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Emerging Patterns in Dollar/Yen Exchange Rate

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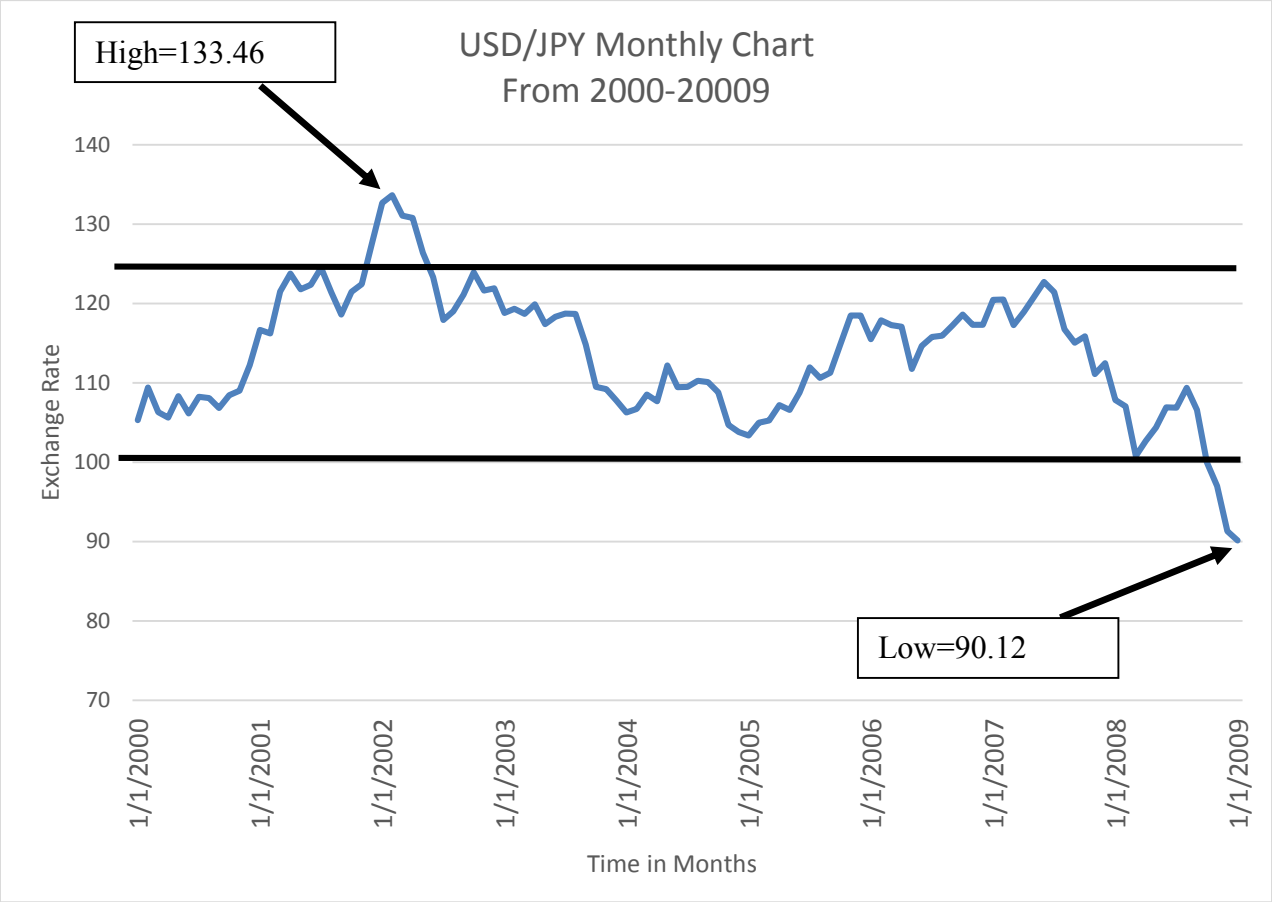
EXECUTIVE SUMMARY

In order to properly hedge your company's overseas exposure, we have analyzed the foreign exchange patterns between the Japanese Yen and the United States Dollar (USD). The graph below shows the foreign exchange rates between the years 2000 and 2009.



