Safe Haven Currency and Market Uncertainty:
Yen, renminbi, dollar, and alternatives

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Abstract

This paper investigates the relationship between market uncertainty and exchange rate movements of safe haven currencies that tend to appreciate during the risk-off episodes. A safe haven index—the tendency of currency movements to a change in market uncertainty as measured by the Chicago Board Options Exchange (CBOE)'s volatility index (VIX)—are calculated to assess if a currency has a safe haven tendency. The results indicate that the yen is a safe haven currency and its status is robust. The offshore traded renminbi (CNH) has a vulnerable status to the U.S. dollar and the yen, while having lost its safe haven status to the euro since mid-2014. The won, rupiah, and Singapore dollar tend to be vulnerable. Higher market uncertainty with policy swings may increase safe haven demand for alternative assets such as gold and bitcoin, but not substituting for the yen and the dollar due to limited liquidity. Safe haven gauges help explain the uncovered interest rate parity puzzle associated with carry trade. The implication from the results suggests the yen's strength driven by its safe haven status may slow down the post-crisis recovery via exports, masking the vulnerability of government finance with massive monetary easing. The CNH's shift to a vulnerable status could accelerate capital outflows, supporting export-driven growth. The yen's safe haven status would help balance capital flows within Asia, contributing to post-crisis economic recovery in the area.

Keywords: Safe haven, Yen, Renminbi, Bitcoin, Volatility, Carry trade, Capital flows
JEL classification: E44; F31; G15

1. Introduction

The Japanese yen and the Swiss Franc are often called a safe haven currency—a currency that appreciates when the risk-averse behavior of global investors and the uncertainty of economic policy and outlook increase, while the U.S. dollar is regarded as the most reliable international currency as an anchor. The safe haven status is usually observed for a country that has the current account surplus, low interest rates—the funding source of carry-trade opportunity—, and the investors' perception as the safe-haven currency, resulting in suffering from the deterioration of the trade balance during a crisis. That may improve the trade balance of the country's trade partners and competitors, especially if their currencies are vulnerable to a shock.

The yen tends to rise during periods of increased financial market volatility. This tendency—clearly evident when the currency surged after the Brexit shock—has strengthened since mid-2015 (Masujima 2016). While widening yield differentials between the U.S. and Japan are a force to weaken the yen, the currency is vulnerable to sudden gains on higher risk aversion.

The Chinese renminbi (CNY) is a rising star. Its internationalization is on the fast track (Fratzscher and Mehl 2011; Ito 2010; Kawai and Pontines 2016; Prasad 2016; Shu, He, and Cheng 2015). The share of CNY turnover in the global foreign exchange market increased to 4% in 2016, approaching to 5% of the Swiss Franc's share (Table 1). The renminbi's inclusion into the SDR basket represents its internationalization[2], making the renminbi a reserve currency alongside the USD, the JPY, the EUR, and the GBP. Still, the renminbi was depreciated by 4% between its announcement on November 30, 2015 and actual inclusion on October 1, 2016.

Recent political uncertainty generated unexpected shocks—from the U.S. presidential election to Federal Reserve interest rate decisions and political events in Europe—that could affect sentiment toward the yen, the renminbi, and relatively

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[2] More illustrative of the current state of the internationalization of the renminbi are the economically significant facts that the renminbi is currently traded in official offshore clearing centers in 17 locations outside of Mainland China, as of March 2016 the renminbi is the fourth most used global payments currency by value, and the total investment quota for renminbi Qualified Foreign Institutional Investors (RQFIIs) is more than doubled as of October 31, 2016 since People's Bank of China announced the first allocation to the US (in the amount of CNY 250 billion).

vulnerable Asian currencies, increasing safe-haven demand for alternative assets such as gold and bitcoin.

The yen's safe-haven status may signal in advance shifts in risk appetite in the foreign exchange market. The skew in risk reversals on yen-dollar currency options, which turns negative when bets on yen appreciation outweigh bets on depreciation, tends to follow, or is at least associated with, the index. For example, 12 weeks after the start of a VIX spike, net non-commercial positions on the yen on the Chicago Mercantile Exchange are 20 billion U.S. dollars longer than would be the case absent the rise in the VIX (Botman, de Carvalho Filho, and Lam 2013).

There are a number of possible explanations for the close relationship between the VIX and the safe-haven currencies. Higher volatility in U.S. stocks could affect expectations about the future monetary policy stances of major central banks, resulting in shifts of capital out of dollars and into yen. For example, the Brexit shock resulted in a surge in the VIX and a delay in a Fed rate hike. That led to yen appreciation as yield differentials between Japan and the U.S. narrowed.

In the European sovereign crises of 2011, the yen was purchased aggressively as a safe asset[3] and finally reached the historical high value, 75.54 yen per dollar and remained around 80 yen. Thus, just after the East Japan Earthquake and the meltdown of nuclear power plants, the highest value of the yen is hard to be explained by economic fundamentals. In January 2015, the Swiss National Bank (SNB) abolished its exchange rate cap against the euro, meaning that the SNB stopped intervening by purchasing the Swiss franc against the euro. As a result, the Swiss franc was appreciated against U.S. dollar by 30% within 10 minutes (Figure 1). At the same time the yen and the Singapore dollar were appreciated by 1% as investors needed to sell the euro and buy some safe currencies instead of the Swiss franc that was limited liquidity and capacity compared to the euro. So, not only the yen and the renminbi, but other currencies in the Asian emerging market may be in transition to the safe-haven status.

This paper, therefore, tries to measure whether the yen, the renminbi, other

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[3] See IMF (2012b) for the detailed reason for the lack of safe assets globally.

currencies, and alternative assets have a safe-haven or vulnerable status. Introducing long-term and short-term gauges help judge if the safe-haven status is temporary or consistent. The results shows that the yen consistently has the safe-haven status, the renminbi temporarily obtained the safe-haven status in early 2010, but has been returning to a vulnerable currency. The Korean won and the Indonesia rupiah tend to be vulnerable, while the Singaporean dollar has signaled the early sign for the safe-haven status. Higher market uncertainty with political uncertainty tends to increase safe-haven demand for alternative assets such as gold and bitcoin, while not substituting the yen and the dollar due to limited liquidity.

2. Review of Save Haven and Safe Asset Literature

Safe-haven currencies tend to be associated with three conditions: low interest rates, net foreign asset positions, and highly liquid financial markets. Japan and Switzerland meets all the criteria. Habib and Stracca (2012) find that safe-haven status is, after controlling for the carry trade, associated with greater net foreign asset positions, less relevant to the stock market capitalization. For advanced countries, the government debt to Gross Domestic Products ratio, financial development indicators, and the liquidity of foreign exchange are also associated with safe-haven status.

Policymakers in safe-haven countries face the challenge of dealing with sharp real appreciations or surges in capital flows when risk-off episodes recur. Fatum and Yamamoto (2014) find all currencies except the yen have significant market uncertainty thresholds. As the real appreciation and surge in capital flows continue, the potential for vulnerabilities tends to be built up in either private or public sector balance sheets (Sorsa et al. 2007). In economies with low inflation and close to the zero interest rates, real appreciations driven by risk-off episodes could feed deflation risks and place downward pressures on aggregate demand (International Monetary Fund 2012a; Carvalho Filho 2015). Transitory real appreciation may lead to strong adjustment costs to the economic dislocation when exchange rates eventually revert back (Bussière, Lopez and Tille 2013).

Several studies confirmed the yen's safe-haven status. De Bock and de Carvalho Filho (2013) find that the yen and the Swiss franc are the only two currencies that appreciate against the U.S. dollar on average during risk-off episodes. Ranaldo and Söderlind (2010) see that the yen appreciate against the U.S. dollar when U.S. stock prices decrease and U.S. bond prices and foreign exchange rate volatility increase. Botman, de Carvalho Filho, and Lam (2013) well documented the literature related to the yen's safe have behavior.

In contrast, the assessment of the safe-haven status in the renminbi is mixed. Financial market observers and participants have been musing about whether the renminbi is becoming or has become a safe-haven currency (Harjani 2014, and Burland 2016). While some market participants argue that the renminbi has already had the safe-haven status, others consider the renminbi won't become a safe-haven currency until Chinese economic and broader institutional reforms are implemented, focusing on insufficient liquidity and low convertibility.

Though the domestically traded renminbi (CNY) doesn't meet the criteria of high convertibility and liquidity as a safe-haven currency, the offshore traded renminbi (CNH) might have met the criteria since July 2010[4]. Investors can open renminbi bank accounts in an offshore renminbi clearing center Hong Kong and transfer funds into and out of these accounts without any restrictions, although cross-border fund transfers to and from Mainland China are subject to regulations in Mainland China. Fatum and Yamamoto (2016) find evidence of some degree of safe-haven currency behavior of the renminbi during the early part of their sample, which do not support the suggestion that the renminbi is currently a safe-haven currency. This paper's results are close to this study, testing both CNY and CNH.

Increasing political uncertainty in the global market and weakness of the renminbi may increase demand for traditional and innovative alternative assets, though the size and

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[4] As of April 2015 the daily turnover of renminbi foreign exchange transactions in Hong Kong alone reached the equivalent of USD93 billion, thereby implying that the offshore renminbi market is highly liquid.

liquidity of the markets haven't developed well yet and they are vulnerable to regulatory changes. A bitcoin price surged in late 2016 as the renminbi depreciates[5], but it tumbled to $789 on January 11, 2017, down 28% from a peak of $1,091 on January 4, 2017. The proximate cause – signals from China's central bank that they are paying close attention to irregularities in the market. Orlik and Jimenez (2017) see the small size of the market makes bitcoin impractical as a channel for large-scale capital flight. Gold could be considered as a good asset in the diversification of Chinese portfolios. Wong and Zhu (2015) find, however, it is only for risk-seeking investors and in crisis periods on the Shanghai Gold Exchange in the diversification of Chinese portfolios. So, there are limited studies that regard bitcoin and gold as a safe-haven, while this paper pointed out some possibility that their safe-haven tendency might be increasing, particularly relative to the renminbi under high policy uncertainty.

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[5] China's bitcoin transactions account for some 99% of the total on global exchanges as of end of 2016, according to Bitcoinity.

3. Data and the Model

3.1. Safe Asset Index: Long-term Perspective

In order to build the Safe Asset Index (*SAI*) — the gauge of the safe-haven tendency, the exchange rate pressure index (*EMP*), the rate of change in U.S. dollar per local currency exchange rate plus rate of change in reserves year-over-year is estimated (Girton and Roper 1977). The *EMP* for country *c* at time *t* is:

$$EMP_t^c = (1 - \omega_t^c)\dot{e}_t^c + \omega_t^c \frac{dr_t^c}{GDP_t^c} \qquad (3.1)$$

where *r* is foreign reserves, *GDP* is the nominal Gross Domestic Product, *e* is the dollar value per local currency, ω is the weight. Goldberg and Krogstrup (2013) modified the standard EMP, adding new weights that weigh the component which best captures exchange market pressures highest:

$$\omega_t^c = \frac{var(\frac{dr_t^c}{GDP_t^c})}{var(\dot{e}_t^c) + var(\frac{dr_t^c}{GDP_t^c})} \qquad (3.2)$$

The Safe Asset Index, following Goldberg and Krogstrup (2013), in turn measures the correlation between the *EMP* and the VIX - a measure of implied volatility of S&P 500 index options – during the period *t -n* and *t*:

$$SAI_t^c = \rho EMP, VIX = \frac{E_{i=t-n,t}[(EMP_t^C - \mu EMP^C)(VIX_i - \mu VIX)]}{\sigma EMP^C \sigma VIX} \qquad (3.3)$$

where the σ is standard deviation, μ is mean.

· *SAI* > 0: Period and country specific "safe-haven" type tendency.

· *SAI* < 0: Period and country specific "vulnerable currency" type tendency.

