Is Thai Baht a safe haven currency during the Covid-19 Pandemics

Miss Nanapat Chaochavanil

จุฬาลงกรณ์มหาวิทยาลัย
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INDEPENDENT STUDY COMMITTEE

-- Chairman

()

-- Advisor

(Associate Professor VIMUT VANITCHAREARNTHUM, Ph.D.)

-- Examiner

(BOONLERT JITMANEEROJ, Ph.D.)

-- Examiner

(Assistant Professor TANAKORN LIKITAPIWAT, Ph.D.)

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This paper empirically investigates whether or not Thai Baht (THB) is actually one of the safe haven currencies. Moreover, we also extend analysis to see if its safe haven pattern is persistent during the COVID-19 pandemic. We are not only study for THB, but also take into account other traditional well known safe- haven currencies namely U.S. Dollar (USD), British pound sterling (GBP), Euro (EUR), Swiss Franc (CHF) and Japanese Yen (JPY). By investigating between 2010 - 2019, our results do not support the idea that THB is a safe haven currency. Nevertheless, this paper found that for other well-known traditional currencies, EUR exhibits to be the safest currency among the others followed by CHF and JPY. Because when the return of 10-year US treasury yield decreases and VIX Index and TED spread increase, only EUR exhibits safe haven behavior as the value of EUR is significantly strengthen. Moving to different timeframe, during 2020, the result remains the same for THB that it still does not possess safe haven currency role. In this period, the safest currency turns to be CHF and JPY following by EUR, GBP and THB.This paper empirically investigates whether or not Thai Baht (THB) is actually one of the safe haven currencies. Moreover, we also extend analysis to see if its safe haven pattern is persistent during the COVID-19 pandemic. We are not only study for THB, but also take into account other traditional well known safe- haven currencies namely U.S. Dollar (USD), British pound sterling (GBP), Euro (EUR), Swiss Franc (CHF) and Japanese Yen (JPY). By investigating between 2010 -

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This paper empirically investigates whether or not Thai Baht (THB) is actually one of the safe haven currencies. Moreover, we also extend analysis to see if its safe haven pattern is persistent during the COVID-19 pandemic. We are not only study for THB, but also take into account other traditional well known safe- haven currencies namely U.S. Dollar (USD), British pound sterling (GBP), Euro (EUR), Swiss Franc (CHF) and Japanese Yen (JPY). By investigating between 2010 - 2019, our results do not support the idea that THB is a safe haven currency. Nevertheless, this paper found that for other well-known traditional currencies, EUR exhibits to be the safest currency among the others followed by CHF and JPY. Because when the return of 10-year US treasury yield decreases and VIX Index and TED spread increase, only EUR exhibits safe haven behavior as the value of EUR is significantly strengthen. Moving to different timeframe, during 2020, the result remains the same for THB that it still does not possess safe haven currency role. In this period, the safest currency turns to be CHF and JPY following by EUR, GBP and THB.

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1. Introduction

This paper aims to empirically investigate whether or not Thai Baht (THB) is actually one of the safe haven currencies. Moreover, we also extend analysis to see if its safe haven pattern is persistent during the COVID-19 pandemic. In this study, we are not only study for THB, but also take into account other traditional well known safe- haven currencies namely U.S. Dollar (USD), British pound sterling (GBP), Euro (EUR), Swiss Franc (CHF) and Japanese Yen (JPY).

We address 2 questions along the paper.

First, does THB really meet safe haven currency status?

Second, does the status persistent over time during COVID-19 pandemic?

To answer the research questions, we analyze the linkage between the relative value of USD, JPY, GBP, EUR, CHF and THB with respect to the stock market and bond market as well as market liquidity and uncertainty.

In 2019, we all have faced great market turmoil originated from COVID-19 pandemic. The sharp increasing in COVID-19 cases have severely destroyed the global financial markets and caused great market turmoil all over the world. The first COVID-19 case was initially found at the end of 2019 in China, Asia and after that the pandemic spread out to Europe and America. To prevent the spread of this serious outbreak, government in each country

imposed strong regulations and applied social distancing approach. These actions immediately lead to economic shut down and destroy international trade and foreign direct investment in many countries across the world. As a result, the unemployment rate surges significantly and thousand numbers of businesses are permanently closed. Finally, the collapse of economy has an impact on negative gross domestic product (GDP) growth in many countries.

During the outbreak, the financial markets react by the sharp falling in stock prices around the world including Thailand. SET Index was triggered 2 circuit breakers to halt all activities for a while. These were the fourth and immediately followed by fifth circuit breakers in the next day in SET since 2008.

Some practitioners pointed out that COVID-19 has an impact on stock markets more severely than any previous outbreaks that have been occurred. Unsurprisingly, in the amid of stresses, the financial markets turn into risk off mode. Market participants become increasingly more risk averse. A lot of investors, who faced with an unexpected risk and market turmoil, enthusiastically seek for such a safe haven instrument that can store or increase its value during times of high uncertainty such as commodities like gold or foreign exchange which can mitigate their exposure of loss from their reference risky portfolio. As a result, the importance of safe haven currencies has been considered among practitioners and investors.

Some of market participants have also included THB currency as one of safe haven currencies during the stress period. The main reason to support this statement is because Thailand run high level of foreign currency reserves and persistent of current account surplus. These reasons are in accordance with the existing literatures of (Habib & Stracca, 2012), the study finds that fundamental of safe haven is consistent with net foreign assets position and size of the stock market instead of interest rate differentials as prior literature mentioned. Moreover, these reasons are also in line with (Fratzscher, 2009) whose study finds that countries with low foreign exchange reserves, weak current account positions and high direct financial exposure suffer more in term of currency depreciations during the crisis. Furthermore, there are many more reasons behind the idea why THB is considered as safe haven currency during the market uncertainty.

