, fostering a won appreciation, consistent with conventional economic theory expectations. Hence, the interplay of these capital and monetary forces presents a comprehensive elucidation of the won's pronounced depreciation during this period [7].

3.4. VND and INR

The exchange rates of VND and INR against the US dollar exhibit notable parallels, as both currencies underwent significant depreciation following 2008, as illustrated in Figures 7 and 8. It can be inferred that the profound impacts of the 2008 global financial crisis on both Vietnam and India manifested in their respective foreign exchange rates.

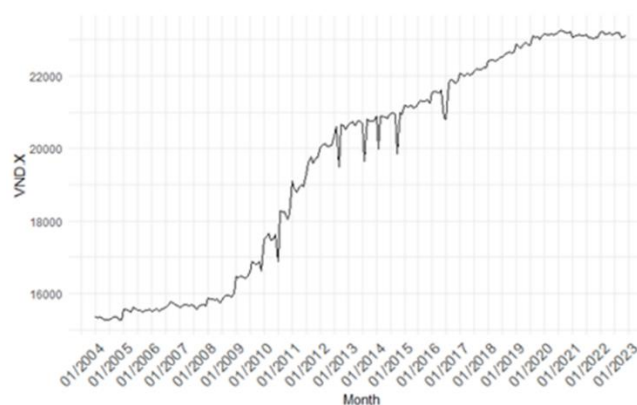


Figure 7. VND/USD exchange rate 2004-2022

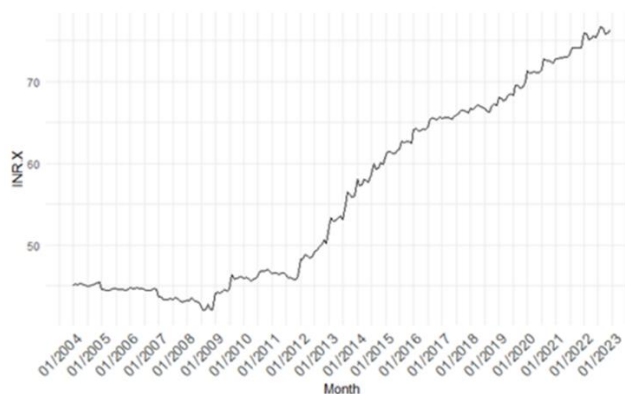


Figure 8. VND/USD exchange rate 2004-2022

In 2007, Vietnam grappled with substantial financial inflows, equivalent to 24% of its GDP. These inflows dramatically outpaced the nation's financing needs for its current account deficit, which stood at 10% of GDP (Riedel, 2009). Consequently, the State Bank of Vietnam (SBV), in line with its policy of pegging the local currency to the dollar, found itself in a position to acquire this excess foreign exchange. This action not only swelled the nation's foreign reserves but also, inadvertently, led to an expansive surge in money and credit supply. As a result, inflationary pressures mounted, culminating in a staggering 30% inflation rate by May 2008 [8].

However, by May 2008, the unsustainability of the mounting trade deficits and inflation rates became glaringly apparent. This sparked a frenzied run on the currency, with a broad spectrum of investors, both domestic and foreign, hastening to exit the Vietnamese Dong and its associated assets. Faced with this exigency, the government swiftly intervened, employing a multifaceted strategy: suppressing black market currency exchanges, sharply increasing interest rates, enforcing stricter administrative controls over credit, and committing to significant reductions in governmental

spending. While these measures managed to temporarily stabilize the exchange rate, steering it back to its official trading band, the latter part of 2008 witnessed the Dong once again being buffeted by depreciation pressures. This time, however, the pressures stemmed from the broader global financial crisis, a force largely beyond the purview of Vietnamese regulatory mechanisms [8].