· *SAI* = 0: Exchange rate movement doesn't follow specific tendency

The data for this study are taken from International Finance Statistics (IFS) provided by the International Monetary Fund (IMF), and Bloomberg. Monthly data for the panel of 13 emerging and advanced economies, areas, 1996-2015. Bilateral exchange rates against the dollar are used to capture appreciation pressures (exception U.S.). The data is the five-year average and five observations per country or area.

3.2. Safe Haven Index: Short-term Perspective

This paper's model that captures the safe-haven status of a currency in short-term perspectives is to assume capital flows driven by excess returns from the currency carry trade, rather than uncovered interest rate parity (UIP). This paper's view follows Brunnermeier, Nagel, and Pedersen (2013)'s carry trade hypothesis that defines the currency carry trade, which consists of selling low interest-rate currencies "funding currencies" and investing in high interest-rate currencies "investment currencies." They find that carry trades losses money on average in times of rising VIX. While the UIP hypothesizes that the carry gains due to the interest-rate differential is offset by a commensurate depreciation of the investment currency, empirically the reverse holds. The investment currency appreciates a little on average despite with a low predictive R^2 (Fama 1984). This violation of the UIP – often referred to as the "forward premium puzzle" – is precisely what makes the carry trade profitable on average.

The UIP is defined as

$$(1 + i_\$) = \frac{E_t(e_{t+k})}{e_t} \quad (1 + i_{LCY}) \quad (3.4)$$

where the i is nominal interest rates, e is nominal exchange rates – the number of local currency units per the U.S. dollar. '$\$$' indicates the U.S. dollar and 'LCY' means the local currency. Adding the gauge of market risk sentiment to predict the future spot exchange

rate changed the equation into

$$\Delta E_t(e_{t+k}) = \Delta(i_\$ - i_{LCY}) + \Delta x \quad (3.5)$$

where the *x* is the gauge of the market risk sentiment. That said, a change in expected exchange rate is explained by a change in interest rate differentials and the market risk sentiment. To capture the impacts of a change in the market risk sentiment on exchange rates, a rolling OLS regression of a daily change in the VIX and the two-year yield differential between local currency and the U.S. dollar on a percentage change in local currency per dollar is conducted. The sample period starts from the beginning of 2001 at earliest, depending on data availability by currency, through January 26, 2017, with a 250 business day window. The high frequency data support the search of structural breaks more accurately.

The VIX is a good measure of investors' risk sentiment. Increases in the VIX are associated with higher volatility in Japanese and Germany stock prices, as measured by the Nikkei VI and VDAX, as well as in the yen's exchange rate to dollar (Figure 2). The VIX correlates to the Nikkei VI at 0.83, to the VDAX at 0.87 and to implied volatility on 1-month at-the-money yen-dollar options at 0.71. The standard model is:

$$dln\left(\frac{LCY}{USD}\right) = \alpha + \beta_1 d(USDLCY\_2Y) + \beta_2 d(VIX) + \varepsilon \quad (3.6)$$

where *USDLCY_2Y* is two-year government bond yield differential, is *VIX* denotes the implied volatility of S&P 500 index options[6], ε is an error term. The UIP assumes the sign of the coefficient of *USDLCY_2Y* is negative, while the carry trade hypothesis sees its sign positive during a normal period. So, the determinants of its sign are answers from an

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[6] The VIX, which often referred to as the fear index or the fear gauge, is calculated by the Chicago Board Options Exchange (CBOE), representing the market's expectation of stock market volatility over the next 30-day period.

empirical question, rather than a theory. The coefficient of the VIX is defined as the Safe-haven Currency Index (*SCI*) and assessed the safe-haven status as follows:

· *SCI* > 0: Period and country specific "safe-haven" type tendency.

· *SCI* < 0: Period and country specific "vulnerable currency" type tendency.

· *SCI* = 0 or insignificant: exchange rate movement doesn't follow specific tendency.

4. Results

4.1. Safe Asset Index – Long-term Perspective

The safe asset indexes indicate only three currencies – the Swiss franc, the yen, and the dollar – out of 13 currencies have the safe-haven status on average throughout the sample period (Table 2). Though the Swiss franc has the strongest safe-haven status on average, its status has been weakened from 2007 until 2011 – the period of the Global Financial Crisis and the European Sovereign Crisis. That may mean the Switzerland suffered from rapid currency appreciation against the euro, its safe-haven demand relative to the dollar seemed to be limited. In contrast, growing dollar demand during the crises had strengthened the dollar's safe-haven status. The yen has consistently kept the safe has status during the risk-off episodes, while the Korean won has been the vulnerable currency.

Moreover, the currency status of some currencies has been switching between a safe-haven and a vulnerable currency. The British pound had had the safe-haven status until early 2000s, but it fell into the vulnerable currency status from 2007 until 2015, followed by a rapid depreciation due to the Brexit shock in June 2016. On the other hand, the Singapore dollar was the vulnerable currency until 2011, turning into the safe-haven currency in the latest sample period. Thus, the safe-haven status doesn't necessarily last

for a long time, and it does change overtime. Higher frequency data provides the detailed transitional status in the short-term perspective.

The safe-haven status seems to be associated with the internationalization of the currency. The dollar has about 90% of the total share (200%) of turnover of Over-The-Counter (OTC) of transaction from 1995 until 2016 (Table 1). The yen's share is about 20% throughout the same period. The shares of the European currencies such as the euro, the pound, and the Swiss franc have peaked in 2001; they have been gradually shrinking. In contrast, the Asian currencies have been emerging. The share of the renminbi, the Singapore dollar, and the won reached 4%, 2%, and 2% from 0%, 1%, and 0%, respectively.

4.2. Safe Haven and Vulnerable Currency – Short-term Perspective

In this section, we see how uncertainty represented by the VIX affects exchange rate movements on daily basis, after controlling two-year interest rate differential between the local currency and the dollar. Zero interest rates are applied for alternative assets.

4-2-1 Yen's Safe Haven Status

The Safe-haven Currency Index suggests the yen has kept its safe-haven status during the global crises. The results of the ordinary least square rolling (OLS) regression in daily data supported this scenario. The yen's safe-haven status has been held since 2007 except a period of the aftermath of the Great East Japan Earthquake and the downgrade of the U.S. sovereign rating provided by Standard and Poor's (Figure 3). Still, when the yen had the vulnerable status, the coefficient of the VIX wasn't significant (Figure 4). Since market participants tended to expect higher possibility of massive monetary easing

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as the part of the Abenomics in late 2012, the yen's safe status has been strengthening. The index shows that each 1 percentage point rise in the VIX is associated with a 0.13% appreciation in the yen as of January 26, 2017, while 1 percentage point increase in two-year interest rate differential between the U.S. and Japan is accompanied to an 11.4% appreciation in the yen. The negative coefficients of U.S.-Japan interest differentials held in almost all the time of the sample period. Removing the yield differentials strengthens the absolute impacts of a change in the VIX, but it doesn't change the robustness of the yen's safe-haven status (Figure 5). These results support the carry trade hypothesis rather than the UIP.

A shift in the monetary policy framework helps explain a change in the yen's safe-haven status. Lower interest rates increase opportunity for the carry trade, strengthening the save haven status. The structural breaks for the safe-haven status are tested with the Schwarz criterion in global information criteria. The test signals July 21, 2006, August 31, 2010, and January 31, 2013 as the timings of structural breaks (Table 3). These dates are relevant to significant changes of monetary policy framework in Japan. The Bank of Japan lifted the quantitative easing policy in March 2006 and the zero-interest-rate policy in July. The BOJ introduced 'comprehensive easing policy' in October 2010, and the BOJ introduced asset purchase programs in April 2013. The coefficient of the VIX was around zero in late 2012, but it dropped to -0.25% in early 2014. Further monetary easing appears to enhance the yen's safe-haven status. During the same period, Japan's net foreign asset relative to the GDP has been highest in the world, but it has decreased in the dollar terms. So, investors' risk appetite and their perception for the yen's safe-haven status would play a vital role in the determination of exchange rate movement. The strength of its status may rely on excess profits from carry trade rather than economic fundamentals such as

net foreign assets.

The long-term government bond yields contain more risk premium than short-term yields. Still, the yen's safe-haven status, which reflects invertors' risk appetites, is robust even if adding a change in the yield curve: the ten-year, two-year spread between the U.S. and Japan (Figure 6). An increase in the spreads means the U.S. government bond yield curve is getting steeper relative to the Japanese government bond yield curve. The coefficient of the VIX remains significant overall even if the rolling regression is implemented with the yield curve variable.

These results suggest a higher level of VIX predicts higher returns for investment currencies and lower returns for funding currencies, and controlling for VIX reduces the predictive coefficient for interest-rate differentials. That is consistent with the carry trade hypothesis of Brunnermeier, Nagel, and Pedersen (2013).

4-2-2 Renminbi's Shift to Vulnerable Currency Status

The SCI suggests the renminbi is a vulnerable currency except the period of 1997-2001. As capital flows from and into the Mainland China are restricted its interest rate differential to another currency and the VIX haven't well tracked the movement of onshore renminbi (CNY). In order to capture the investor's risk perception under uncertainty, the offshore renminbi (CNH) might be the more appropriate gauge of the safe-haven and vulnerable status. In fact, during the risk episode such as the U.S. sovereign credit downgrade, CNH tended to depreciate more rapidly than CNY did (Figure 7). The tests for safe-haven status in CNY are neither stable nor significant not only against the dollar, but the euro (Figure 8, Figure 9). In contrast, the CNH's vulnerable currency status against the dollar and the yen is consistent (Figure 10, Figure 11), while

its status relative to the euro was regarded as a safe-haven until April 2014, shifting to the vulnerable currency toward May 2015, significantly (Figure 12). The results are consistent with the results of tests for the structural breaks, overall (Table 5, Table 6).

4-2-3 Other Asian Currencies' Status

The same estimation method is conducted for the Korean won, the Indonesia rupiah, and the Singapore dollar. The won and the rupiah have remained vulnerable currency during the sample period (Figure 13, Figure 14), while the vulnerable Singapore dollar inched to the safe-haven status in 2015 (Figure 15). The structural break tests suggest that the won and the rupiah are vulnerable currencies that have no structural break (Table 7), and the Singapore dollar has two breaks, but it has remained the vulnerable currency (Table 8).

4-2-4 Alternative Assets: Gold and Bitcoin

The final empirical tests assess the safe-haven status against old and new alternative assets or currencies: gold and bitcoin.

Gold is traditionally regarded as a safe asset as well as a safe-haven currency. The empirical results suggest that its movement is more sensitive to the U.S. interest rates rather than the market risk sentiment (Figure 16), implying that it might be alternative assets when U.S. interest rates are low, rather than a safe-haven. Still, it might have been working as a safe-haven asset since the Brexit vote of June 2016. The strength of the status was upgraded after the U.S. presidential election in November 2016. In contrast, the gold kept its vulnerable status relative to the yen during the same period, i.e., the yen is regarded as a safe-haven to the gold (Figure 17). The gold's status against the Swiss

franc was unstable during the sample period (Figure 18).

The bitcoin — a cryptocurrency and a payment system — has been emerging as the non-national currency. The size of bitcoin transaction has been increasing. The value of its weekly transaction reached about 50 billion dollar. The renminbi has dominated the share of the counter party currency to bitcoin since the mid-2014 (Figure 19). The bitcoin price tends to be accompanied by the weaker renminbi (Figure 20). The appeal of bitcoin lies in the capacity to skirt China's capital controls and move funds out of the country (Orlik and Jimenez 2017). So, it could be used as the loophole of China's capital restrictions[7]. The safe-haven index suggests the bitcoin had the safe-haven status relative to the renminbi after the China's stock market crush in the early 2016 (Figure 21), while it also had the safe-haven status relative to the U.S. dollar after the U.S. presidential election in November 2016 (Figure 22). It would be too early to say that the bitcoin really worked as a safe-haven as its status might be temporary. Still, the result may signal the new trend of investors' preference to alternative assets under global policy uncertainty.