First, Thailand holds large amount of foreign currency reserves. Refer to Bank of Thailand statistics, Thailand's foreign currency reserve keep gradually increasing from 150millions of USD, in 2010 to approximately 245millions of USD by the end of quarter 4, 2020.
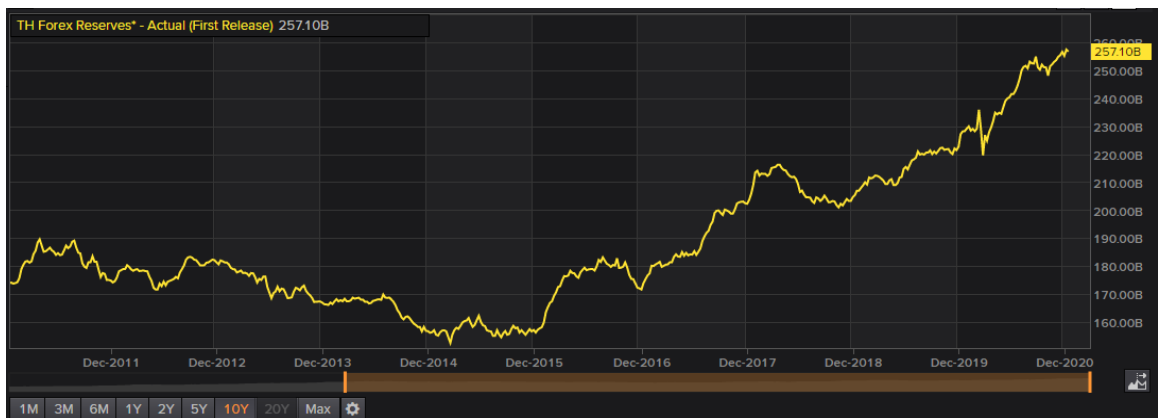
Figure 1. Thailand Foreign Reserve, Source: Refinitiv

Second, although Thailand's current account has been affected by the weak economy from COVID-19 until the current account eventually turns to be deficit at the end of 2020, Thailand still on average has current account surplus since 2010. This is another important reason that help encourage foreign investment into Thailand either direct or indirect investment because of seeing THB as a safe haven currency.

Figure 2. Thailand Current Account, Source: Refinitiv

Another reason is that if we analyze through net international investment position (NIIP) or net foreign asset (NFA) which acts as balance sheet of the country determining whether

the country is net debtors or creditors. The positive number means that the country is a net creditor to other countries and vice versa. We found that Thailand's net foreign asset number is less negative until it becomes first po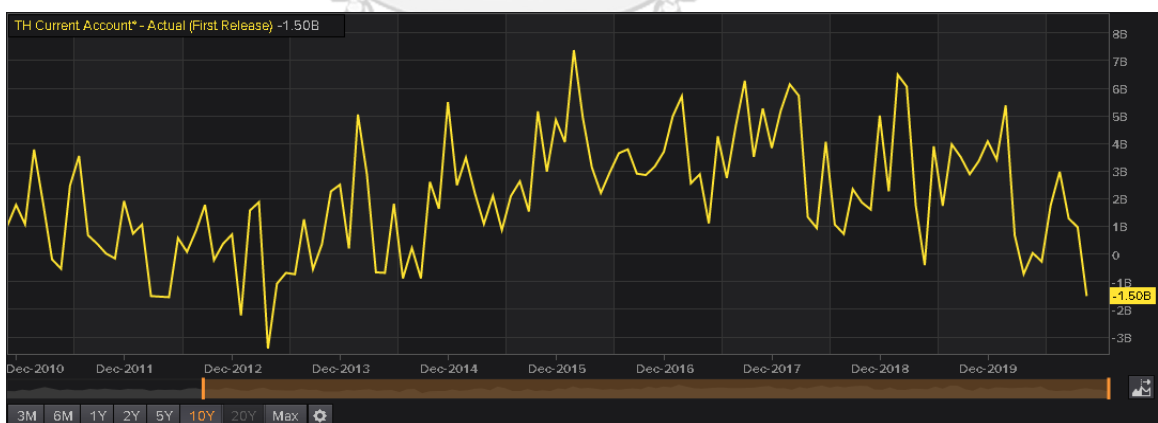sitive in quarter4, 2019. This positive number can be used as one of the good measurements to confirm the stability of Thailand economic outlook.

However, the majority of Thailand's gross domestic product (GDP) heavily relies on exports and tourisms. Based on the current COVID-19 situation from 2019 until now, Thailand has not yet allowed any international tourists coming into the country caused the service account hit negative number eventually. The tightening of mobility restrictions is also likely to have negative impact on Thailand's economic activities. Followed by the second and third wave of COVID-19 outbreaks, the confirmed cases keep rising each day. All these concerns lead to the curious question related to Thailand's economic fundamentals in long run. What if the economy of Thailand is really good enough to make THB continue considering as one of safe haven currencies in the perspective of US investors in the time of high market uncertainty.

2. **Motivation and Contribution**

The main contribution of this paper is to study if THB is actually a safe haven currency by analyzing the relationship between THB plus other well-known safe haven currencies which recognized in the past as safe haven currencies and the market uncertainty, stock

market and bond market as well as the market liquidity in different market conditions. This paper also contributes to many numbers of aspects.

First, nowadays, international trade has played an important role in Thailand's economy for a decade. Moreover, Thailand on average has positive number of trade balance since 1997. There are a lot of market participants both foreign and Thai investors exposed to THB currency risk. Thus, it is important and quite useful to understand THB direction because its value affects investors' returns. As we all know that export sector contributed to a large portion of Thailand's GDP, once they receive revenue in foreign currency, they expose to foreign currency risk at the same time as they need to convert their foreign currency revenue into home currency. Hence, it would be better if they could know THB trend in short term and long term so that they can decide timing to hedge their revenue and cost precisely to enter forward contract or any other derivatives contracts i.e., currency swap contracts, interest rate swap contracts to hedge their revenue and cost denominated in foreign currency today or to wait and see.
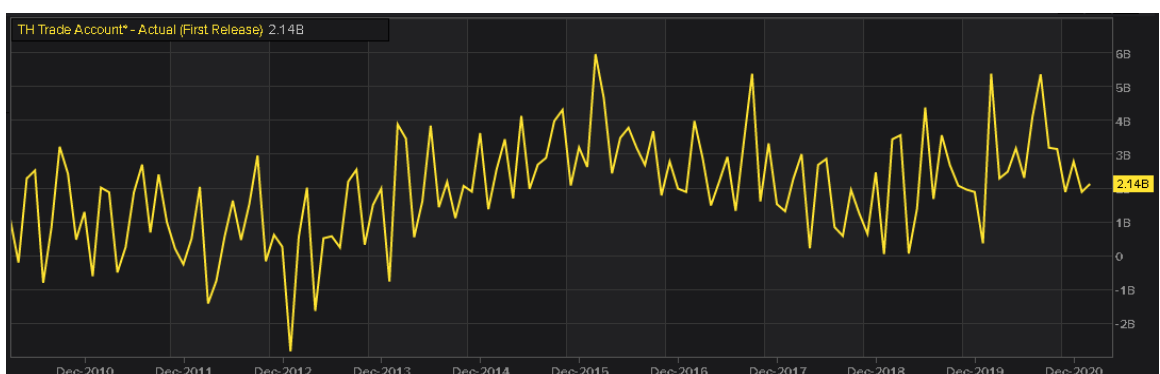

Figure 3. Thailand Trade Account, Source: Refinitiv

Second, even though safe haven currencies have become more popular during the market turmoil and THB has been recognized as one of safe haven currencies in the past year, the studies on safe haven currency that penetrate to THB are not so popular. Moreover, the literature on safe haven currencies is almost rare and hard to find. Thus, this paper aims to empirically investigate on this point.