Following the onset of the 2008 global financial crisis, the Indian Rupee (INR) experienced a significant depreciation. In October 2008, the INR breached the symbolic threshold of 50 per USD, a clear indication of the turbulent market conditions influenced by the global financial turmoil (Srikanth & Kishor, 2012). This downward trajectory of the INR was fueled by multiple factors, including a widening Current Account Deficit (CAD), an escalating oil import bill, substantial redemptions related to External Commercial Borrowings (ECBs) and Foreign Currency Convertible Bonds (FCCBs), diminished capital inflows from Foreign Institutional Investors (FIIs), and the looming sovereign debt crisis in the Eurozone. It's noteworthy that India's foreign exchange operations are heavily USD-centric, with over 96% of its foreign exchange turnover denominated in USD [9]. According to the BIS Central Banks' Triennial Survey in 2010, the Indian foreign exchange market, which witnessed its market share surge from 0.1% in 1998 to 1% in 2010, ranks as the 15th largest globally, boasting a daily average net turnover of USD 27.4 [9]. The dominant role of the USD in India's foreign exchange dynamics underscores the acute sensitivity of the INR to global financial shocks and shifts in USD performance.

4. Correlation analysis

An examination of the correlation matrix presented in Table 1 elucidates several notable interdependencies among the exchange rates of the selected Asian countries.

Foremost, the high positive correlation coefficient of 0.980 between the Singapore Dollar (SGD.X) and the Chinese Yuan (CNY.X) suggests that the movements of these two currencies are almost synchronized. Such a close linkage can be attributed to the tight trade relations between China and Singapore, as well as possibly shared economic dynamics in the region. For instance, Singapore's economy is deeply integrated into the global supply chain, of which China plays a significant role.

Interestingly, the Vietnamese Dong (VND.X) and the Indian Rupee (INR.X) also share a robust positive correlation of 0.930. This is juxtaposed against their respective negative correlations with the CNY.X, with coefficients of -0.779 for VND.X and -0.567 for INR.X. These figures may hint at an inverse relationship between these countries' economic situations and China's, or perhaps differing monetary policies.

The South Korean Won (KRW.X) presents an intriguing dynamic. It shares inverse correlations with the CNY.X (-0.442), SGD.X (-0.384), and THB.X (-0.337), suggesting that certain economic factors pushing these currencies upward might have a downward effect on the KRW. Conversely, KRW.X displays positive correlations with the VND.X (0.543) and INR.X (0.502), highlighting possible shared economic challenges or trade dynamics among these nations.

Table 1. Correlation Matrix of Selected Asian Currencies against the US Dollar

	CNY.X	JPY.X	SGD.X	KRW.X	INR.X	THB.X	PHP.X	VND.X
CNY.X	1.000	0.363	0.980	-0.442	-0.568	0.873	0.752	-0.780
JPY.X	0.363	1.000	0.445	-0.257	0.340	0.470	0.618	0.022
SGD.X	0.980	0.445	1.000	-0.384	-0.532	0.931	0.765	-0.771
KRW.X	-0.442	-0.257	-0.384	1.000	0.502	-0.338	-0.027	0.543
INR.X	-0.568	0.340	-0.532	0.502	1.000	-0.434	0.072	0.930
THB.X	0.873	0.470	0.931	-0.338	-0.434	1.000	0.740	-0.667
PHP.X	0.752	0.618	0.765	-0.027	0.072	0.740	1.000	-0.210
VND.X	-0.780	0.022	-0.771	0.543	0.930	-0.667	-0.210	1.000

Figure 9, which visualizes the scatter plot matrix of these currencies, offers additional insights. By analyzing the scatterplots, one can discern the nature of these relationships – whether they are linear, nonlinear, or display any notable outliers. Some currencies might show a clear linear relationship,

reinforcing the high correlation values, while others might present more dispersed or clustered data points, indicating less predictability.