5. Conclusion

This paper investigates the relationship between market uncertainty and the relative value of Asian currencies against currencies that the safe-haven literature typically considers as the traditional safe-haven currency candidates. The results suggest that the yen is a safe-haven currency as well as safe assets. Its safe-haven status is stronger on average than other safe-haven currencies such as the Swiss franc, bitcoin, and gold are (Figure 23). The offshore traded renminbi (CNH) has the vulnerable status to the U.S.

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[7] Bitcoin prices tumbled to $903 on Jan. 10, down 17% from a peak of $1,091 on Jan. 4 (Figure 20). The proximate cause – signals from China's central bank that they are paying close attention to irregularities in the market.

dollar and the yen, while the CNH shifted to the vulnerable status relative to the euro in May 2014 from the safe-haven status. The won, rupiah, Singapore dollar have vulnerable currencies overall. Still, due to restricted capital flows, foreign exchange regime, and intervention might have distorted the results for the Asian emerging economies. Higher market uncertainty with policy swings may increase safe-haven demand for alternative assets such as gold and bitcoin, while not substituting the yen and the dollar due to limited liquidity. The safe-haven index could predict the exchange rate movement, tracking the deviation of the current exchange rate from the estimates. The yen's rapid depreciation after the U.S. president Donald Trump's win could be overshooting, compared to the investors' average behavior for the past 250 days (Figure 24). That could mean the actual value has been approaching the estimated value as the investors become more risk-averse.

Policy implications from the results are the yen's safe-haven status may have damped the business sentiment and export-driven recovery, but it may have masked vulnerability of Japan's government finance with massive monetary easing, which is an advantage to be a safe-haven. Fading the renminbi's safe-haven status may support export-driven growth for the Chinese economy. Consequently, within Asia, the yen's safe-haven status could have helped the post-crisis recovery of other Asian countries' exports driven by weaker currencies due the vulnerable status of the won, the rupiah, and the renminbi (Figure 25), balancing capital flows between Asia and other regions.

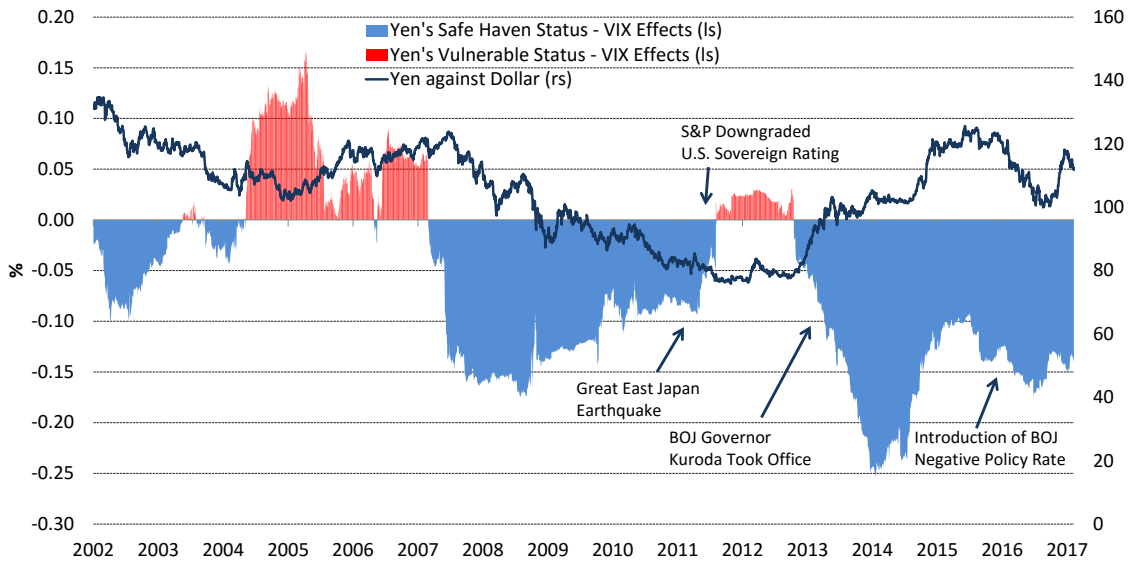# Figure 1. Swiss Shock on Asia—Has the SGD been a Safe Haven?

（2015/1/15 16:00 JST=100 against USD）
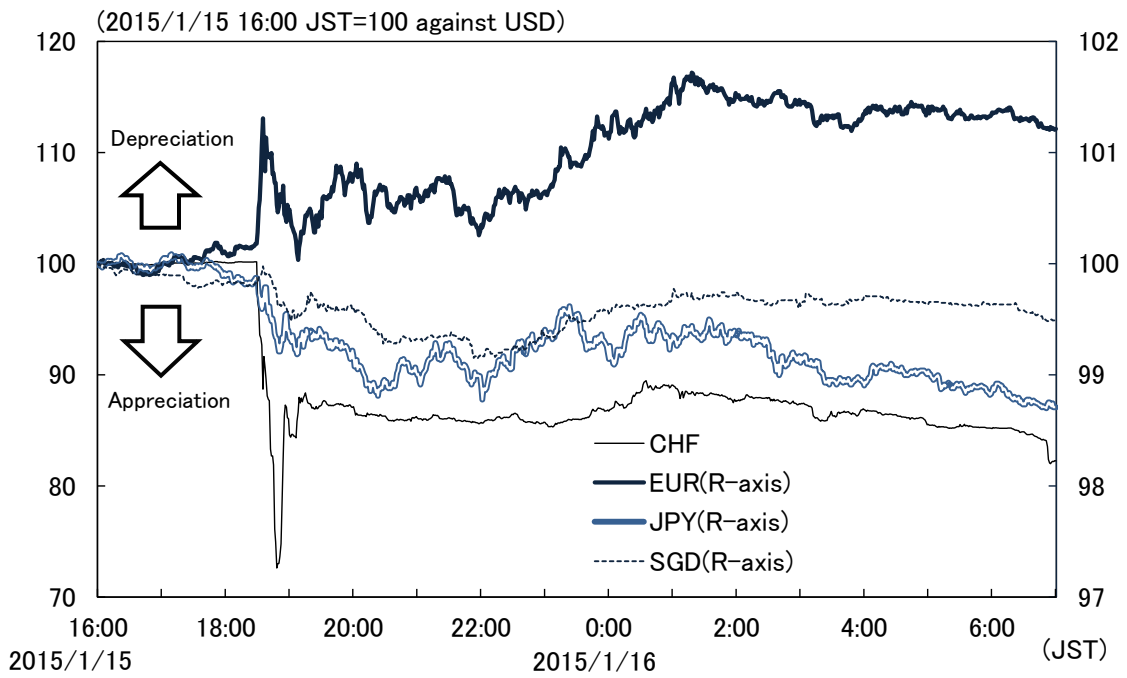
Source: Bloomberg

# Figure 2. Implied Volatility in the. U.S., Japan, and German Stock Markets
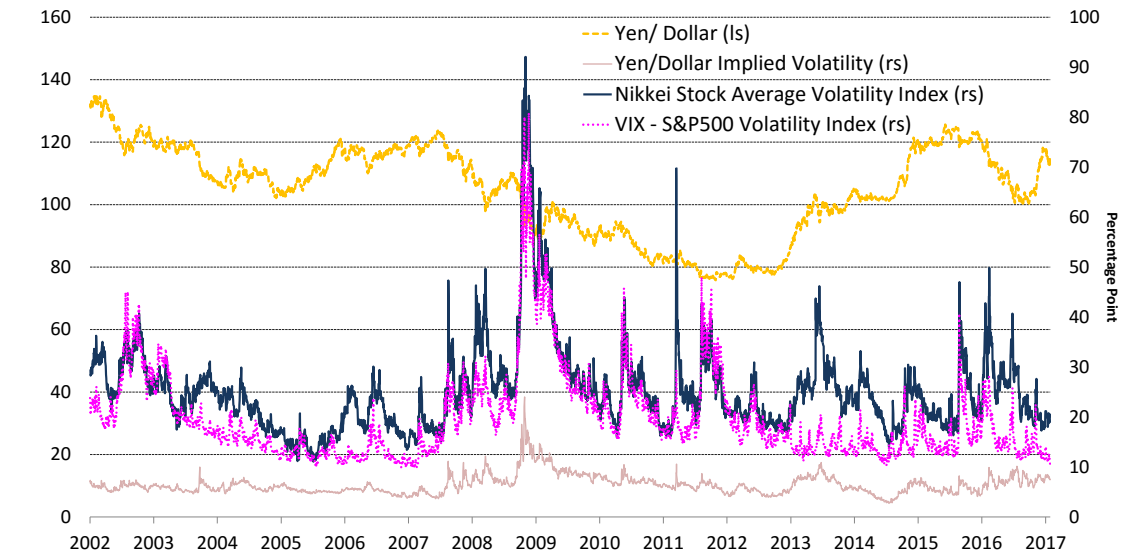
Source: Bloomberg

Figure 3. Yen's Safe Haven Status Have Enhanced since 2007

Note: Impacts of one percentage point change in VIX on a change in value of currencies against dollar.
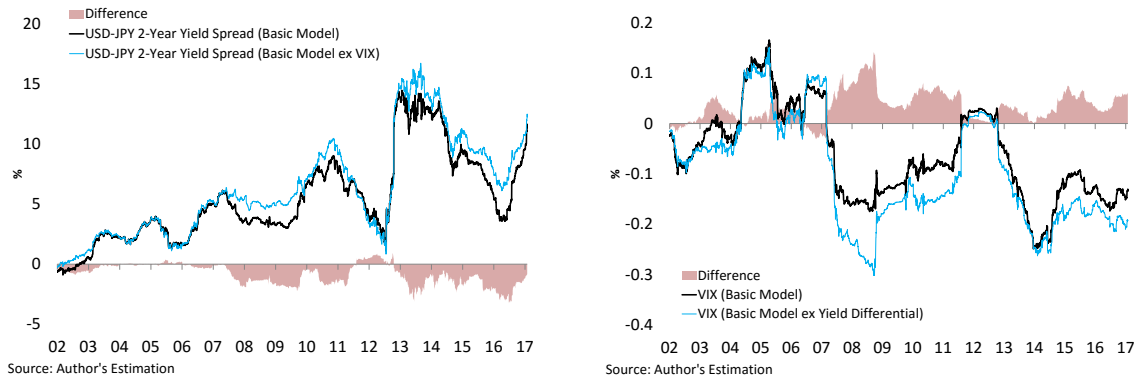Source: Bloomberg Intelligence, Author's Estimation

Figure 4. Yen's Safe Haven Status with Short-Term Yields

Source: Author's Estimation

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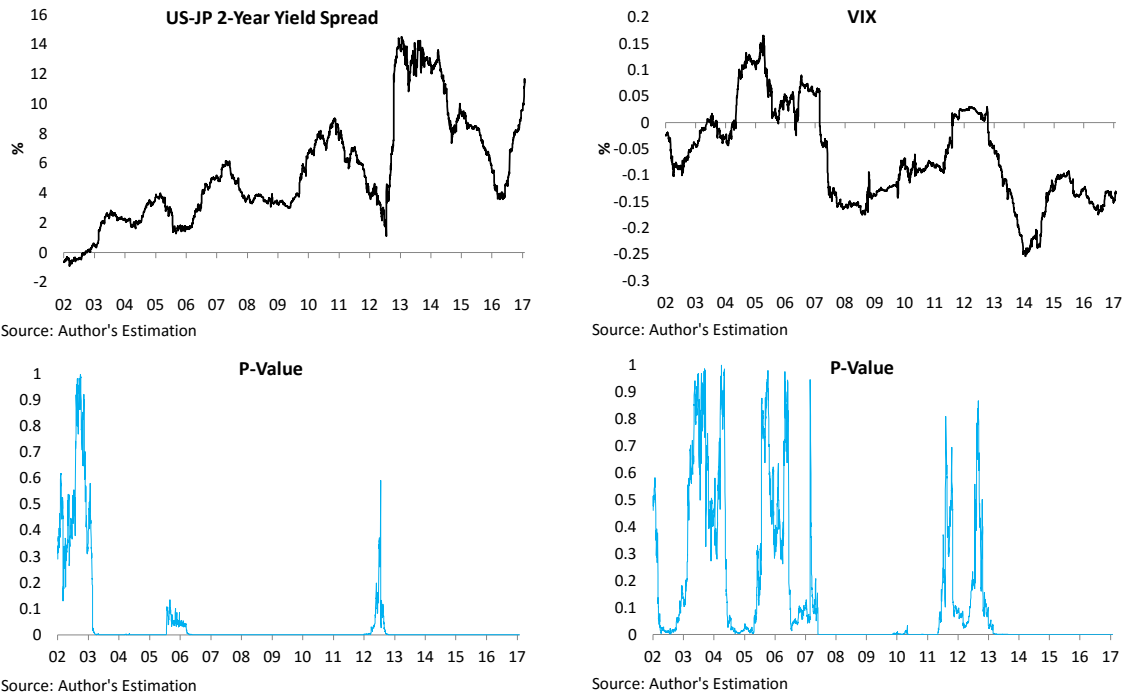
**Figure 5. Yen's Safe Haven Status with Short-Term Yield and Yield Curve**