Third, the definitions of safe haven currency mostly define as a currency in which on average has negative correlation with the reference risky portfolio during the increasing in market uncertainty. Our contribution is that this paper also includes liquidity and risk factors to see the relationship and correlation between the variables. We will show whether liquidity and volatility factor have significant effects on currency or not so that we will get better understanding of some reasons that cause the exchange rate to move.

Last, the time interval in this study covers from 2010 to 2020, which not only offers the most updated dataset compared to other literatures, but this observation period has different market conditions and it has interesting new phenomenon which is the occurrence of COVID-19. This study also penetrates into subperiod in 2020 so that the readers will clearly see the behavior of THB.

3. Literature Reviews

First, according to (Kaul & Sapp, 2006), they investigate the impact of safe haven flow during Y2K event. The paper shows that USD is considered as a safe haven currency.

This is because the quoted bid-ask spread of USD as well as swap points for tenors up to 6 months are the most widen around Y2K event. The reason comes from the effect of inventory positions and market liquidity that causes dealer to widen the spread. The result of the study concludes that safe haven flows can significantly impact market liquidity. Thus, we will further take market liquidity as one of our explanatory variables in this analysis.

Second, (Ranaldo & Söderlind, 2010), using the high-frequency exchange rates over the period 1993-2008, defines safe haven currency as a currency that gives benefits when there is negative exposure to risky assets, in other word, the currency that appreciates when market risks increase. The study shows that the appreciation of CHF and JPY against USD is associated with the decreasing of US stock prices, increasing in US bond prices and increasing in FX volatility. Moreover, they find the evidence which shows safe haven behavior of JPY is more obvious during the global financial crisis period. Furthermore, the study of (Carvalho Filho, 2015), indicates that the CHF and the JPY are the two currencies that on average have risen their value against the USD during risk-off periods. Third, (Coudert et al., 2014) provides the features to be safe haven currencies using daily data of a sample of 26 currencies during the period 1999-2013 that neither the EUR nor the CHF qualify for this role. Only JPY and USD are safe haven currencies while (Hossfeld & MacDonald, 2015) find that only CHF and USD are qualified to be safe haven

currencies. (Cho et al., 2019) , using high frequency data in both good and bad times during 2004-2017 to see the relationship among currencies, FX volatility, equity and bond markets, find that the JPY is the strongest safe haven currency followed by CHF and EUR because CHF, EUR and JPY are the currencies those appreciate when FX volatility and US Treasury bond yields increase. Nevertheless, there is only JPY which sharp appreciates when US stock return decreases.

Lastly, (Fatum & Yamamoto, 2016) states that during global financial crisis, using VIX Index measured, JPY is the safest currency as it is the only one currency that appreciates when the market certainty increases, and the CHF and USD are in the second and third safe currencies respectively. In addition, (Fatum & Yamamoto, 2016) , also investigate Chinese Renminbi (RMB), USD, JPY, GBP and EUR with respect to change in market uncertainty measured by VIX Index, their study find out that as the market uncertainty increases, on average, USD and JPY are safer than Chinese Renminbi (RMB) while GBP and EUR are less safe than Chinese Renmindi (RMB).

4. Data

This paper employs daily data on exchange rate and market uncertainty in which we use VIX Index as a key variable to capture the global risk aversion. This paper also incorporates TED spread to capture market liquidity. The time interval of all daily dataset covers from 2010 to 2020.

First, daily bilateral exchange rates data are collected from Refinitiv. The currencies we consider are included USD, JPY, GBP, EUR, CHF and THB

Second, to measure the market liquidity, this study employs the TED spread which is computed by 3-month USD LIBOR minus 3-month US Treasury bills. For the global risk aversion, we follow the study of (Habib & Stracca, 2012) and many others well known studies to use the VIX Index of Chicago Board Options Exchange (CBOE). The VIX Index is calculated real time from midpoint of S&P500 index call and put options. It represents the market expectation of 30-day forward looking volatility. Thus, it gives the measure of market sentiments. Because the VIX Index is highly correlated with risk aversion, it is well known and acceptable in common to use to measure global risk aversion. Hence, in this paper, we also use the VIX Index as our indicator to capture market uncertainty.

As we can see in Figure 4, the VIX spiked to the highest level in quarter1, 2020 by the time the World Health Organization (WHO) declared COVID-19 to be a pandemic because there are over 110,000 detected COVID-19 cases over more than 100 countries over the world.
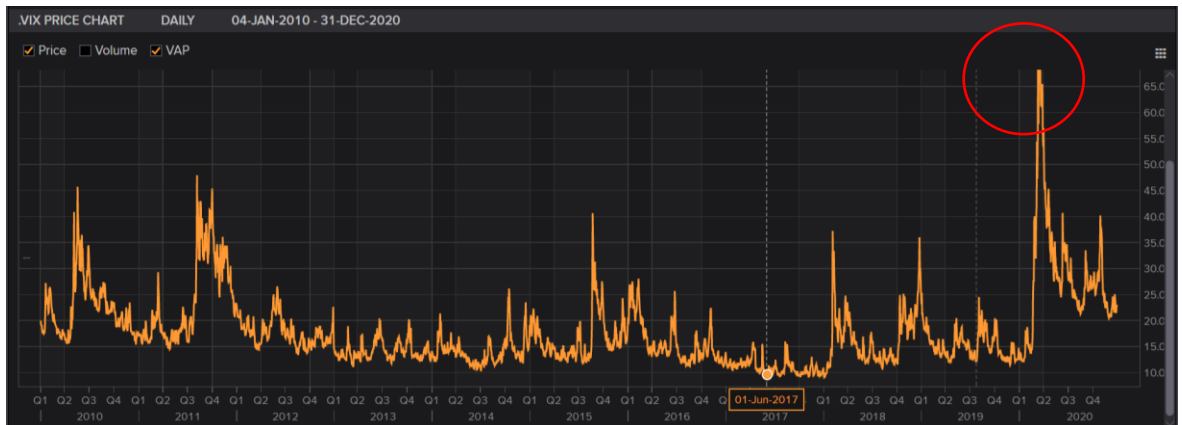
Figure 4. VIX Index, source: Refinitiv

Third, we use Standard & Poor's 500 Stock price Index as a proxy for stock market and
10-year US Treasury Notes is used as a proxy for bond market. All data are collected from
Refinitiv on last price basis.

