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Economic Research

Safe-Haven Currencies

Safe-haven currencies are believed to serve as a reliable investment in times of economic instability. However, the methods for identifying such currencies remain more intuitive than systematic. In this issue we employ one of the possible strict definitions to see which currencies can be called safe-haven and whether this property varies over time.

In this research we will examine safe-haven properties in relation to economic indicators. Namely, a currency will be called a safe-haven if it tends to appreciate when the financial market depreciates or faces great instability. Additionally, to make the study less complex, we will limit the global concept of a safe-haven currency to being "a safe-haven in a particular currency pair".

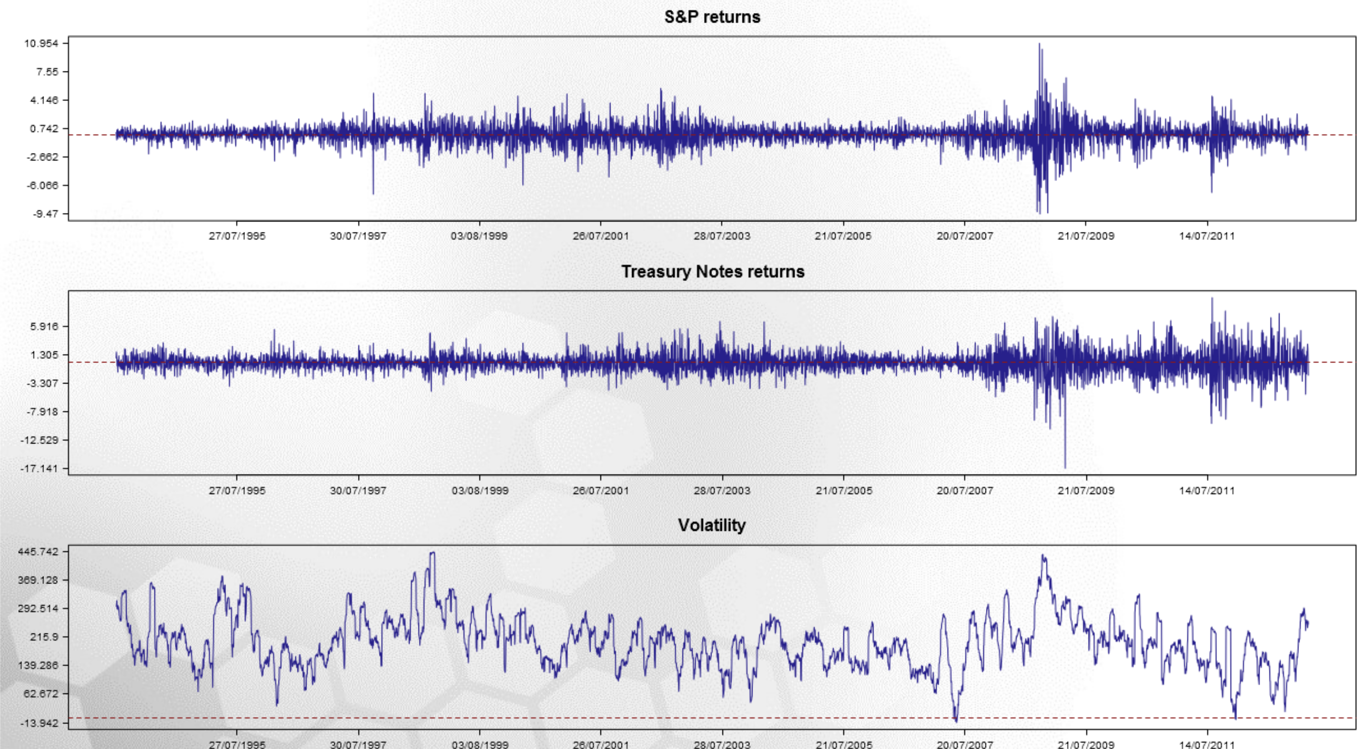

Figure 1: Data used in the research: 1993 – 2013 returns (%) on S&P and T-Notes, and market volatility for JPY

We have chosen to pair the examined currencies with the U.S. dollar, concentrating on USD/JPY, USD/CHF, GBP/USD, NZD/USD, USD/CAD, AUD/USD, EUR/USD, USD/SGD, and USD/SEK. The financial market, in turn, is represented by Standard & Poor's 500 Stock Price Index and 10-Year US Treasury Notes, with instability measured by currency market volatility (see the Appendix for further information). All data is collected over the period from 1993 to 2013.

The Japanese yen, the Swiss franc, the euro, and the British pound are generally considered to be safe-haven currencies. Therefore, we expect the test results to set them apart from the others. However, we do not rule out the possibility of adding some new currencies to the list, or, conversely, crossing out some of those mentioned.

Methodology

As we want to investigate appreciation and depreciation of the assets, we apply the tests to logarithmic or continuously compounded daily returns.

The simplest way to examine the link between the currency pairs and the financial market is to construct a linear factor model.

A linear factor model employs a linear equation to describe a relationship between a dependent variable and a finite number of factors. In our study, the dependent variable is the currency pair returns (*Curr*), but the factors are market volatility (*Vol*) and returns on S&P and T-Notes. The associated equation is [1]:

$$Curr_t = \beta_0 + \beta_1 \cdot S\&P_t + \beta_2 \cdot T-Notes_t + \beta_3 \cdot Vol_t + \beta_4 \cdot S\&P_{t-1} + \beta_5 \cdot T-Notes_{t-1} + \beta_6 \cdot Vol_{t-1} + \varepsilon_t$$

Coefficients β_i (*i = 1, 2, …, 6*) measure the change in currency pair returns per unit change in the corresponding factor. β_0, or intercept, shows how the dependent variable can change while the factors are equal to zero. The term ε_t represents the change in the dependent variable that is not related to the examined factors.