Source: Author's Estimation

Source: Author's Estimation

Figure 6. Yen's Safe Haven Status with Short-Term Yield and Yield Curve

Source: Author's Estimation

Source: Author's Estimation

Source: Author's Estimation

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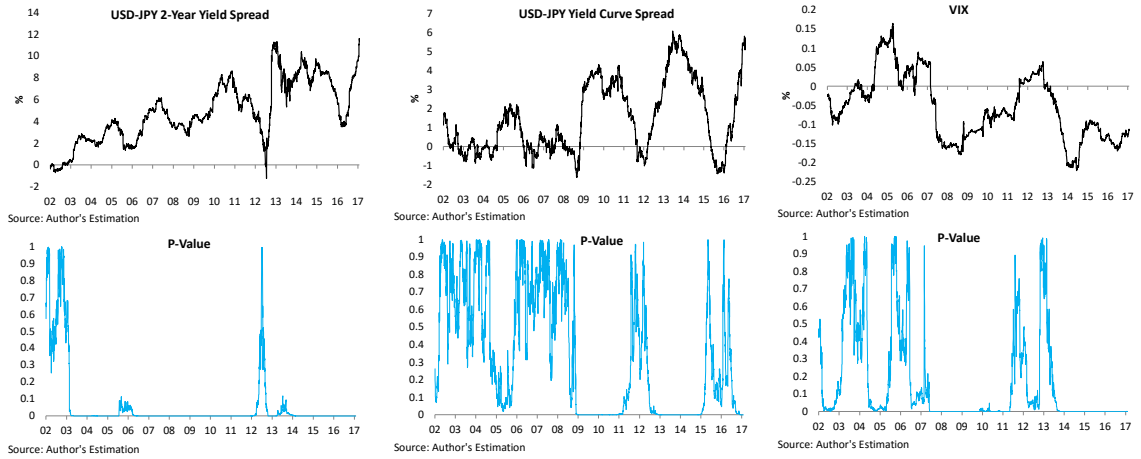
Figure 7. Renminbi in Onshore (CNY) and Offshore (CNH) Markets

Source: Bloomberg, Author's Estimation
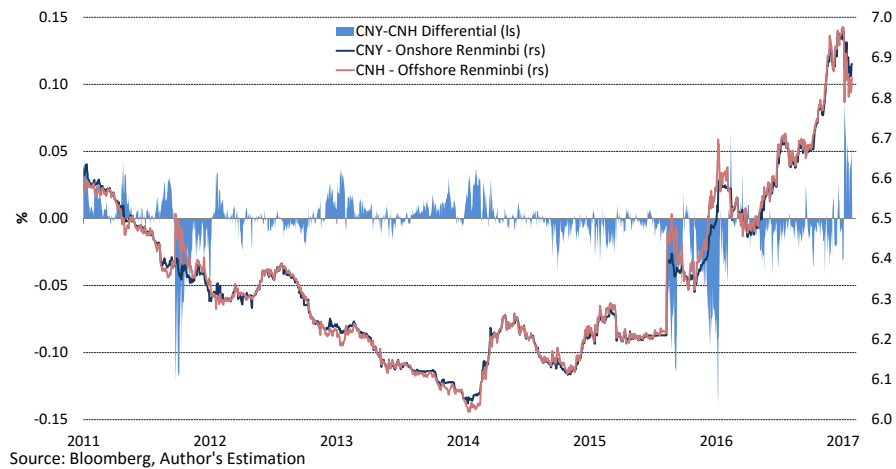
Figure 8. CNY's Vulnerable Currency Status to Dollar

USD-CNY 2-Year Yield Spread

Source: Author's Estimation

VIX

Source: Author's Estimation

P-Value

Source: Author's Estimation

P-Value

Source: Author's Estimation
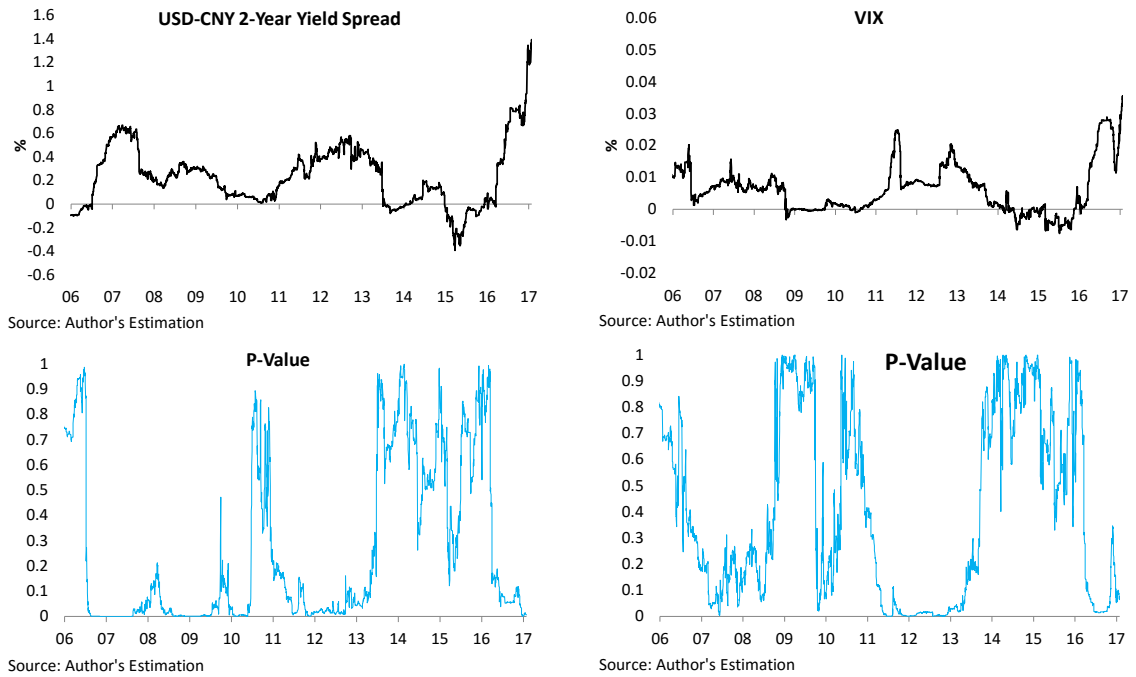
Figure 9. CNY's Safe Status Relative to Euro Is Ambiguous

EURCNY 2-Year Yield

Source: Author's Estimation

VIX

Source: Author's Estimation

P-Value

Source: Author's Estimation

P-Value

Source: Author's Estimation

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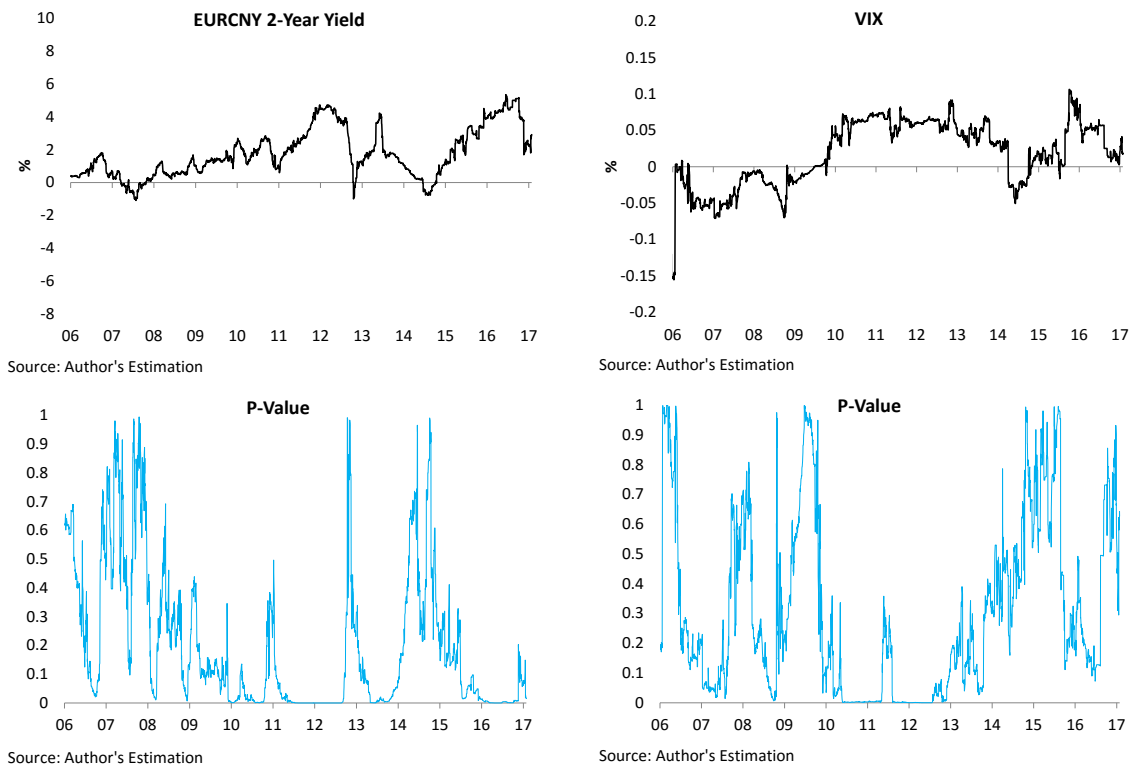
Figure 10. CNH's Shift to Vulnerable Currency Status to Dollar