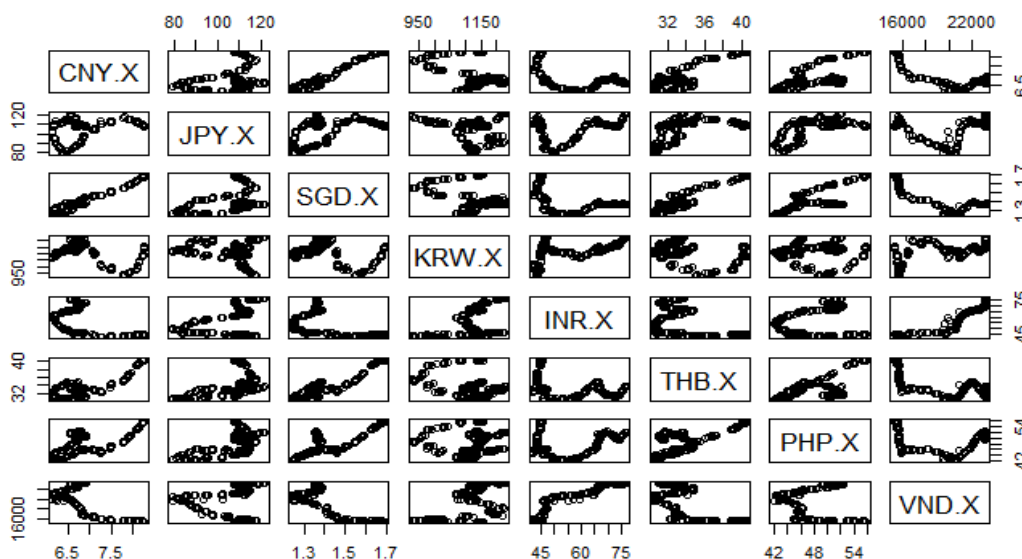


Figure 9. Scatter Plot Matrix of Selected Asian Currencies against the US Dollar

5. Investment Advice

Given the observed interdependencies among the exchange rates of the selected Asian currencies, potential investors should approach the region with a nuanced understanding of the underlying dynamics. The pronounced correlation between the Singapore Dollar (SGD.X) and the Chinese Yuan (CNY.X) suggests that exposure to one might inadvertently mean exposure to the other, given their close economic integration and shared regional economic dynamics. This could render diversification strategies less effective if both currencies are included in a portfolio in significant proportions. Furthermore, the Vietnamese Dong (VND.X) and the Indian Rupee (INR.X) display not only a robust positive interrelation but also negative correlations with the CNY.X. This suggests a possible inverse relationship with China's economic conditions or divergent monetary policies. Hence, investors seeking hedging opportunities might consider a balanced exposure to these currencies, offsetting potential risks inherent to China-centric economic disruptions.

The South Korean Won (KRW.X) presents a unique investment landscape, displaying inverse correlations with several major regional currencies. This characteristic could be leveraged in a strategic portfolio design, utilizing the KRW as a counterbalancing asset in the face of potential downward pressures on other regional currencies. Moreover, the visualization of currency relationships, as highlighted in the scatter plot matrix, underscores the necessity to differentiate between linear and nonlinear correlations, thereby refining investment strategies to account for varied currency response magnitudes.

In summation, while the Asian currency market presents lucrative opportunities, it is paramount that investment decisions be underpinned by a thorough understanding of intercurrency relationships, regional economic dynamics, and potential externalities emanating from global economic events. Such a meticulous approach will ensure not only optimized returns but also minimized exposure to systemic risks inherent in the region.

6. Conclusion

The intricate web of interrelationships among Asian currencies, as evidenced by the analysis, underscores the complex economic and trade dynamics inherent to the region. High correlations, both positive and negative, between specific currency pairs highlight the synchronous and asynchronous economic forces at play. While opportunities abound for discerning investors, a deep understanding

of these dynamics is paramount for risk mitigation. The need for such nuanced comprehension is further emphasized by the varying linear and nonlinear correlations observed. Ultimately, successful investment in this domain necessitates a blend of strategic foresight and informed decision-making, rooted in rigorous empirical analysis.

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