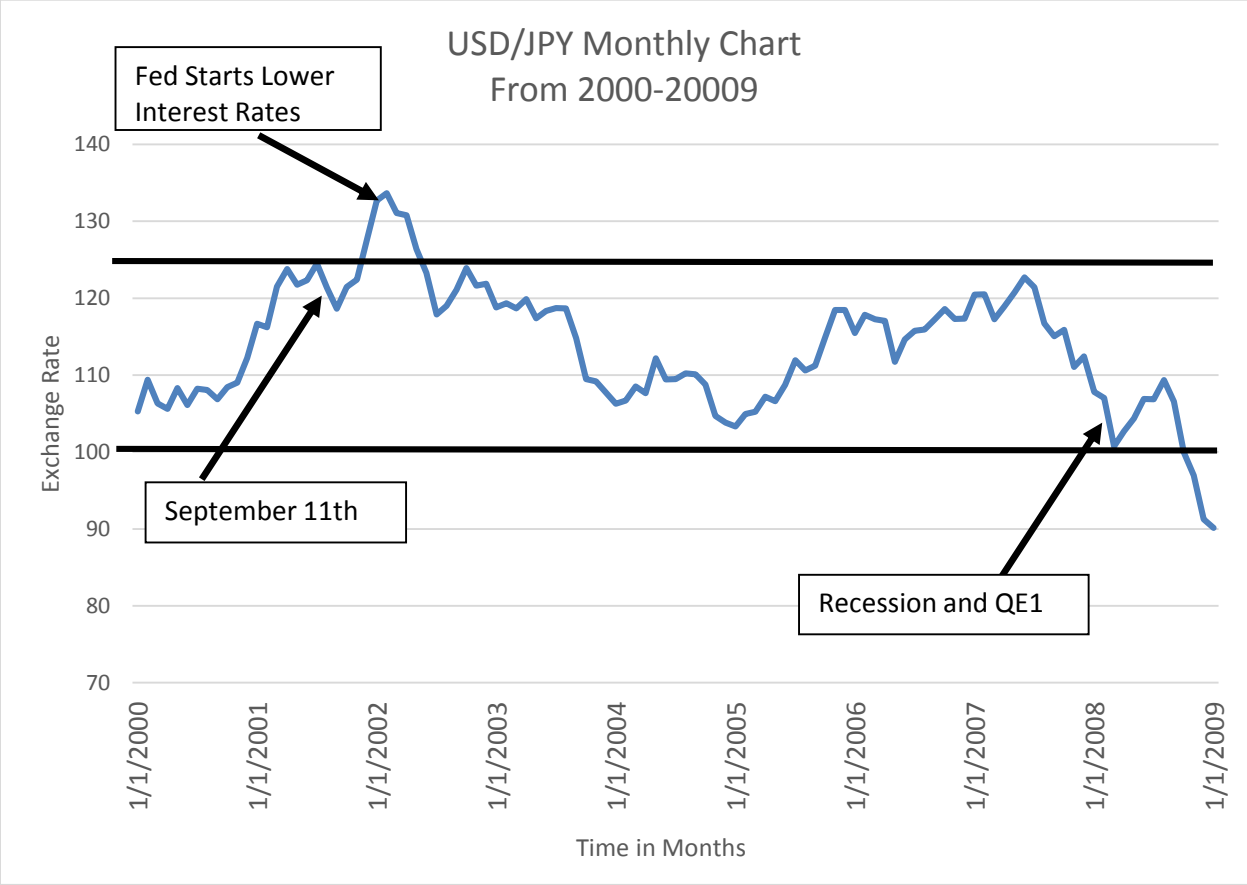
We see some distinct trends in the USD/JPY graph, such as clear levels of support, reactions to world events, and large amounts of volatility to the upside and downside that seem to correspond with monetary policy. Our analysis provides an in depth look at these trends and the possibility for future modeling moving forward.

ANALYSIS

In order to analyze the USD/JPY data, we examined distinct patterns in the chart and conducted three different autocorrelation analysis in order to see if there were any mathematical relationships between the data and itself, without taking into account any other factors.