Indices *t* and *t-1* denote the concerned time moments. Thus, for example, modelling today's returns (t = today) would require current and lagged (t -1 = yesterday) values of the factors.

We describe "economic instability" by increasing market volatility and negative returns on S&P. Under such circumstances the prices on government bonds, including T-Notes, are expected to rise. In theory, safe-haven currencies would in turn appreciate against the U.S. dollar. **Therefore, we are looking for equations that have positive β coefficients for volatility and T-Notes, and negative – for S&P.**

The proposed linear model measures the combined impact of the factors. To investigate the relationship between the currency pairs and each factor separately we use correlation analysis.

Correlation is a measure of dependence between two variables. Coefficient of correlation ranges from -1 to 1. A positive coefficient of correlation indicates that the variables are moving in the same direction. If one variable decreases when the other goes up, the correlation is negative.

In correlation analysis, just like in linear equation, we expect safe-haven currencies to have negative coefficients with S&P, and negative with T-Notes and volatility.

Results

1. Safe-haven properties are time-dependent and can be observed in different currencies.

It is a common belief that safe-haven properties are most evident when the financial market is hit by global events. Thus, as a preliminary test, we look at the behaviour of the currency pairs during two major events – the financial crisis of 2007-2008, and hurricane Sandy.

August 7, 2007 can be viewed as a starting point of the global financial crisis. Figure 2 shows the evolution of cumulative currency pair returns from that date up to the end of December 2008.

A cumulative return measures the change in price in relation to a certain starting point. Each point on a cumulative return chart shows a gain or loss on an investment held from the starting date up to the corresponding time moment.

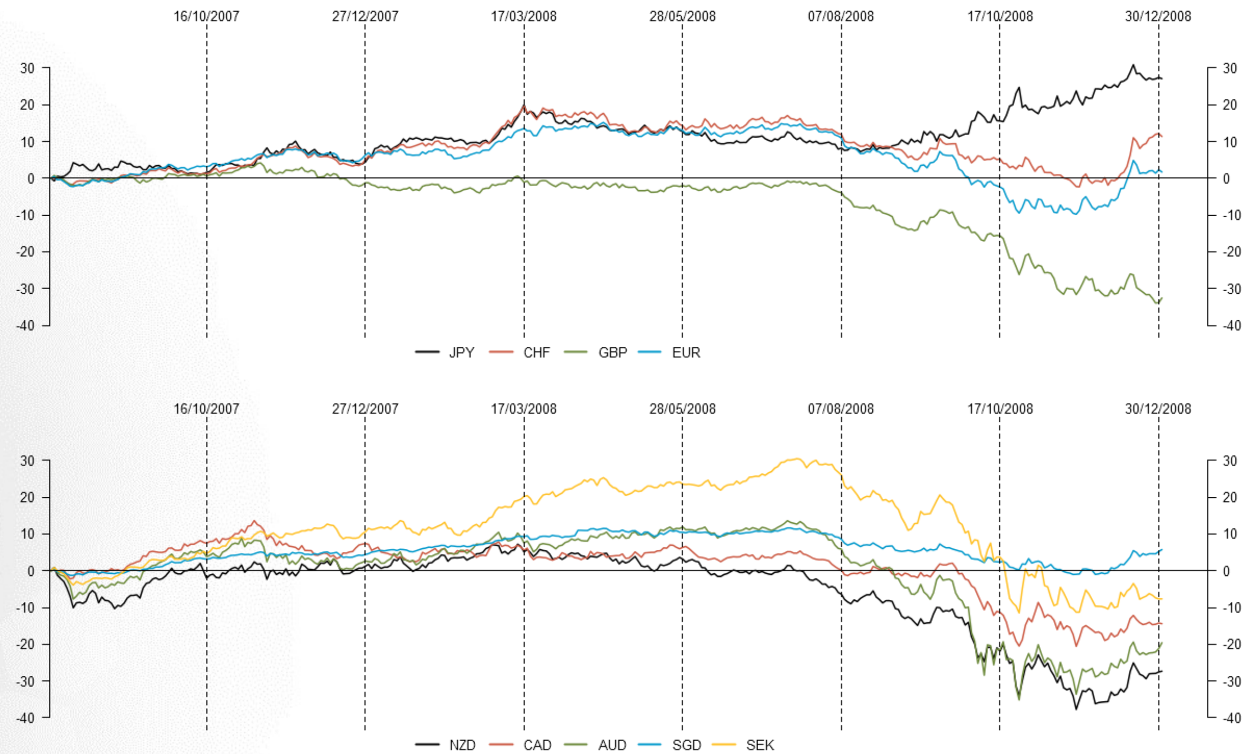

Figure 2: Cumulative daily returns (%) during financial crisis of 2007-2008

As can be seen, JPY showed the most rapid appreciation against the USD with only a few downward movements. CHF and EUR performed almost as good up until August 2008. Then both currencies started to lose their value against USD, while JPY, on the contrary, went up. GBP apparently went together with the market, having negative cumulative returns throughout the whole period.

Some of the other currencies performed similarly to CHF and EUR. SEK showed the greatest appreciation in mid-2008, while SGD maintained positive cumulative returns during the crisis.

Hurricane Sandy that hit the North-eastern coast of the United States in late October 2012 led to a different picture.