4.1 Data Descriptive

Table (1): Descriptive statistics of all variables

Variable	Obs	Mean	Std. dev.	Min	Max
$\Delta R_{THB,USD}$	2,748	0.0000399	0.0028967	-0.0162516	0.0134426
$\Delta R_{GBP,USD}$	2,748	-0.0000427	0.0057629	-0.0806783	0.0265973
$\Delta R_{EUR,USD}$	2,748	-0.0000447	0.0055797	-0.0261956	0.030837
$\Delta R_{CHF,USD}$	2,748	0.0000793	0.0069099	-0.0854216	0.1870035
$\Delta R_{JPY,USD}$	2,748	-0.0000229	0.0058129	-0.0341764	0.0386723
$\Delta R_{JPY,EUR}$	2,748	0.0000438	0.0068304	-0.0403097	0.0637686
$\Delta R_{JPY,GBP}$	2,748	0.0000482	0.007589	-0.0399012	0.1293583

$\Delta R_{JPY,CHF}$	2,748	-0.0000696	0.0070763	-0.1492656	0.0823839
$\Delta R_{JPY,THB}$	2,748	-0.0000576	0.0060558	-0.0350494	0.0438658
$\Delta R_{EUR,GBP}$	2,748	0.0000134	0.0052977	-0.020501	0.0623834
$\Delta R_{EUR,CHF}$	2,748	-0.0000996	0.0055007	-0.1747139	0.0774508
$\Delta R_{EUR,THB}$	2,748	-0.0000837	0.0050176	-0.0235979	0.0300224
$\Delta R_{GBP,CHF}$	2,748	-0.0000877	0.0071771	-0.1792644	0.07468
$\Delta R_{GBP,THB}$	2,748	-0.000077	0.0058712	-0.0767764	0.0233785
$\Delta R_{CHF,THB}$	2,748	0.0000382	0.0064179	-0.0823135	0.1563628
ΔS&P500	2,748	0.0004976	0.0110557	-0.1198405	0.0938277
ΔUS-TREASURY	2,748	-0.0000611	0.0305278	-0.2767361	0.4436639
ΔVIX Index	2,748	0.0032544	0.0837012	-0.2957265	1.155979
ΔTED Spread	2,748	0.0031868	0.1142789	-0.6626701	4.976069

Table (1) reports the summary statistics of the variables during 2010-2020. All dataset is

collected from Refinitiv and Bloomberg on daily basis. There are 2,748 observations for

the whole period. The data include the returns on S&P500 (ΔS&P500), returns on 10-year

US Treasury (ΔUS-TREASURY), changes in VIX Index (ΔVIX Index), changes in TED

spread (ΔTED Spread) and the excess returns of various exchange rates ($\Delta R_{A,B}$). For

example, $\Delta R_{THB,USD}$ is the excess return of THB/USD calculated from an appreciation

of THB currency against USD currency plus the interest rate differential between both countries. From all of the dependent variables which are the excess returns of exchange rates, the average excess return of CHF/USD provides the highest value of 0.0000793 with the standard deviation of 0.0069099. Moreover, CHF/USD's Max value is the highest at 0.1870035 compared to other dependent variables. On the other hand, the currency that gives the lowest average excess return is EUR/CHF. Its average excess return is only at -0.0000996 with the standard deviation of 0.0055007 and its max value is at 0.077451. In term of risk, measured by standard deviation, JPY/GBP shows the highest number of 0.007589. As for independent variables, the average mean returns of VIX index show to be the highest at 0.0032544 and 10-year US Treasury gives the lowest average mean returns. However, the gap between Max and Min value of Ted spread is extremely wide. This is due to the high volatility during the Subprime Mortgage Crisis in 2008.

5. Hypothesis Developments and Methodology

The main purpose of this study is to investigate the linkages between the market uncertainty and liquidity as well as the stock and bond market with the relative value of USD, JPY, GBP, EUR, CHF and THB then see how THB performs whether it possesses safe haven behavior or not.

The objective of this paper is to answer 2 questions which are

First, does THB really possess the safe haven currency status?

Second, does the status persistent over time during COVID-19 pandemic?

To answer the research questions, we will empirically analyze the relationship between the relative value of USD, JPY, GBP, EUR, CHF, THB, stock market and the bond market as well as market liquidity.

Thus, we address hypothesis developments as follow.

First hypothesis: Does the excess return of exchange rate is negatively related to the return on stock market during the time of crisis?

We all know that stock market is broadly considered as risky asset thus it should be negatively related with THB if THB possesses safe haven currency. Because when the market is in risk off mode, investors will sell off the risky assets like stock (Return on stock will go down) and buy safe haven assets as well as currencies that caused such a safe haven currency to appreciate.

Second hypothesis: Does the excess return of exchange rate is negatively related to bond yield return during the time of crisis?

Bond instruments are widely recognized by investors as one of the safe haven assets. When there is an economic downturn and investors are risk averse, they will aggressively buy bonds causing bond prices to rise along with the falling on bond yields and THB

should benefit if it is considered as a safe haven currency. Hence, bond yield return and the return on THB should be negatively related.

Third hypothesis: Does the excess return of exchange rate is positively related to the return on VIX Index during the time of crisis?

VIX Index is commonly accepted to measure the global risk aversion. When the market risk increases, the safe haven currencies should be strengthened. Therefore, both of them should be positively related.

Forth hypothesis: Does the excess return of exchange rate is positively related to the return on TED Spread during the time of crisis?

Ted spread is the difference between 3-month Libor and 3-month T-bill rate which is considered as risk free. It is generally used as one of the risk proxies for analyzing liquidity risk. During economic downturns, the gap reflected in Ted spread number frequently increases while the value of THB should also increase if it is one of safe haven currencies. Thus, they should be positively related.