USD-CNH 2-Year Yield Spread

Source: Author's Estimation

VIX

Source: Author's Estimation

P-Value

Source: Author's Estimation

P-Value

Source: Author's Estimation
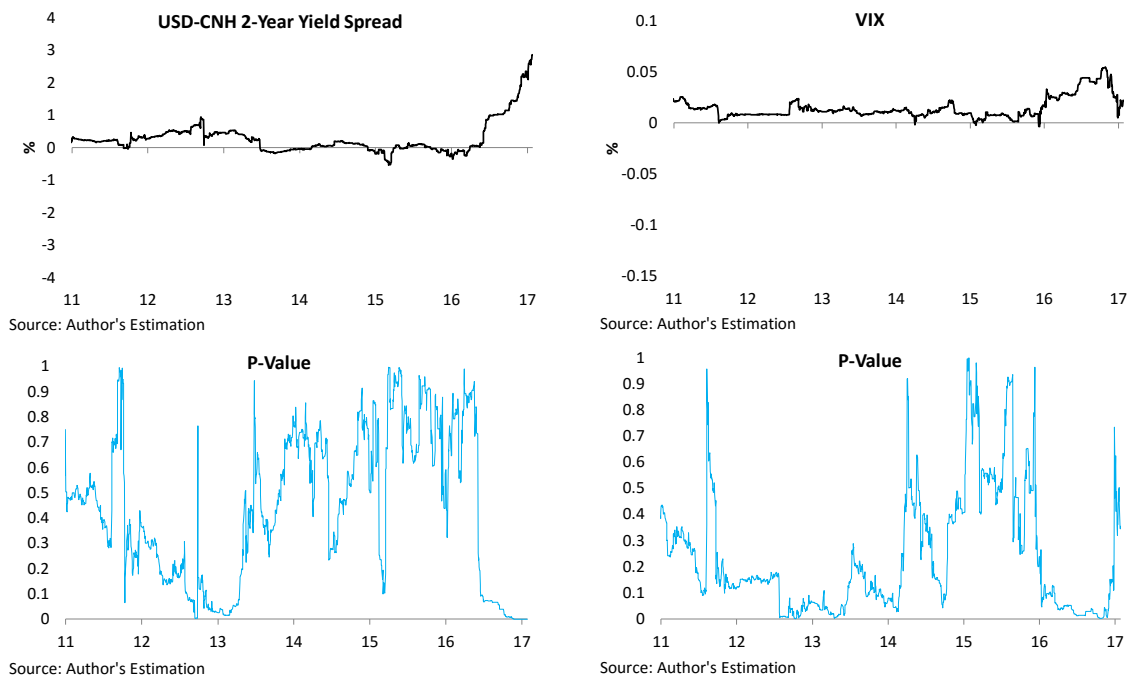
Figure 11. CNH's Vulnerable Currency Status to Yen

CNH-JPY 2-Year Yield Spread

Source: Author's Estimation

VIX

Source: Author's Estimation

P-Value

Source: Author's Estimation

P-Value

Source: Author's Estimation

21
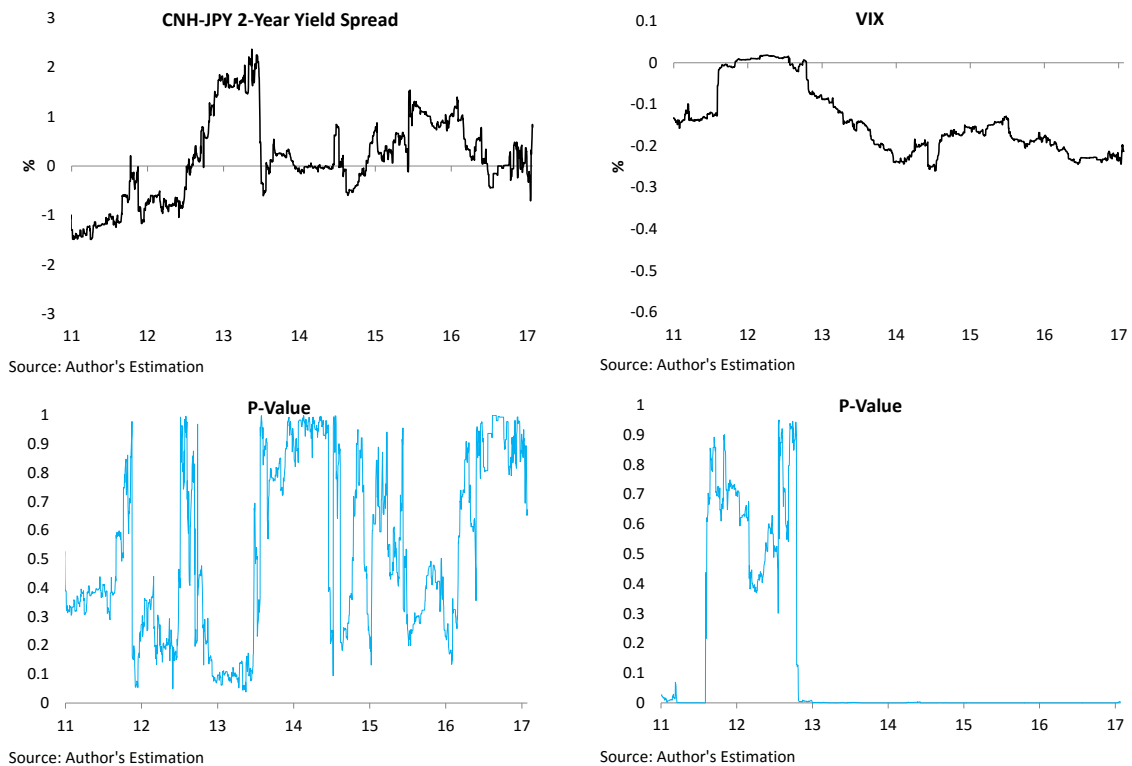
Figure 12. CNH's Safe Haven Status Relative to Euro Has Changed

EUR-CNH 2-Year Yield Spread

Source: Author's Estimation

VIX

Source: Author's Estimation

P-Value

Source: Author's Estimation

P-Value

Source: Author's Estimation
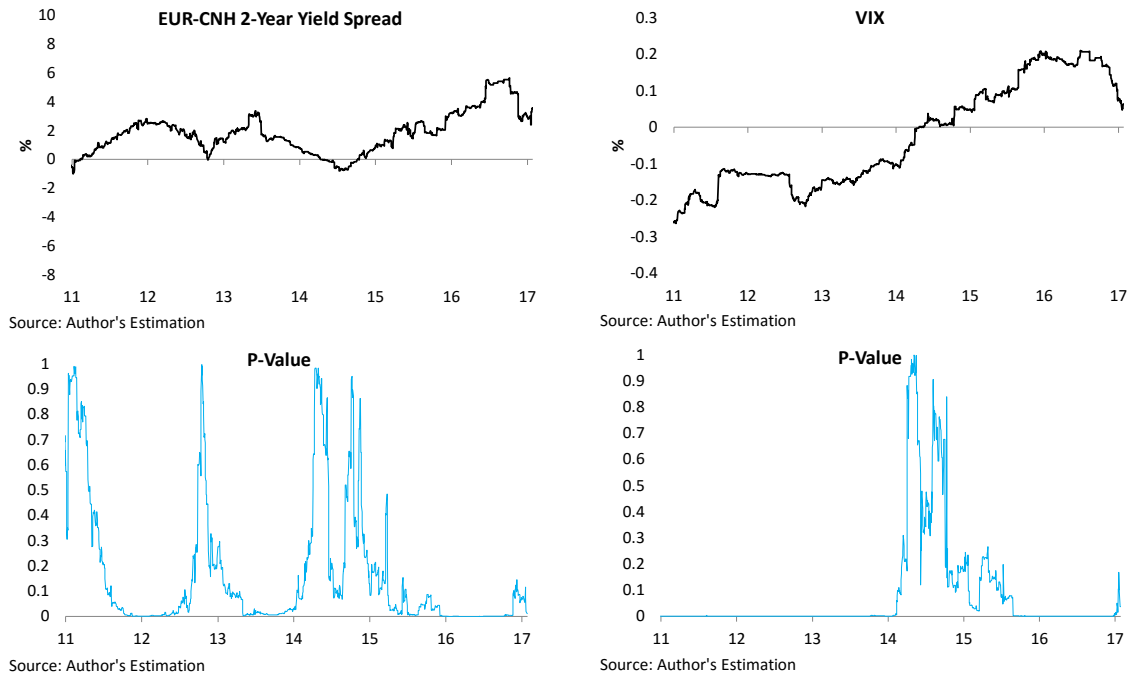
Figure 13. Korean Won's Vulnerable Currency Status to Dollar

USD-KRW 2-Year Yield Spread

Source: Author's Estimation

VIX

Source: Author's Estimation

P-Value

Source: Author's Estimation

P-Value

Source: Author's Estimation

22
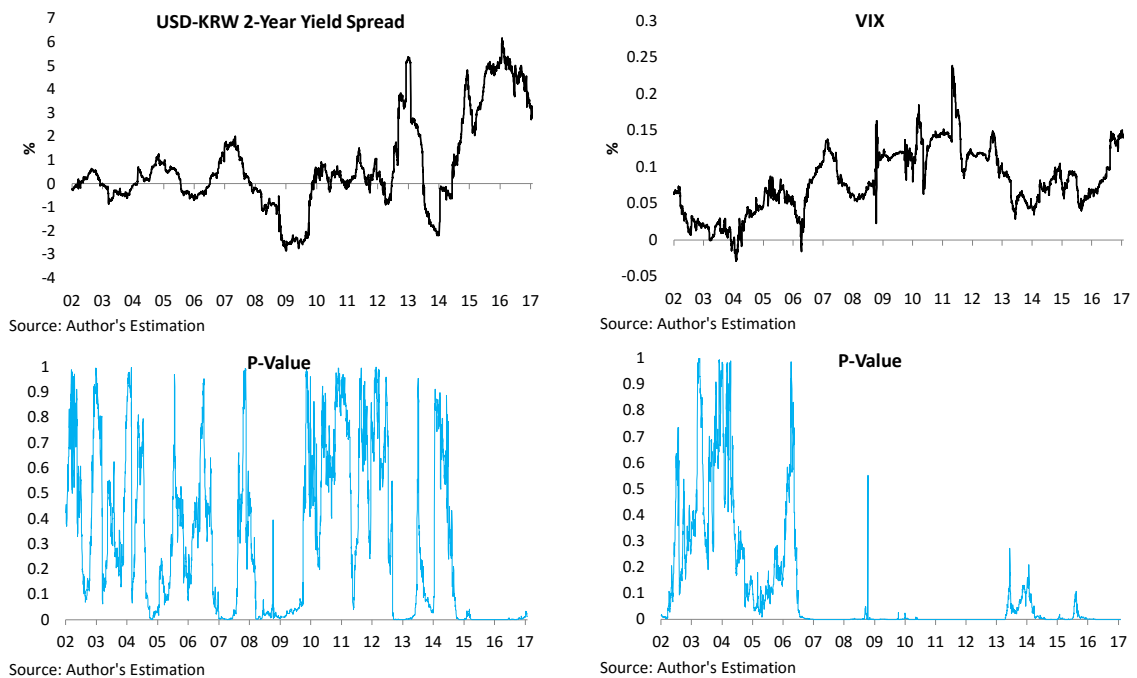
Figure 14. Indonesian Rupiah's Vulnerable Currency Status to Dollar

USD-IDR 2-Year Yield Spread

Source: Author's Estimation

VIX

Source: Author's Estimation

P-Value

Source: Author's Estimation

P-Value

Source: Author's Estimation
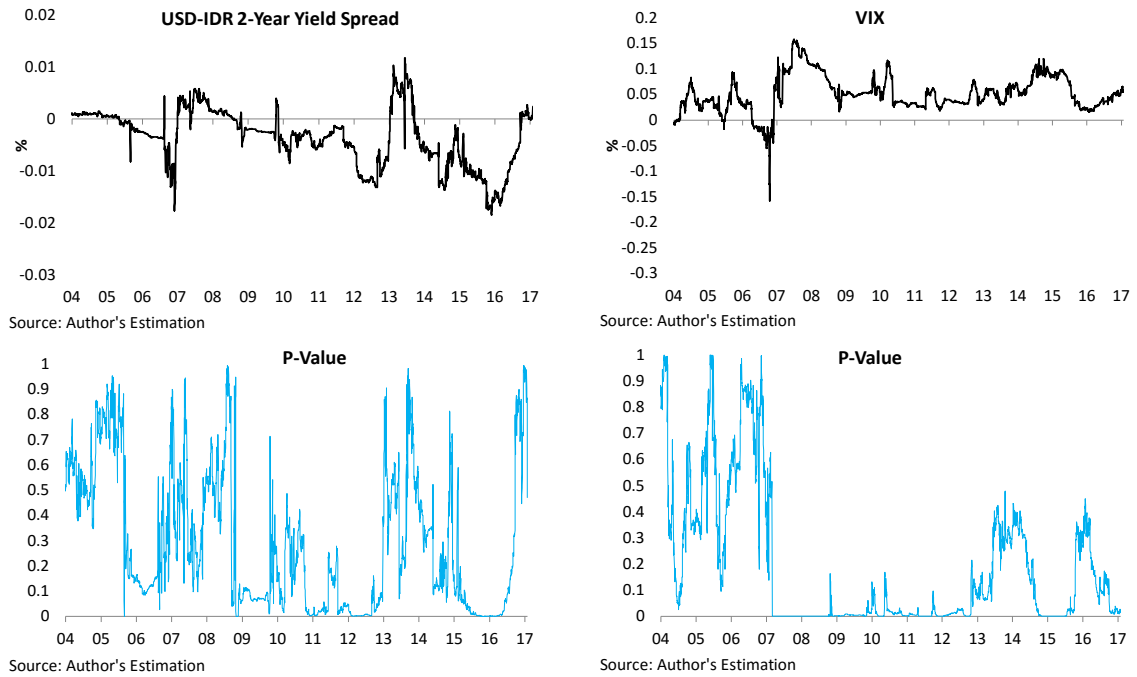
Figure 15. Singapore Dollar's Vulnerable Currency Status to Dollar