Figure 3 shows that GBP was the only “presumably safe-haven” currency to appreciate against USD. The rest had mainly negative returns, with just a brief upturn in JPY.

Surprisingly, safe-haven properties were expressed more clearly by the currencies outside the list. Both NZD and AUD appreciated rapidly during the first hours of the storm, and kept their cumulative returns on a relatively high level. SGD/USD showed little change during the event, but nevertheless performed better than the pairs with CHF, EUR, and JPY.

Thus it can be seen that safe-haven properties are not everlasting and are not necessarily expressed during every shocking event. Furthermore, the currencies that are believed to be safe-haven do not always behave similarly, and can sometimes be outperformed by others.

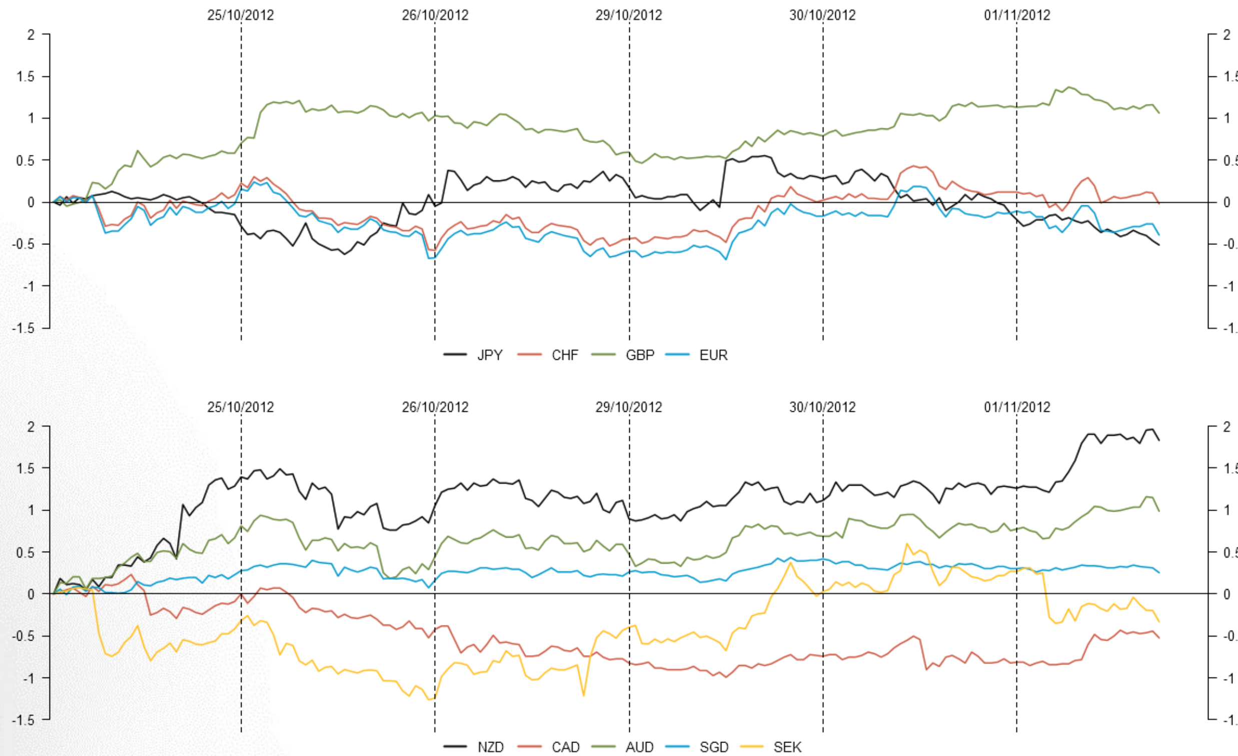

Figure 3: Cumulative daily returns (%) during hurricane Sandy

2. The Japanese yen shows the strongest safe-haven patterns.

Table 1 summarises the results of linear model fitting. It shows the coefficients, their *t*-statistic values, and R^2 values for the equations.

Coefficients of the linear equation are estimated from a data sample. *t*-statistic measures the significance of each estimation – a greater absolute value of *t*-statistics means greater probability of the true coefficient to be different from zero. For the examined models the benchmark *t*-statistic value is 1.65. Therefore, if some coefficient has a lesser *t*-statistic, the corresponding factor most probably does not affect the dependent variable.

R^2 measures how well the equation explains the behaviour of the dependent variable. It ranges from 0 to 1.