Since the datasets are time series, we will first run the test to make sure that there are no multicollinearity and autocorrelations among variables. The results report in Table (2), Table (2.1), Table (3) and Table (3.1).

Table (2) and Table (2.1) show the correlation matrix among the explanatory variables. As

our analysis will focus into 2 periods so we separate our observations into 2 tables.

Table (2): Correlation Matrix period 2010-2019

	ΔS&P500	ΔUS-TREASURY	ΔVIX Index	ΔTED Spread
ΔS&P500	1			
ΔUS-TREASURY	0.4696	1		
ΔVIX Index	-0.7933	-0.3708	1	
ΔTED Spread	-0.0576	-0.1068	0.0529	1

Table (2.1): Correlation Matrix period 2020

	ΔS&P500	ΔUS-TREASURY	ΔVIX Index	ΔTED Spread
ΔS&P500	1			
ΔUS-TREASURY	0.5895	1		
ΔVIX Index	-0.7204	-0.4029	1	
ΔTED Spread	0.0261	0.0156	0.0406	1

The correlation among explanatory variables shown in Table (2) and Table (2.1) are quite

low except the correlation between VIX Index and S&P500 which seem to be highly

correlated. Thus, we extend the analysis by employing Variance Inflation Factor test (VIF

Test) to recheck whether our data faced multicollinearity or not. The results of VIF test are

displayed in Table (3) and Table (3.1).

Table (3): VIF of explanatory variables during period 2010 – 2019

Variable	VIF	1/VIF
ΔS&P500	2.98	0.335013
ΔUS-TREASURY	2.7	0.370665
ΔVIX Index	1.29	0.773073
ΔTED Spread	1.01	0.988374
Mean VIF	2.00	

Table (3.1): VIF of explanatory variables during period 2020

Variable	VIF	1/VIF
ΔS&P500	2.67	0.374018
ΔUS-TREASURY	2.09	0.479065
ΔVIX Index	1.54	0.649294
ΔTED Spread	1.02	0.978745
Mean VIF	1.83	

After we use Variance Inflation Factor Test (VIF Test) to investigate the correlation between explanatory variables, the result shows the maximum mean VIF of both periods is only 2. Thus, it can be concluded that there is no multicollinearity among independent variables or no independent variable has a linear relationship with any other in this paper since VIF is no greater than 10, Jeffrey M. Wooldridge (2015).

Next step before we could perform time series analysis is to check if our datasets are stationary or not. Stationary properties can be divided into 2 which are strict and strong form stationary and weak stationary. Generally, weak stationary should be enough to do time series analysis.

Under weak stationary assumptions, they require 3 properties as per below.

1. Mean: $$E(Y_t) = E(Y_{t-k}) = \mu$$
2. Variance: $$\text{Var}(Y_t) = E(Y_t - \mu)^2 = E(Y_{t-k} - \mu)^2 = \sigma^2$$
3. Covariance $$E(Y_t - \mu)^2 (Y_{t-k} - \mu)^2 = Y_k$$

First, mean should be the same no matter what period you pick from the dataset. Second, variance should be constant overtime and last, covariance does not depend on time. To check if the dataset follows stationary assumptions above or not, we will use Augmented Dickey Fuller Test (ADF Test). The equation of ADF is

$$\Delta Y_t = \beta_1 + \beta_2 t + \rho Y_{t-1} + \sum_{t=1}^{m} \alpha_i \, \Delta Y_{t-i} + \varepsilon_i$$

Stationarity is tested by using ADF Test having null hypothesis as the variables have a unit root (nonstationary) and the alternative hypothesis is all variables are stationary.

$$H_0 = \text{Nonstationary or unit root} \text{ or } \rho = 1$$

$$H_1 = Stationary \text{ or } \rho < 1$$

Table (4): Augmented Dickey Fuller Test (ADF Test)

Variable	Test-statistic
$\Delta R_{THB,USD}$	-50.027***
$\Delta R_{GBP,USD}$	-51.971***
$\Delta R_{EUR,USD}$	-52.534***
$\Delta R_{CHF,USD}$	-51.991***
$\Delta R_{JPY,USD}$	-53.038***
$\Delta R_{JPY,EUR}$	-52.968***
$\Delta R_{JPY,GBP}$	-50.735***
$\Delta R_{JPY,CHF}$	-51.741***
$\Delta R_{JPY,THB}$	-54.403***
$\Delta R_{EUR,GBP}$	-51.181***
$\Delta R_{EUR,CHF}$	-52.289***
$\Delta R_{EUR,THB}$	-49.863***
$\Delta R_{GBP,CHF}$	-53.499***
$\Delta R_{GBP,THB}$	-51.989***
$\Delta R_{CHF,THB}$	-52.398***
ΔS&P500	-60.969***

ΔUS-TREASURY	-57.249***
ΔVIX Index	-55.673***
ΔTED Spread	-60.093***

Notes: ***stands for significance at 1%

Table (4) shows the result from Augmented Dickey Fuller Test (ADF Test) of all variables.

The result reports that all of the variables are stationary with 1% significance level.

After our time series datasets have been proved that they are all stationary, we will run

static time-series model to study contemporaneous relationship between stationary time-

series variables and estimate the parameter by using OLS.

To do so, this study applies OLS regression to estimate our time series data over the

period 2010 to 2020. As we study safe haven currency in perspective of US investors, we

will consider the relationship of the excess return on spot rate for each currency

$\left(\Delta R_{A,B} \right)$ and the other factors which are return on equity index ($\Delta S\&P_t$), return on

10-year US Treasury Notes ($\Delta Treasury\ Note_t$), return on VIX Index (

$\Delta VIX\ Index_t$) and return on TED Spread ($\Delta Ted\ Spread_t$). Therefore, the

empirical model is

$$
\begin{aligned}
\Delta R_{A,B} = \ & \beta_{i,1}\Delta S\&P_t + \beta_{i,2}\Delta Treasury\ Note_t \\
& + \ \beta_{i,3}\Delta VIX\ Index_t \\
& + \ \beta_{i,4}\Delta Ted\ Spread_t \\
& + \ \varepsilon_{i,t} \qquad\qquad\qquad (1)
\end{aligned}
$$

Where the dependent variable, $\Delta R_{A,B}$, is the excess returns from different exchange rates. The excess return of exchange rate is calculated from an appreciation of A currency against B currency plus the interest rate differential between both countries. The independent variables are first, $\Delta S\&P_t$ is the return on Standard and Poor's index. Next, $\Delta Treasury\ Note_t$ is the return on 10-year Treasury note and the return on $VIX\ Index_t$ ($\Delta VIX\ Index_t$) and $Ted\ Spread_t$ ($\Delta TED\ Spread_t$).