USD-SGD 2-Year Yield Spread

Source: Author's Estimation

VIX

Source: Author's Estimation

P-Value

Source: Author's Estimation

P-Value

Source: Author's Estimation

23
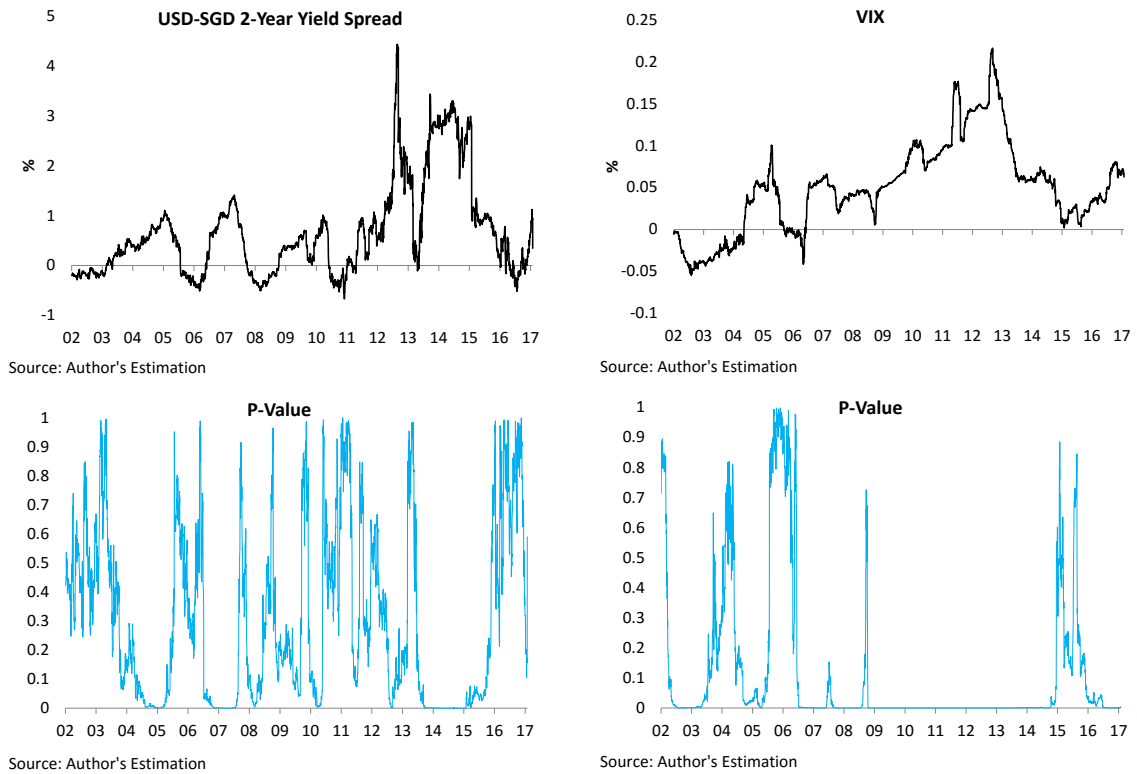
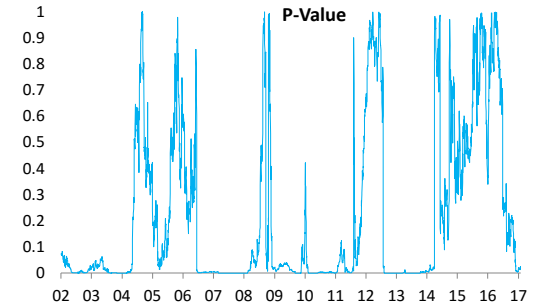# Figure 16. Gold's Vulnerable Currency Status to Dollar
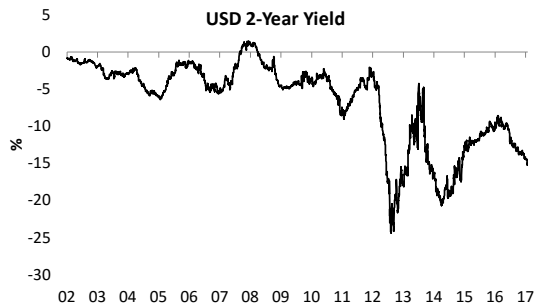
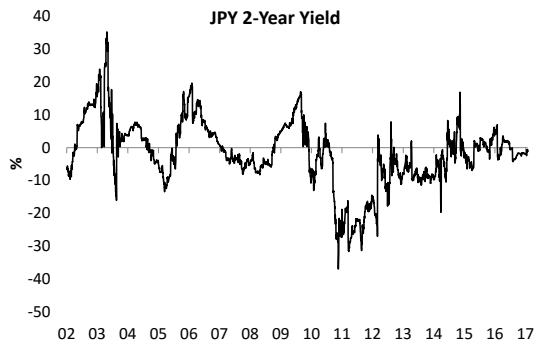
Source: Author's Estimation
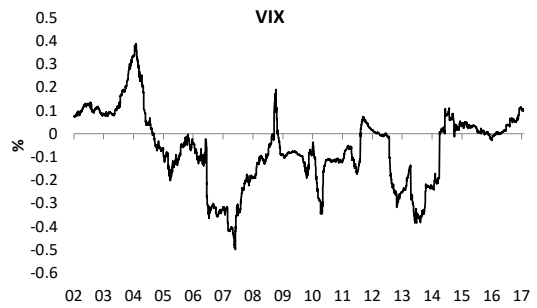
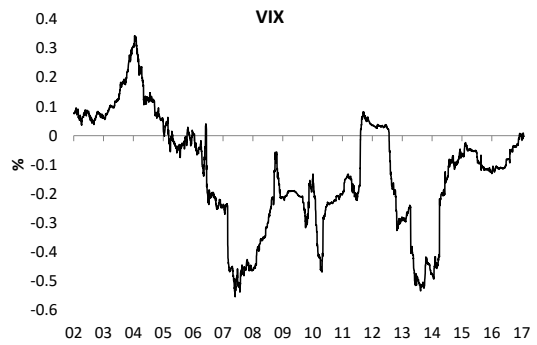Source: Author's Estimation
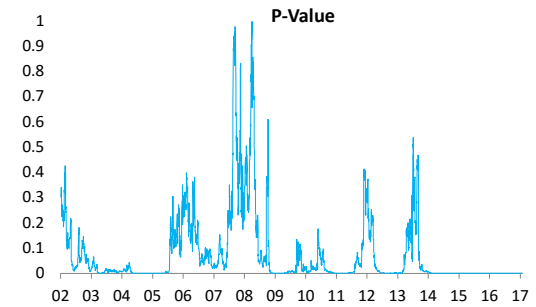
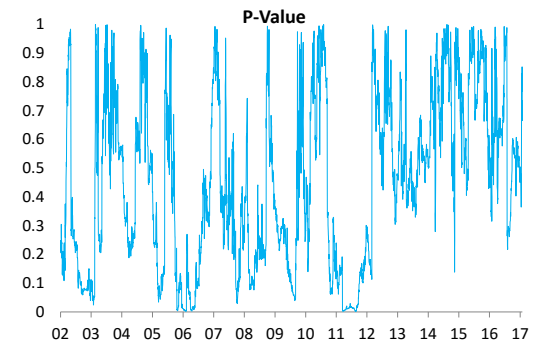Source: Author's Estimation

Source: Author's Estimation

Figure 17. Gold's Vulnerable Currency Status to Yen
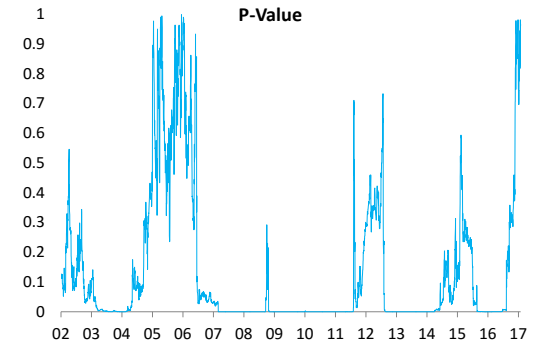

Source: Author's Estimation

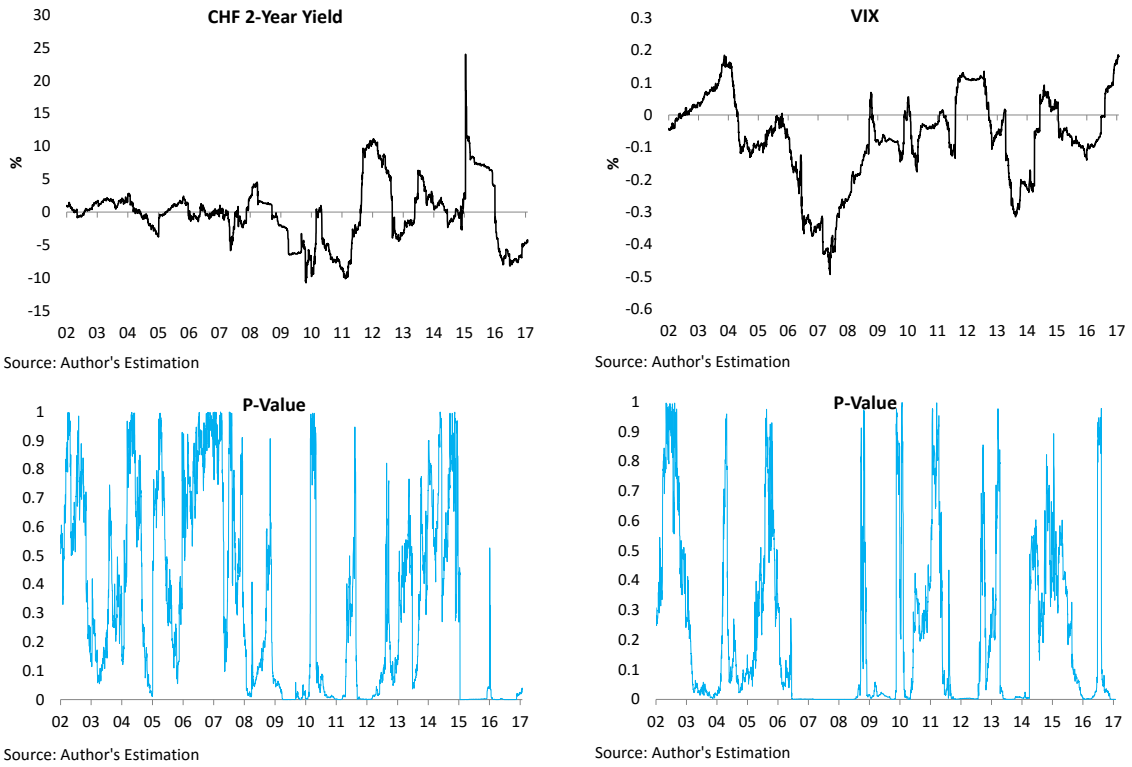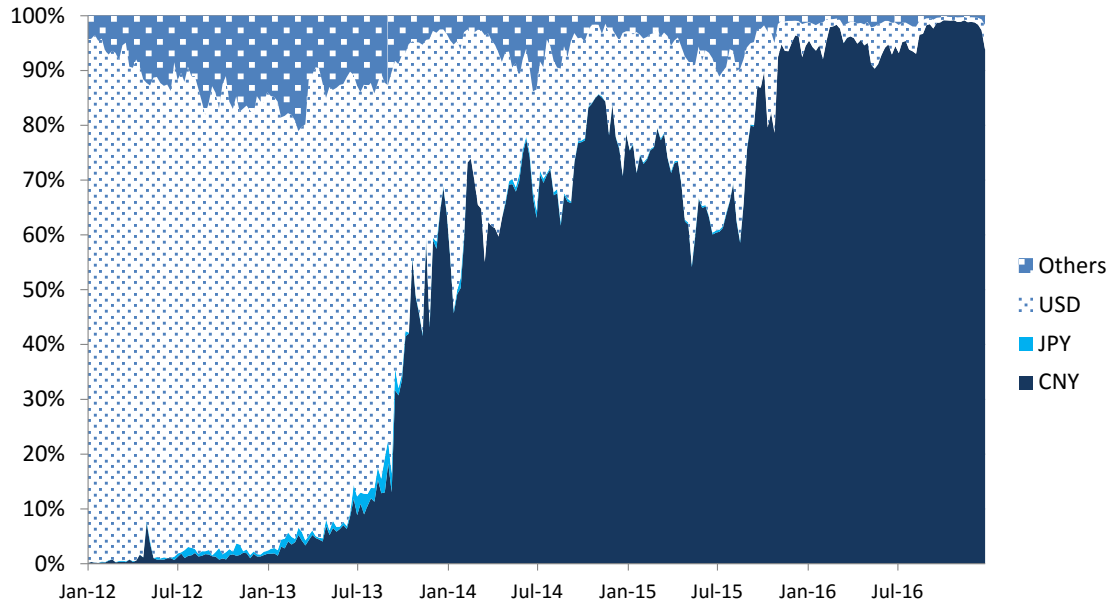Source: Author's Estimation