	JPY		CHF		GBP		NZD		CAD		AUD		EUR		SGD		SEK	
Intercept	0.0029	(0.30)	0.0091	(0.89)	-0.0026	(-0.32)	0.0023	(0.22)	0.0001	(0.02)	0.0020	(0.19)	0.0008	(0.09)	0.0039	(0.76)	-0.0001	(-0.01)
S&P (t)	-0.0892	(-6.49)	-0.0406	(-3.24)	0.0506	(4.20)	0.2225	(13.95)	0.1669	(15.77)	0.2342	(11.91)	0.0398	(3.23)	0.0597	(9.37)	0.1358	(8.94)
Treasury Notes (t)	0.0136	(1.90)	-0.0027	(-0.33)	-0.0053	(-0.86)	-0.0033	(-0.43)	-0.0076	(-1.47)	-0.0071	(-1.04)	-0.0023	(-0.33)	-0.0016	(-0.42)	0.0028	(0.35)
Volatility (t)	0.1863	(3.33)	-0.1298	(-2.07)	-0.0479	(-1.26)	0.0358	(0.68)	0.0031	(0.10)	0.0441	(0.81)	-0.0759	(-1.42)	0.0028	(0.12)	-0.0879	(-1.38)
S&P (t-1)	0.0241	(2.55)	0.0291	(2.59)	0.0348	(4.33)	0.0280	(2.14)	0.0298	(0.10)	0.0595	(2.98)	0.0223	(2.15)	0.0101	(1.95)	0.0709	(5.17)
Treasury Notes (t-1)	-0.0685	(-7.65)	-0.0390	(-3.77)	-0.0010	(-0.16)	0.0116	(1.21)	0.0275	(4.00)	0.0316	(3.40)	-0.0064	(-0.70)	0.0116	(2.46)	0.0166	(1.56)
Volatility (t-1)	-0.1802	(-3.26)	0.1298	(2.10)	0.0569	(1.54)	-0.0301	(-0.59)	-0.0009	(-0.03)	-0.0443	(-0.85)	0.0774	(1.48)	-0.0039	(-0.17)	0.0919	(1.47)
Depr (t-1)	-0.9013	(-0.42)	-0.0347	(-2.02)	-0.0134	(-0.81)	-0.0207	(-1.15)	-0.0563	(-3.15)	-0.0643	(-1.94)	-0.0163	(-1.03)	-0.0280	(-1.07)	-0.0667	(-4.13)
R^2	0.0799		0.0251		0.0183		0.1234		0.1829		0.1541		0.0076		0.0499		0.0623	

Table 1: Linear model coefficients with t-statistic (in braces) for pairs XXX/USD

JPY is the only currency that meets all safe-haven characteristics: its equation has a negative coefficient for S&P, and positive – for T-Notes and volatility. CHF has a good negative S&P coefficient, but also a significant negative coefficient for volatility. None of the other currencies have a significant positive volatility coefficient, but all have positive ones for S&P.

Coefficients of lagged factors do not mark any currency as safe-haven. This suggests that the property does not occur after some disturbing events, but develops simultaneously with it.

All observed models have small R^2 values, meaning that the relationship, if there is one, is not linear. However, as we are not interested in investigating the true nature of the relationship, there is no need to try and build a more complex model.

3. JPY, CHF, and EUR show safe-haven properties more often than other currencies.

To see how safe-haven properties change in time we construct linear models over moving time-frames. That is, we estimate the equation coefficients based on moving data subsets. Figure 4 shows the resulting coefficients for the JPY equation. Shaded regions mark time periods when the equation conforms to the definition of a safe-haven currency. Similar charts for some other currencies can be found in the Appendix.

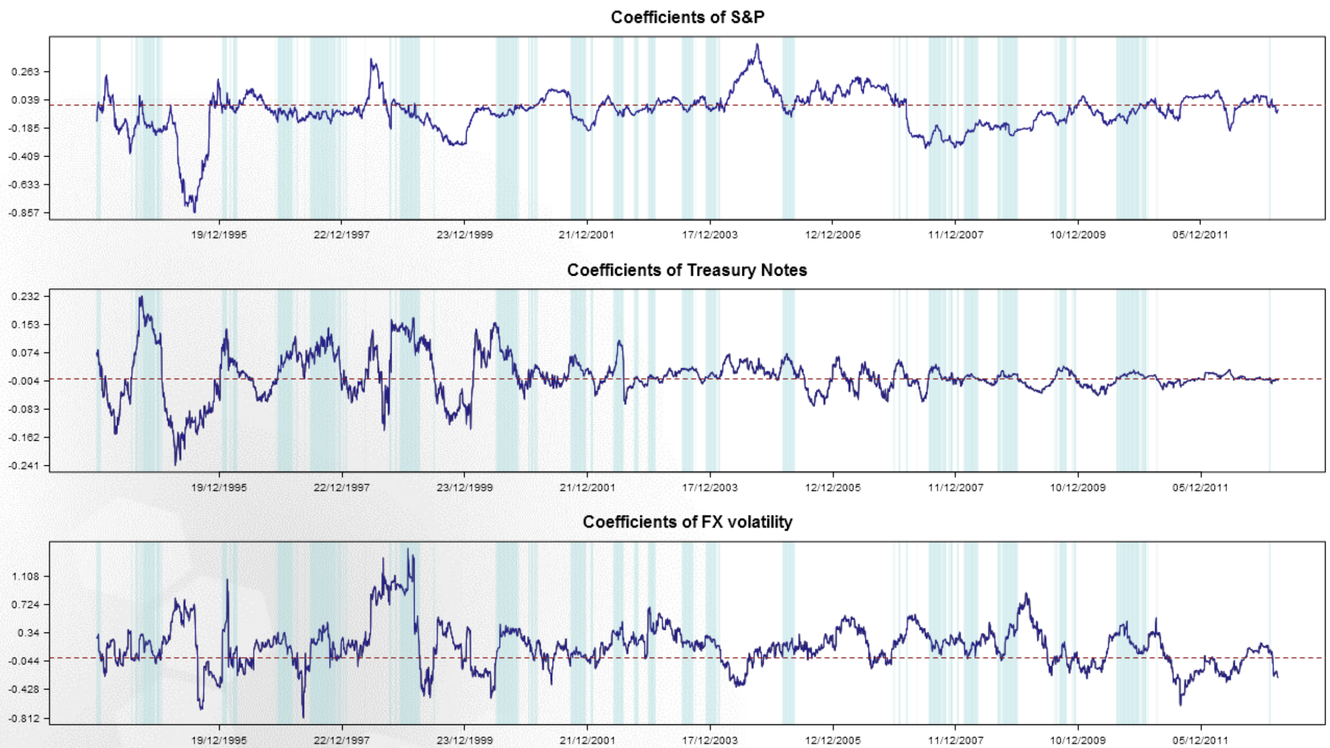

Figure 4: Moving linear model coefficients for JPY with 100 day window

Such analysis shows that in the period of 1993-2013 JPY had safe-haven properties 26.88% of time, CHF – 11.18%, NZD – 10.26%, EUR – 9.45%, and GBP – 8.02%.