This paper defines safe haven currencies as a currency that provides a hedge for risky portfolio during normal times and the safe haven currency should exhibit negatively related to the risky assets or it should act as a barrier for reference risky portfolio during the time of stress. In other word, safe haven currency is a currency that appreciates when the market certainty increases, moreover, safe haven currency should not be sensitive to market volatility and illiquidity.

The Equation (1) will allow us to investigate and answer all of the hypothesis developments about the safe haven behavior in many ways. First, if the excess return of exchange rate is negatively related to risky assets or stock return ($\beta_{i,1} < 0$) Second, if the excess return of exchange rate is positively related to bond yield return ($\beta_{i,2} < 0$)Third, if the excess return of exchange rate is positively related to Ted Spread ($\beta_{i,3} > 0$) and VIX Index ($\beta_{i,4} > 0$).

However, some practitioners and readers might come up with a big question that if the value of USD affects the results. It could be the depreciation of USD that causes other currencies to appreciate not because of safe haven currency status itself.

To answer this question, holding other explanatory variables constant, we extend our analysis to run cross rates with the same equation to show the result. We will replace the left-hand side of the Equation (1) by JPY/EUR, JPY/GBP, JPY/CHF, JPY/THB, EUR/GBP, EUR/CHF, EUR/THB, GBP/CHF, GBP/THB, and CHF/THB then see the result if such that currency still exhibit safe haven currency status.

The benefit of running the cross rates will help us eliminate the depreciation of USD effected from QE policy in USA and could also help us ensure safe haven patterns of the currency.

To gain more benefit and see whether the prior results are persistent over time during the pandemic or not, we will re-run the Equation (1) with different event window that is during 2020, starting from January 2020 to December 2020 compared to the whole period which is 2010 - 2019 and see if the currency that exhibit the safe haven currency still performs its role or not.

6. Empirical Results

The results of Equation (1) during period 2010 – 2019 are displayed in Table (5) and during period 2020 are displayed in Table (6) respectively.

Table (5): Equation (1) period 2010 - 2019

VARIABLES	$\Delta R_{THB,USD}$	$\Delta R_{GBP,USD}$	$\Delta R_{EUR,USD}$	$\Delta R_{CHF,USD}$	$\Delta R_{JPY,USD}$
ΔS&P500 ($\boldsymbol{\beta_{i,1}}$)	0.0854***	0.177***	0.222***	0.123***	0.0106
	(8.487)	(8.786)	(10.97)	(4.742)	(0.562)
Δ10-year US Treasury ($\boldsymbol{\beta_{i,2}}$)	-0.0214***	-0.00736	-0.0146***	-0.0611***	-0.104***
	(-7.749)	(-1.332)	(-2.633)	(-8.598)	(-20.14)
ΔVIX ($\boldsymbol{\beta_{i,3}}$)	-0.00165	0.00240	0.00892***	0.00744***	0.0122***
	(-1.522)	(1.108)	(4.087)	(2.669)	(6.015)
ΔTED Spread ($\boldsymbol{\beta_{i,4}}$)	0.000638	0.00331*	0.00395**	0.00244	0.00258
	(0.689)	(1.786)	(2.116)	(1.022)	(1.489)
Constant	1.11e-05	-0.000158	-0.000222	-3.49e-05	-9.62e-05
	(0.203)	(-1.435)	(-2.011)	(-0.247)	(-0.936)
Observations	2,497	2,497	2,497	2,497	2,497
R-squared	0.081	0.065	0.066	0.033	0.235

T-statistics in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Table (5) shows the result from the regression of Equation (1) with different exchange rates against USD on daily data basis during sample period 2010-2019 and T-statistics in parentheses.

<u>First hypothesis</u>: Does the excess return of exchange rate is negatively related to the return on stock market during the time of crisis? ($\beta_{i,1} < 0$)

When market participants are risk averse, they will sell risky assets and seek for safe haven assets, such as safe haven currencies, to protect their wealth. In other word, a safe haven currency tends to appreciate as riskier assets are sold off. As a result of this behavior, S&P500 return will fall while the value of safe haven currency would rise. Hence, we estimate the coefficients between safe haven currency and S&P500 return to be negatively related.

Unfortunately, the empirical results during 2010 - 2019 show the opposite case. The results from regression can be interpreted as when the return from risky assets increase, THB, GBP, EUR and CHF systematically strengthen against USD and the results also reveal that S&P500 has no meaningful impact on JPY against USD.

Hence, USD is safer than THB, GBP, EUR and CHF in this case. It is not surprised that the results sometimes show that USD exhibits to be safer currencies than others. Sometimes, USD Index and S&P500 are positively related and the other time, the correlation could be reversed. Most of the time, USA attracts money inflow to US denominated assets including

stock market like S&P500. The reasons are that firstly, the USD's attraction is supported

by its country's political and economic stability as well as USA is less volatile than many

other emerging countries. In addition, many central banks held USD as a reserve. Another

reason is that USD accounts for a major currency of international payments. So, there are

a lot of high demand in USD caused the USD to appreciate and become one of safe haven

currencies sometimes.

Second hypothesis: Does the excess return of exchange rate is negatively related to

bond yield return during the time of crisis? ($\boldsymbol{\beta_{i,2} < 0}$)

Another behavior of rationale investors when they see market in bad sentiment, they will

buy the bonds which recognized as safe haven asset and terminate the risky assets. As

a result, bond prices will rise while bond yields will fall. Thus, we anticipate a negative

correlation between safe haven currency and 10-year US Treasury yield return. (Baur &

Lucey, 2010; Baur & McDermott, 2010) also define safe haven as such a thing that has

zero or negative correlation with the risky assets or portfolio during the market downturns.

The results from the Table (5) are corresponding with the second hypothesis. It can be

concluded as 10-year US Treasury is significant for all currencies at 1% significance level

except GBP. When bond yields fall as market participants become more risk averse, THB,

EUR, CHF, and JPY strengthen strongly against the USD. Using 10-year US Treasury as

an indicator, THB exhibits safe haven currency status while USD is less safe than THB, EUR, CHF and JPY.