Source: Author's Estimation

Source: Author's Estimation

24

Figure 18. Gold's Vulnerable Currency Status to Swiss Franc

CHF 2-Year Yield

Source: Author's Estimation

VIX

Source: Author's Estimation

P-Value

Source: Author's Estimation

P-Value

Source: Author's Estimation

Figure 19. Renminbi Dominates Bitcoin Transactions

Source: Bitcoinity

Figure 20. CNH and Bitcoin Price Movement

Source: Bloomberg

Figure 21. Bitcoin's Safe Haven Status to CNH

Source: Author's Estimation

Source: Author's Estimation

Source: Author's Estimation

Source: Author's Estimation
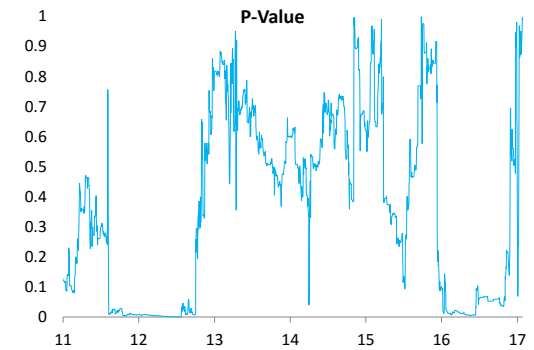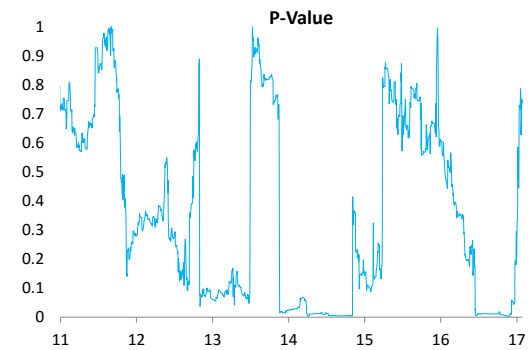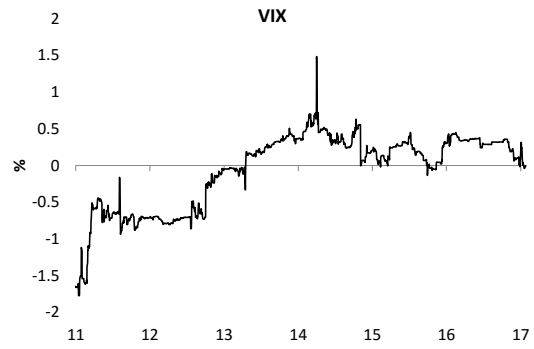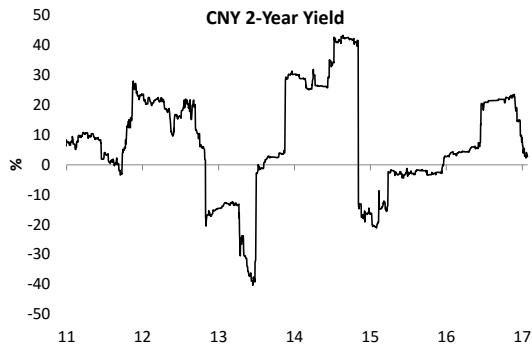
Figure 22. Bitcoin's Safe Haven Status to Dollar

Source: Author's Estimation

Source: Author's Estimation
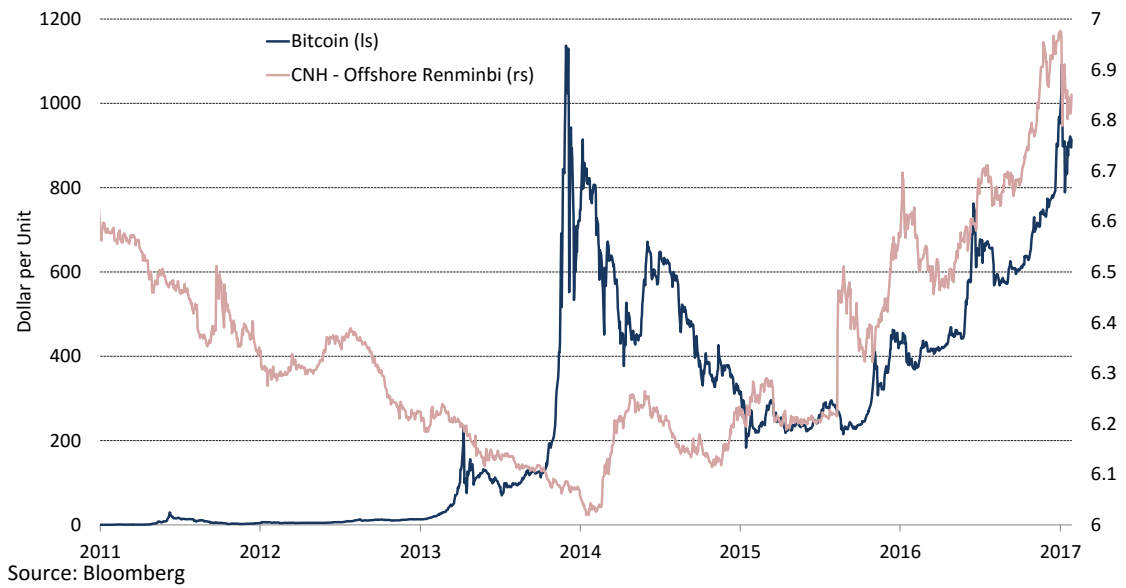
Source: Author's Estimation

Source: Author's Estimation
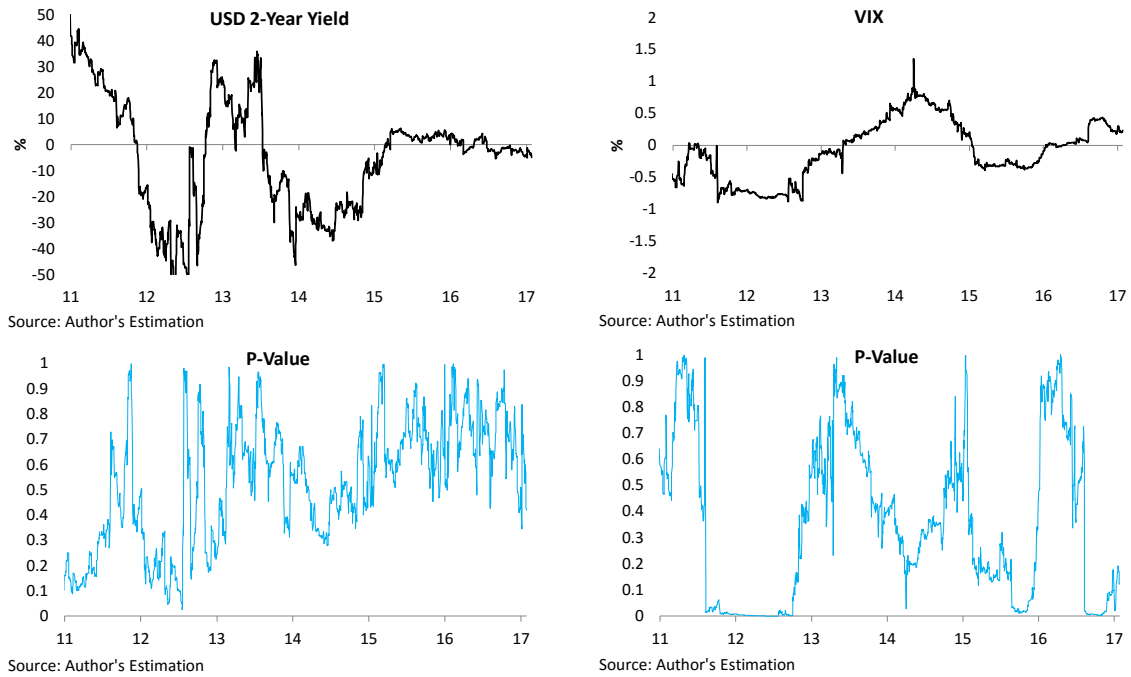
Figure 23. Comparison of Safe Haven Currencies
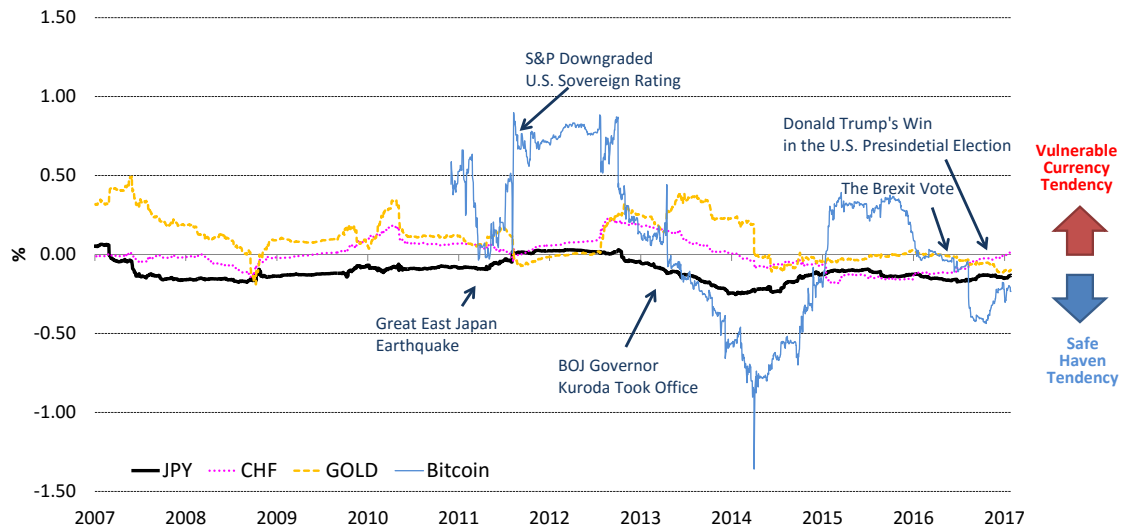
Note: Impacts of one percentage point change in VIX on a change in value of currencies against dollar.
Source: Bloomberg Intelligence, Author's Estimation