We performed the same analysis on moving correlation coefficients between the currency pair returns and linear model factors, and got somewhat similar results.

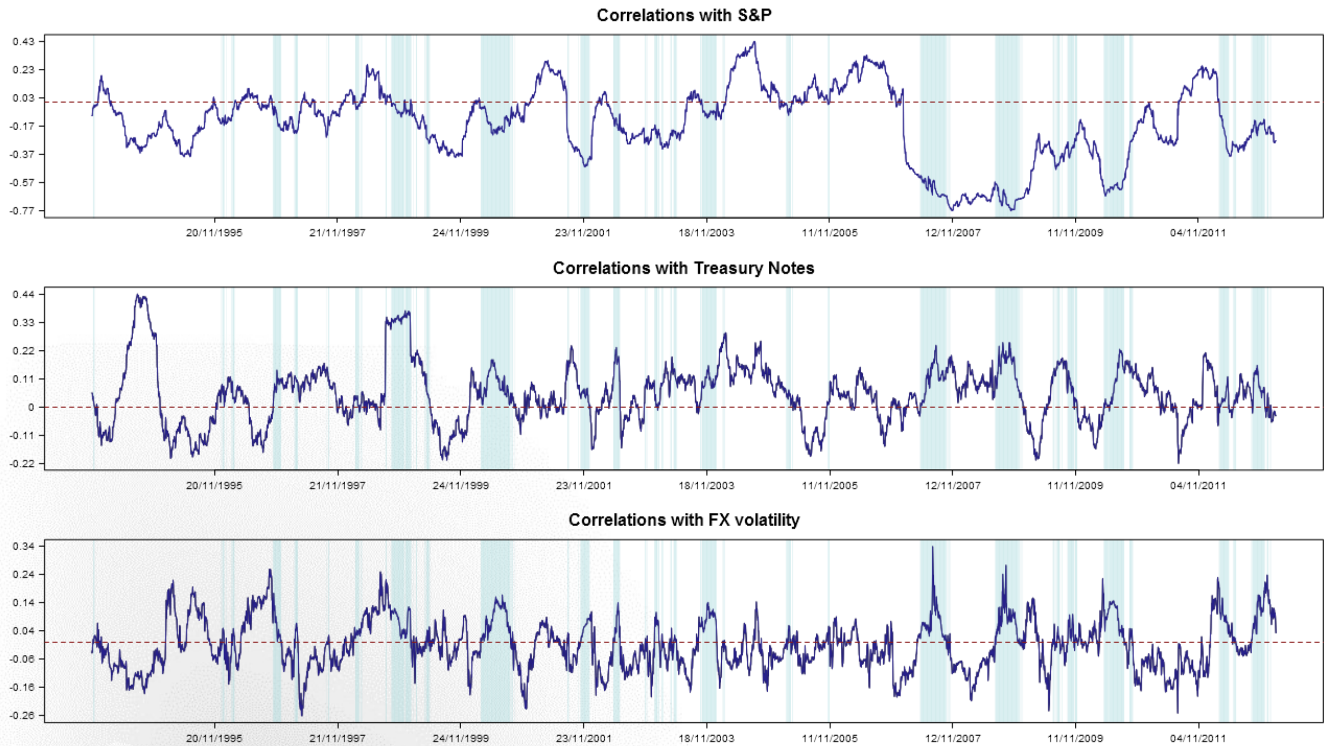

Figure 5: Moving correlation coefficient for JPY over 100 day window

Using the correlation criteria, CHF could be called a safe-haven currency 23.7% of time, JPY – 20.52%, EUR – 19.28%, SEK – 16.47%, and GBP – 14.6%. Unfortunately, we were not able to associate such periods with any distinguishable economic situations neither in this case, nor in the previous one.

Interestingly, the correlation coefficients with T-Notes and market volatility range similarly for all the currencies, but correlation with S&P shows a noticeable differentiation. For JPY, correlation with S&P has the best negative values. For CHF, EUR, GBP, and SEK – both best negative and best positive. Furthermore, the great positive values appeared in the past few years, but before that correlation has mostly been negative. For AUD, CAD, NZD, and SGD the correlation with S&P has the best positive values.

It is worth mentioning that, based on the correlation analysis, **the Japanese yen is at present the only currency to have safe-haven properties**. All the other currencies have the reverse property: they are positively correlated with S&P and negatively – with market volatility.

4. JPY shows clear safe-haven patterns only against USD.

As currently, JPY might be considered safe-haven in the pair against USD. It is therefore logical to wonder whether the same properties hold for other JPY pairs. To answer this question we use the same linear model method, pairing JPY with CHF, GBP, NZD, CAD, AUD, EUR, SGD, and SEK. The results are given in Table 2.