Third hypothesis: Does the excess return of exchange rate is positively related to the return on VIX Index during the time of crisis? ($\beta_{i,3} > 0$)

We follow the study of (Habib & Stracca, 2012) to use VIX Index as a proxy for market uncertainty. The results show that when the market uncertainty increases, it is on average significantly associated with an appreciation of EUR, CHF and JPY against USD. However, the results do not suggest a statistically significant relationship between change in market uncertainty and the value of THB and GBP against USD. These results correspond with (Fatum & Yamamoto, 2016) since their study point out that during the economic turmoil and VIX Index increases, JPY significantly appreciates, on the other hand, GBP depreciates systematically. For THB, our results suggest that it does not seem to be safe haven currency in this case.

Forth hypothesis: Does the excess return of exchange rate is positively related to the return on TED Spread during the time of crisis? ($\beta_{i,4} > 0$)

We also consider another proxy for market risk in this study that is TED spread. TED spread is also used in the study of (M. Brunnermeier et al., 2008). Our empirical results show that TED spread is significant only for GBP and EUR with 10% and 5% significance level respectively but not for the other currencies. In other words, in the period of

economic crisis, GBP and EUR are significantly appreciated against USD. However, THB does not prove to be safe haven currency once again.

Since there are none of the currencies reach all hypotheses we set up, the conclusion will be based on the currency which could reach the criteria as much as possible. During 2010-2019, EUR is a currency that most likely to possess safe haven currency status among others as it meets three from the four hypotheses followed by CHF and JPY which reach two from four hypotheses and THB is at the last place. Thus, it can be concluded as during 2010-2019, THB is less safe than USD, GBP, EUR, JPY and CHF.

To answer our second research question whether the safe haven patterns still persistent during the COVID-19 pandemic or not, we extend our analysis and run the same equation again with different sample period which is during 2020. The results are shown in Table 6.

Table (6): Equation (1) period 2020

VARIABLES	$\Delta R_{THB,US}$	$\Delta R_{GBP,USD}$	$\Delta R_{EUR,USD}$	$\Delta R_{CHF,USD}$	$\Delta R_{JPY,USD}$
ΔS&P500 ($\beta_{i,1}$)	0.0596***	0.146***	0.0608***	0.0646***	-0.00739
	(3.770)	(4.559)	(2.770)	(3.137)	(-0.327)
Δ10-year US Treasury ($\beta_{i,2}$)	-0.00289	-0.0328***	-0.0222***	-0.0269***	-0.0384***

	(-0.801)	(-4.489)	(-4.443)	(-5.724)	(-7.473)
ΔVIX ($\boldsymbol{\beta_{i,3}}$)	0.000886	0.00652	0.00710	0.00997**	0.00895**
	(0.280)	(1.018)	(1.618)	(2.422)	(1.984)
ΔTED Spread ($\boldsymbol{\beta_{i,4}}$)	0.000301	0.000231	2.19e-05	-8.95e-05	0.000871
	(0.466)	(0.177)	(0.0245)	(-0.106)	(0.946)
Constant	-9.76e-05	-3.15e-05	0.000249	0.000242	0.000141
	(-0.460)	(-0.0733)	(0.847)	(0.875)	(0.467)
Observations	251	251	251	251	251
R-squared	0.103	0.111	0.082	0.140	0.342

T-statistics in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Table (6) shows the result from the regression of equation (1) with different exchange rates

against USD on daily data basis during sample period 2020 and T-statistics in

parentheses.

<u>First hypothesis</u>: **Does the excess return of exchange rate is negatively related to the**

return on stock market during the time of crisis? ($\boldsymbol{\beta_{i,1} < 0}$)

Analyzing from S&P500 return, the result remains the same as Table (5). Comparing

period 2010-2019 to 2020, S&P500 is still significant only for THB, GBP, EUR and CHF

against USD but not for JPY, however, the correlation is still in the opposite direction to what we expect.

Second hypothesis: Does the excess return of exchange rate is negatively related to bond yield return during the time of crisis? ($\beta_{i,2} < 0$)

For 10-year US Treasury, it also remains significantly for EUR, CHF and JPY but not THB. However, during 2020, using 10-year US Treasury yield as a proxy, GBP also exhibits safe haven currency status. By contrast, THB does not possess safe haven currency role.

Third hypothesis: Does the excess return on exchange rate is positively related to the return on VIX Index during the time of crisis? ($\beta_{i,3} > 0$)

The results do not suggest a statistically significant relationship between change in market uncertainty and the value of EUR against USD. By contrast, during 2020, VIX Index is now significant only for CHF and JPY.

Forth hypothesis: Does the excess return on exchange rate is positively related to the return on TED Spread during the time of crisis? ($\beta_{i,4} > 0$)

TED spread used by (M. K. Brunnermeier et al., 2008) is not significant for any currencies during 2020.

Overall results during 2020 suggest that CHF is the safest currency. Our finding is in accordance with the result from the paper of (Carvalho Filho, 2015) which stated the

reason behind the appreciation of CHF during risk-off episode that it is because many

investors seek for secure investment so there are a lot of capital inflow to Switzerland

resulting from adjusting portfolio investment by Swiss resident and Non-swiss resident.

Extension

In this section, we extend our analysis to answer the question whether the value of USD

determines the results or not, we re-run the Equation (1) for all cross rates except the USD.

The results of Equation (1) during period 2010 – 2019 (Cross rates) are displayed in Table

(7) and during period 2020 (Cross rates) are displayed in Table (8) respectively.

Table (7): Regression results for cross rates, period 2010-2019.