Figure 24. Yen Might Be Overshooting after the U.S. Presidential Election

Source: Bloomberg, Author's Estimation

Figure 25. Comparison of Safe Haven/Vulnerable Status in Asian Currencies

Note: Impacts of one percentage point change in VIX on a change in value of currencies against dollar.
Source: Bloomberg Intelligence, Author's Estimation

Table 1. Share of Turnover of OTC Foreign Exchange Instruments, by Currency

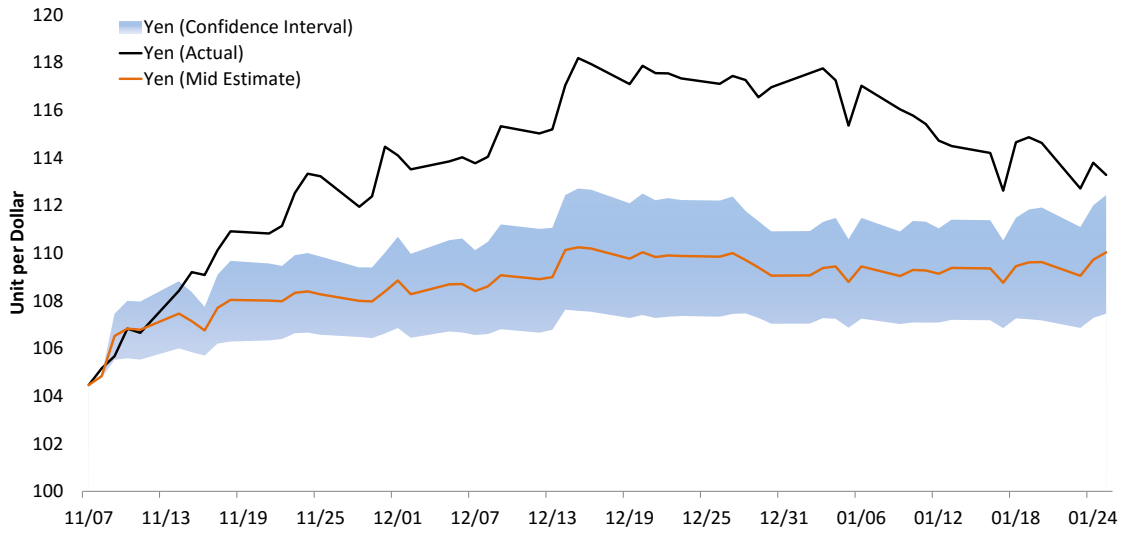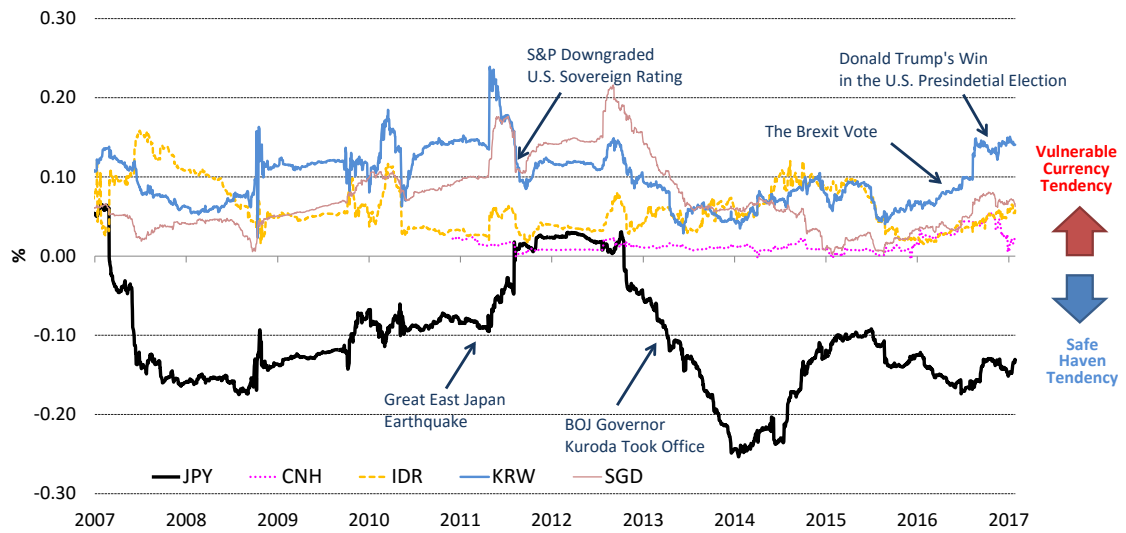| Currency	1995 %	1998 %	2001 %	2004 %	2007 %	2010 %	2013 %	2016 %
USD	83	87	90	88	86	85	87	88
EUR	...	...	38	37	37	39	33	31
JPY	25	22	24	21	17	19	23	22
GBP	9	11	13	16	15	13	12	13
CHF	7	7	6	6	7	6	5	5
CNY	...	0	0	0	0	1	2	4
SGD	0	1	1	1	1	1	1	2
HKD	1	1	2	2	3	2	1	2
KRW	...	0	1	1	1	2	1	2
TWD	...	0	0	0	0	0	0	1
THB	...	0	0	0	0	0	0	0
MYR	...	0	0	0	0	0	0	0
IDR	...	0	0	0	0	0	0	0
DEM	36	30	...	...	...	...	...	...

Source: BIS(2016)

Table 2. Global Safe Asset Index

	1997-2001	2007-2011	2012-2015	Mean
Switzerland	0.35	0.05	0.25	0.15
Japan	0.23	0.20	0.23	0.13
United States	▲0.02	0.47	0.25	0.10
Hong Kong	▲0.16	0.19	▲0.01	▲0.03
United Kingdom	0.08	▲0.44	▲0.19	▲0.05
Phillipines	▲0.11	▲0.23	▲0.22	▲0.06
Singapore	▲0.11	▲0.23	0.20	▲0.06
EMU	▲0.02	▲0.17	▲0.17	▲0.07
China	0.06	▲0.44	▲0.16	▲0.10
Thailand	0.05	▲0.02	▲0.11	▲0.11
Indonesia	▲0.01	▲0.50	▲0.20	▲0.13
Malaysia	0.15	▲0.59	▲0.06	▲0.16
Korea	▲0.18	▲0.50	▲0.23	▲0.20

Note: If the Safe Asset Index (SAI) is greater than 0, a currency has the safe-haven status, while the negative value means the currency depreciates when the VIX increases.
Source: Author's Estimation

Table 3. Yen's Structural Breaks to Dollar (Basic Model)

Country	Japan				
Starting Date	1/5/2001	1/5/2001	7/22/2006	9/1/2010	2/1/2013
End Date	1/26/2017	7/21/2006	8/31/2010	1/31/2013	1/26/2017
dln(JPY)					
Constant	-0.004	-0.003	-0.019	0.013	0.001
*D(*USDJPY 2-year yield spreads*)*	3.4297***	1.5642***	4.2858***	6.1668***	8.4512***
*D(*VIX*)*	-0.0875***	0.0148	-0.1211***	0.0117	-0.143***
Adj. R-Squared	0.176	0.025	0.411	0.085	0.293
F-statistic	412.9	17.8	349.1	27.1	198.7
Durbin-Watson	2.066	2.066	2.132	2.012	1.972
Obs.	3871	1324	999	585	963

Note: *, **, *** indicate the 10%, 5%, 1% significant level.

Table 4. Yen's Structural Breaks to Dollar (Yield Curve Model)

Country	Japan				
Starting Date	1/5/2001	1/5/2001	7/22/2006	9/1/2010	2/1/2013
End Date	1/26/2017	7/21/2006	8/31/2010	1/31/2013	1/26/2017
dln(JPY)					
Constant	0.0000	0.0000	-0.0002	0.0001	0.0000
*D(*USDJPY 2-year yield spreads*)*	3.7257***	1.6665***	4.9464***	5.3263***	8.0504***
*D(*USDJPY 10-year/2-year yield spread differentials*)*	1.7913***	0.6700*	2.7169***	1.3803**	3.0341***
*D(*VIX*)*	-0.0803***	0.0143	-0.1147***	0.0114	-0.1317***
Adj. R-Squared	0.189	0.026	0.438	0.090	0.316
F-statistic	300.8	12.9	259.2	20.3	149.0
Durbin-Watson	2.071	2.066	2.168	1.988	1.964
Obs.	3866	1324	994	585	963

Note: *, **, *** indicate the 10%, 5%, 1% significant level.

Table 5. CNH's Structural Breaks to Euro

Country	China		
Starting Date	8/24/2010	8/24/2010	6/22/2013
End Date	10/12/2016	6/21/2013	1/26/2017
dln(CNH/EUR)			
Constant	0.0000	-0.0001	0.0002
*D(*EURCNH 2-year yield spreads*)*	0.2543*	0.1789***	0.0438
D(VIX)	-0.0840***	-0.1439***	0.0783***
Adj. R-Squared	0.057	0.2303	0.035
F-statistic	33.7	87.9	9.9
Durbin-Watson	1.997	1.972	2.029
Obs.	1078	582	496

Note: *, **, *** indicate the 10%, 5%, 1% significant level.

Table 6. Yen's Structural Breaks to CNH

Country	Japan		
Starting Date	8/24/2010	8/24/2010	1/1/2013
End Date	1/26/2016	12/31/2012	1/26/2017
dln(JPY/CNH)			
Constant	-0.0003	0.0041	0.0062
*D(*CNHJPY 2-year yield spreads*)*	-0.0243	-0.2384	0.0297
*D(*VIX*)*	-0.0825***	-0.0139	-0.2053***
Adj. R-Squared	0.047	0.003	0.158
F-statistic	26.1	0.6	55.9
Durbin-Watson	2.066	2.078	1.938
Obs.	1073	488	585

Note: *, **, *** indicate the 10%, 5%, 1% significant level.

Table 7. No Structural Breaks to Dollar in KRW, CNY, IDR

Country	Korea	China	Indonesia
Starting Date	1/4/2001	6/9/2005	1/4/2005
End Date	1/26/2017	1/26/2017	1/26/2017
*dln(*Local Currency$_t$*)*			
Constant	-0.00734	-0.0114	0.0156
*D(*US$_{t-1}$-Local Currency$_t$ 2-year yield spreads)*	-0.2153	0.214***	-0.2299***
*D(*VIX$_{t-1}$*)*	0.097***	0.004***	0.0512***
Adj. R-Squared	0.057	0.0148	0.037
F-statistic	108.4	16.9	58.5
Durbin-Watson stat	2.070	2.017	2.269
Obs.	3581	2124	3000

Note: *, **, *** indicate the 10%, 5%, 1% significant level.

Table 8. Singapore Dollar's Structural Breaks to Dollar

Country	Singapore			
Starting Date	1/3/2001	1/3/2001	5/28/2010	11/2/2012
End Date	1/26/2017	5/27/2010	11/1/2012	1/26/2017
dln(SGD)				
Constant	-0.00462	-0.0001	-0.0133	0.00998
D(USSGD2Y)	0.4232***	0.2611***	0.7609	0.8373***
D(VIX)	0.0627***	0.0441***	0.1501***	0.0413***
Adj. R-Squared	0.090	0.058	0.383	0.030
F-statistic	182.4	66.9	174.1	4133.4
Durbin-Watson stat	2.032	2.012	1.927	2.038
Obs.	3681	2153	559	969

Note: *, **, *** indicate the 10%, 5%, 1% significant level.

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