	USD		CHF		GBP		NZD		CAD		AUD		EUR		SGD		SEK	
Intercept	0.0029	(0.30)	-0.0058	(-0.53)	0.0053	(0.47)	0.0007	(0.05)	0.0029	(0.25)	0.0012	(0.09)	0.0022	(0.20)	-0.0007	(-0.08)	0.0032	(0.26)
S&P (t)	-0.0892	(-6.49)	-0.0466	(-2.76)	-0.1376	(-6.62)	-0.3097	(-12.88)	-0.2537	(-1.84)	-0.3214	(-11.05)	-0.1269	(-6.66)	-0.1487	(-10.07)	-0.2227	(-10.34)
Treasury Notes (t)	0.0136	(1.90)	0.0167	(2.01)	0.0193	(2.39)	0.0180	(2.13)	0.0223	(2.80)	0.0223	(2.60)	0.0165	(2.23)	0.0162	(2.55)	0.0118	(1.43)
Volatility (t)	0.1863	(3.33)	-0.1438	(-2.63)	-0.2202	(-3.64)	-0.2956	(-4.52)	-0.2806	(-4.24)	-0.3191	(-4.28)	-0.1937	(-3.11)	-0.2154	(-3.88)	-0.2246	(-3.66)
S&P(t-1)	0.0241	(2.55)	-0.0045	(-0.41)	-0.0034	(-0.30)	-0.0063	(-0.41)	0.0005	(0.04)	-0.0360	(-1.64)	0.0007	(0.06)	0.0096	(1.10)	-0.0411	(-2.80)
Treasury Notes (t-1)	-0.0685	(-7.65)	-0.0294	(-2.68)	-0.0675	(-7.19)	-0.0792	(-7.67)	-0.0953	(-9.37)	-0.0987	(-9.27)	-0.0612	(-6.22)	-0.0788	(-10.57)	-0.0841	(-7.37)
Volatility (t-1)	-0.1802	(-3.26)	0.1399	(2.63)	0.2080	(3.55)	0.2848	(4.48)	0.2738	(4.23)	0.3116	(4.33)	0.1877	(3.09)	0.2114	(3.90)	0.2177	(3.65)
Depr (t-1)	-0.0090	(-0.42)	0.0022	(0.11)	0.0206	(1.09)	-0.0298	(-1.66)	-0.0240	(-1.24)	-0.0547	(-2.13)	-0.0283	(-1.49)	-0.0460	(-2.43)	-0.0259	(-1.46)
R^2	0.0799		0.0201		0.0978		0.2042		0.2120		0.2215		0.0816		0.1594		0.1476	

Table 2: Linear model coefficients with t-statistic (in braces) for pairs JPY/XXX

As can be seen, all models have significant negative coefficients for S&P, and significant positive coefficients for T-Notes. However, none of the newly examined pairs have positive volatility coefficients. This makes their set of safe-haven properties incomplete.

Lagged factors give an opposite situation. Lagged volatility has good positive coefficients for all new currency pairs, while lagged T-Notes coefficients have the wrong sign, and lagged S&P coefficients are insignificant. Therefore, technically, JPY/USD is the only JPY pair that meets all safe-haven requirements.

Conclusion

We have performed several types of analysis to examine safe-haven properties in nine currencies. It turned out that such properties are not permanent, and can be observed in different currencies at different times. Furthermore, safe-haven patterns seemed to be better pronounced as a response to S&P behaviour rather than one of market volatility or government bonds.

JPY, CHF, and EUR appeared to act like safe-haven currencies more often than others. However, the periods when the safe-haven properties held seemed to be unpredictable. Moreover, some currencies that are not generally considered safe-haven also occasionally showed the same properties. GBP performed well in one of the preliminary tests, but fell behind other “presumably safe-haven” currencies later on. Currently only the Japanese yen in pair against the U.S. dollar shows safe-haven patterns in its behaviour.

Such findings show that the group of safe-haven currencies is not constant, and currencies tend to change their behaviour under different circumstances. It should be taken into account by the investors who seek to secure their holdings in times of economic instability. Otherwise a seemingly reliable investment might unexpectedly turn into an unprofitable one.

Appendix

[1] The linear model used in this research was proposed by Prof. Dr. Angelo Ranaldo and Prof. Paul Söderlind, Ph.D., in their 2007 paper "Safe Haven Currencies".

S&P 500 (Standard & Poor's 500 Index) - U.S. stock market index consisting of the 500 large-cap shares widely traded on the New York Stock Exchange and the NASDAQ

T-Notes (Treasury notes) – marketable U.S. government debt security with 2-10 year maturity and semi-annual coupon payment

Currency Market Volatility – a weighted sum of the realised volatilities of the currency pairs used in the research. Each realised volatility is calculated as the natural logarithm of the sum of squared returns. Weights are determined using principal component analysis. For each linear model, market volatility is defined using all currency pairs except the one defined as a dependent variable.

Charts

Next pages give examples of the moving parameters charts: for CHF, that often has safe-haven behaviour, and for CAD, that shows no safe-haven properties.