VARIABLES	$\Delta R_{JPY,EUR}$	$\Delta R_{JPY,GBP}$	$\Delta R_{JPY,CHF}$	$\Delta R_{JPY,THB}$	$\Delta R_{EUR,GBP}$
ΔS&P500 ($\beta_{i,1}$)	-0.202***	-0.163***	-0.109***	-0.0577***	0.0477**
	(-8.951)	(-6.623)	(-4.200)	(-3.010)	(2.461)
Δ10-year US Treasury ($\beta_{i,2}$)	-0.0851***	-0.0970***	-0.0451***	-0.0848***	-0.00798
	(-13.76)	(-14.38)	(-6.353)	(-16.11)	(-1.498)
ΔVIX ($\beta_{i,3}$)	0.00350	0.0108***	0.00524*	0.0149***	0.00662***
	(1.442)	(4.067)	(1.882)	(7.200)	(3.167)

ΔTED Spread ($\boldsymbol{\beta_{i,4}}$)	-0.00186	-0.000613	-4.59e-05	0.00252	0.000524
	(-0.895)	(-0.271)	(-0.0192)	(1.431)	(0.293)
Constant	0.000145	8.45e-05	-2.86e-05	-0.000114	-5.22e-05
	(1.183)	(0.630)	(-0.203)	(-1.092)	(-0.493)
Observations	2,497	2,497	2,497	2,497	2,497
R-squared	0.243	0.247	0.080	0.257	0.005

T-statistics in parentheses

*** p<0.01, ** p<0.05, * p<0.1

VARIABLES	$\Delta R_{EUR,CHF}$	$\Delta R_{EUR,THB}$	$\Delta R_{GBP,CHF}$	$\Delta R_{GBP,THB}$	$\Delta R_{CHF,THB}$
ΔS&P500 ($\boldsymbol{\beta_{i,1}}$)	0.0974***	0.0948***	0.0570**	0.130***	-0.00632
	(4.776)	(5.111)	(2.175)	(6.214)	(-0.260)
Δ10-year US Treasury ($\boldsymbol{\beta_{i,2}}$)	0.0449***	0.0141***	0.0538***	0.0217***	0.00851
	(8.007)	(2.768)	(7.485)	(3.766)	(1.275)
ΔVIX ($\boldsymbol{\beta_{i,3}}$)	0.00117	0.00943***	-0.00496*	0.00522**	0.00272
	(0.533)	(4.718)	(-1.759)	(2.314)	(1.039)
ΔTED Spread ($\boldsymbol{\beta_{i,4}}$)	0.00141	0.00122	0.00101	0.00282	-0.00248

	(0.749)	(0.713)	(0.418)	(1.464)	(-1.106)
Constant	-0.000158	-0.000204**	-8.73e-05	-0.000184	2.26e-06
	(-1.424)	(-2.020)	(-0.611)	(-1.613)	(0.0174)
Observations	2,497	2,497	2,497	2,497	2,497
R-squared	0.075	0.019	0.060	0.044	0.002

T-statistics in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Table (8): Regression results for cross rates, period 2020.

VARIABLES	$\Delta R_{JPY,EUR}$	$\Delta R_{JPY,GBP}$	$\Delta R_{JPY,CHF}$	$\Delta R_{JPY,THB}$	$\Delta R_{EUR,GBP}$
ΔS&P500 ($\beta_{i,1}$)	-0.0588***	-0.157***	-0.0723***	-0.0657***	-0.0848***
	(-2.756)	(-5.555)	(-3.526)	(-2.653)	(-3.177)
Δ10-year US Treasury ($\beta_{i,2}$)	-0.0169***	-0.00529	-0.0114**	-0.0354***	0.00997
	(-3.477)	(-0.819)	(-2.434)	(-6.272)	(1.639)
ΔVIX ($\beta_{i,3}$)	0.00260	0.00186	-0.000906	0.00840*	0.000501
	(0.611)	(0.329)	(-0.221)	(1.697)	(0.0938)
TED Spread ($\beta_{i,4}$)	0.000852	0.000659	0.000956	0.000387	-0.000120

	(0.980)	(0.571)	(1.143)	(0.383)	(-0.110)
Constant	-0.000113	0.000215	-9.58e-05	0.000245	0.000312
	(-0.395)	(0.565)	(-0.348)	(0.736)	(0.871)
Observations	251	251	251	251	251
R-squared	0.233	0.295	0.205	0.390	0.073

T-statistics in parentheses

*** p<0.01, ** p<0.05, * p<0.1

VARIABLES	$\Delta R_{EUR,CHF}$	$\Delta R_{EUR,THB}$	$\Delta R_{GBP,CHF}$	$\Delta R_{GBP,THB}$	$\Delta R_{CHF,THB}$
ΔS&P500 ($\beta_{i,1}$)	0.00127	0.0367*	0.0852***	0.0972***	0.0246
	(0.116)	(1.733)	(3.147)	(3.140)	(1.142)
Δ10-year US Treasury ($\beta_{i,2}$)	0.00557**	-0.0213***	-0.00448	-0.0307***	-0.0137***
	(2.233)	(-4.415)	(-0.727)	(-4.350)	(-2.797)
ΔVIX ($\beta_{i,3}$)	-0.00236	0.00719*	-0.00329	0.00612	0.00995**
	(-1.079)	(1.695)	(-0.608)	(0.989)	(2.310)
ΔTED Spread ($\beta_{i,4}$)	0.000168	-0.000834	0.000510	-6.37e-05	0.00185**
	(0.377)	(-0.964)	(0.462)	(-0.0504)	(2.103)

Constant	-7.74e-07	0.000312	-0.000275	5.63e-05	0.000279
	(-0.00527)	(1.095)	(-0.757)	(0.135)	(0.965)
Observations	251	251	251	251	251
R-squared	0.055	0.097	0.102	0.077	0.097

T-statistics in parentheses

*** p<0.01, ** p<0.05, * p<0.1

The empirical results show that when the return on S&P500 and 10-year US treasury decrease and VIX Index increases, JPY is most likely to be safe haven currency against other currencies while TED Spread does not significant for any currencies

7. Conclusion

By investigating between 2010 - 2019, our results do not support the idea that THB is a safe haven currency. Nevertheless, this paper found that for other well-known traditional currencies, EUR exhibits to be the safest currency among the others followed by CHF and JPY. Because when the return of 10-year US treasury yield decreases and VIX Index and TED spread increase, only EUR exhibits safe haven behavior as the value of EUR is significantly strengthen. This result is also in line with the previous study. However, THB is the fourth place from all of the currencies considered in this paper that exhibit safe haven behavior. Thus, THB is less safe than EUR, CHF, JPY and USD but safer than GBP. Moving to different timeframe, during 2020, the result remains the same for THB that it still

does not possess safe haven currency role. In this period, the safest currency turns to be

CHF and JPY following by EUR, GBP and THB.

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VITA

NAME   Nanapat Chaochavanil

DATE OF BIRTH   08 November 1993

PLACE OF BIRTH   Bangkok

INSTITUTIONS ATTENDED   Chulalongkorn University

HOME ADDRESS   70/13 soi29 Bhadamontonsai2 Rd. Salatummasop

                        Taweewattana Bangkok