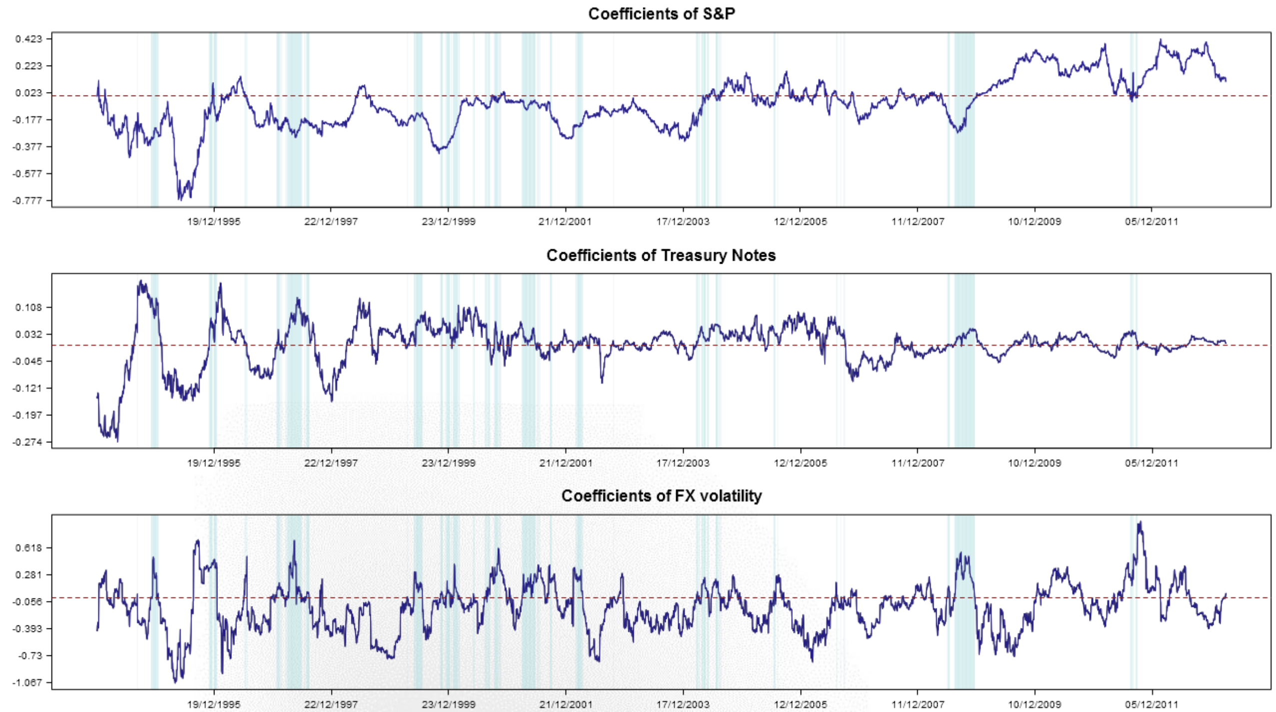

Figure A1: Moving linear model coefficients for CHF

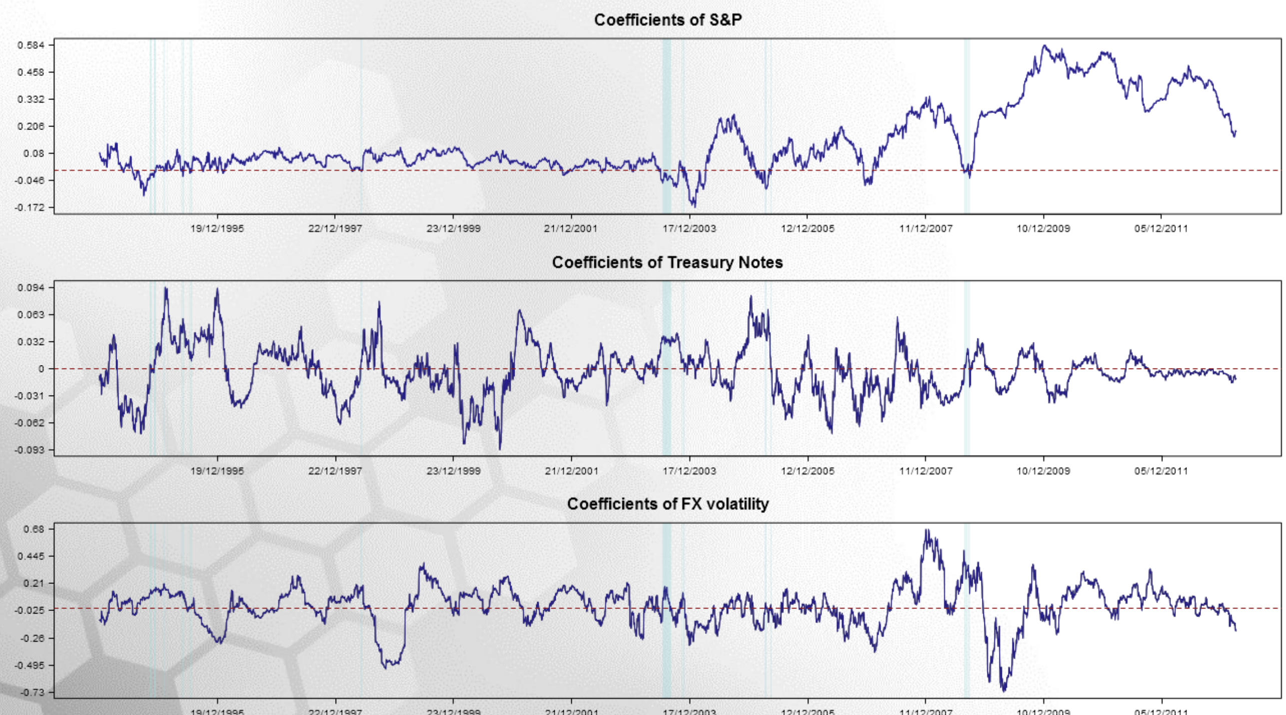

Figure A2: Moving linear model coefficients for CAD

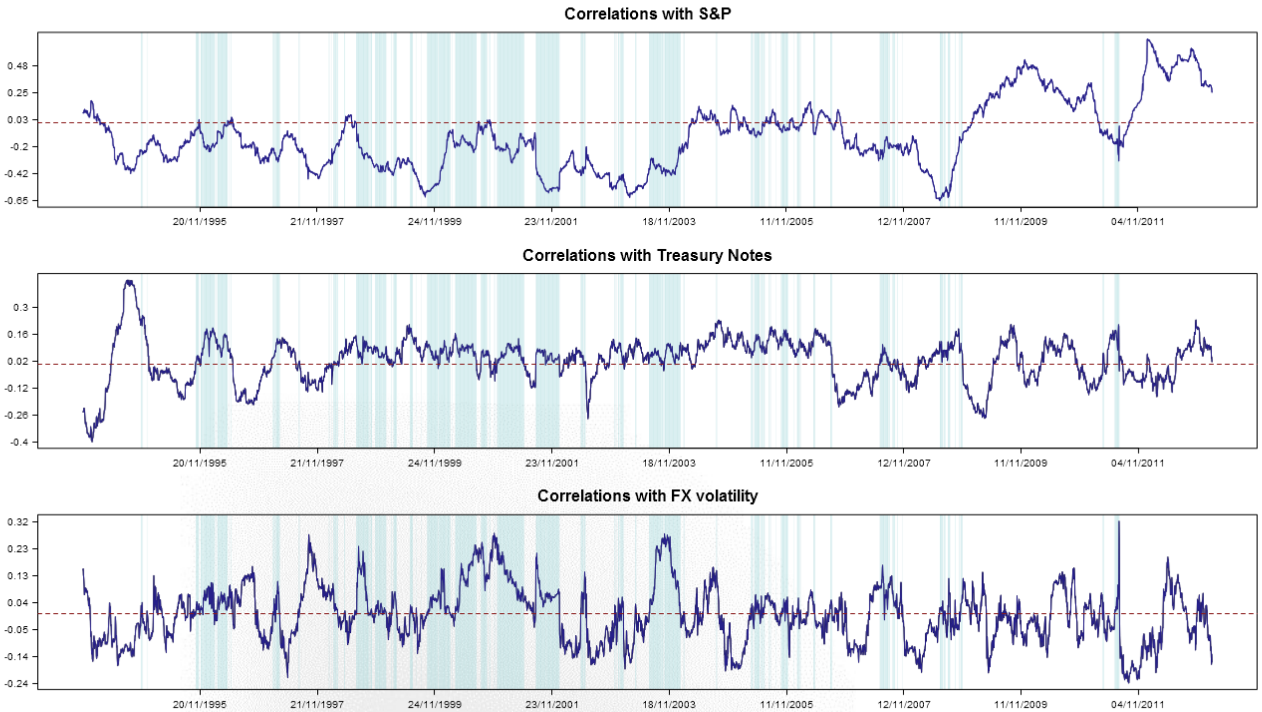

Figure A3: Moving correlation coefficient for CHF

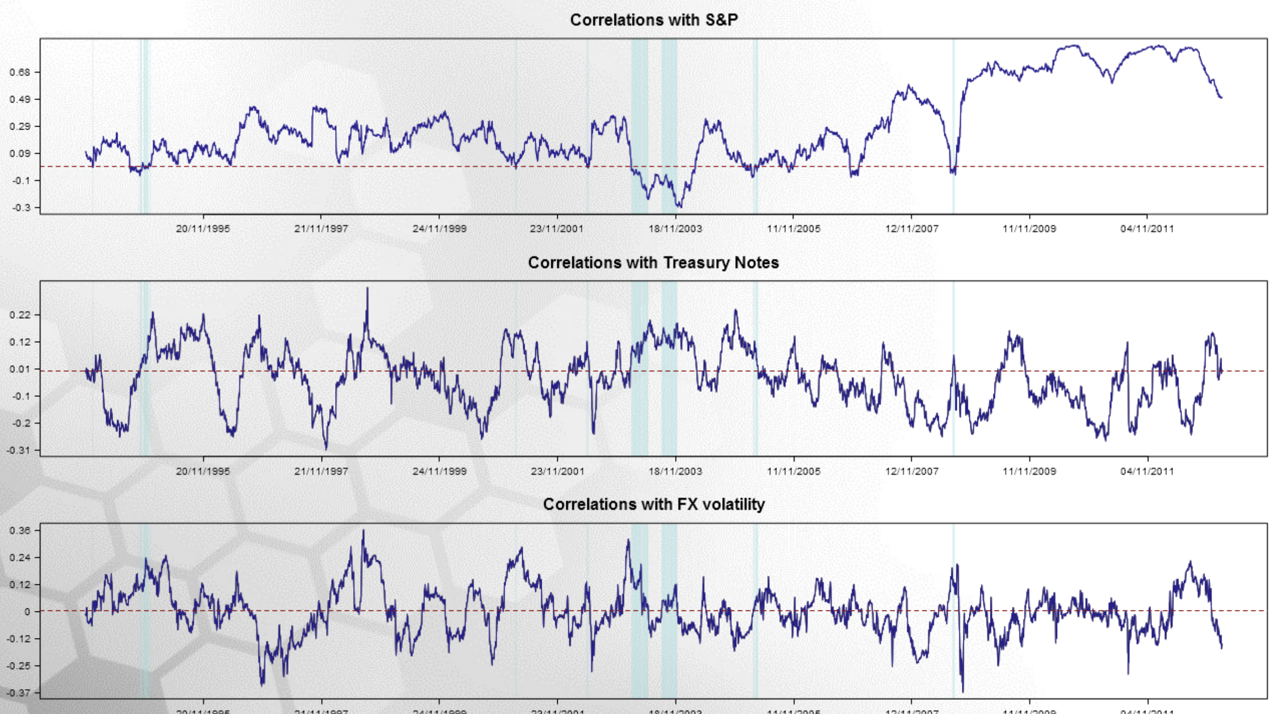

Figure A2: Moving correlation coefficient for CAD

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