Historical Reactions

Trend Analysis



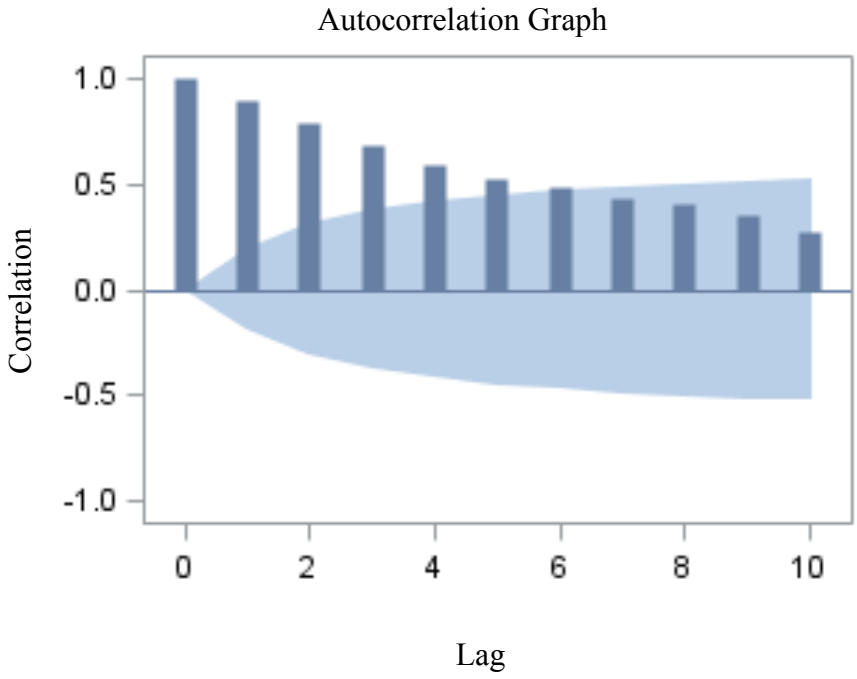
We see that from 2000 to late 2001, the USD strongly appreciated against the Yen, with the exception of a sharp dip following the September 11th Attacks. During this same time, the USD gained approximately 25,000 basis points against the Yen. Starting in 2002, the USD started a long period of depreciation against the Yen, which coincides with easy money policy pursued by the United States Federal Reserve in response to the recession that followed the September

11th attacks. The decline in the USD continued until 2005, when the USD began to recover, finally peaking just above the 120 mark. This second peak came right before the financial crisis which started in late 2007. In late 2007, the USD once again started a sharp decline against the Yen, as the Federal Reserve announced the first round of Quantitative Easing (denoted QE1 in the graph).During this decline, the USD broke through the 100 level, which it had not done it its previous decline.

Autocorrelation Analysis

In order to determine whether or not the relationship between the JPY and USD can be explained with itself, we ran three different autocorrelation functions. In this situation, the purpose of the autocorrelation functions is to determine how past values of the exchange rate are correlated with future values, which will allow us to see how meaningful past exchange rate values could be in future models.

Autocorrelation Function

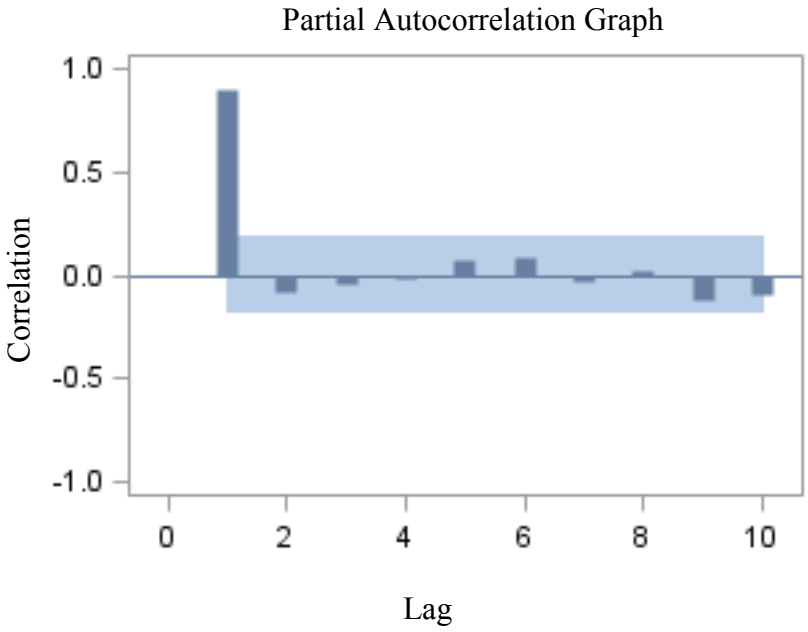


The autocorrelation graph shows the correlation between each lag and the preceeding lag, with a 95% confidence interval shaded around the bars. We see that the strongest correlations exist between lag 1 and lag 2. We also observe the correlations get smaller and smaller as we move further away from lag 1. One downside to using a regular autocorrelation function is that it does not take into account intermediate lags. For example, when looking at the correlation

between lag 1 and lag 3, lag 2 is not taken into accont. This makes it difficult to determine the true relationship between lag 1 and lag 3. This shortfall can be overcome with the Partial Autocorrelation Function.

The first lag for the regular Autocorrelation Function is .90, which means that there is a very strong correlation between month 2 and month 3. The value of the second lag is .793, which means that there is a strong relationship between lag 2 and lag 4. However, we see that there is a weaker correlation between lag 2 and lag 4 as compared to lag 2 and lag 3. We also must remember that since this is a regular Autocorrelation Function, the value of .793 is not accounting for the effect that lag 3 is having on the relationship between lag 2 and lag 4.

Partial Autocorrelation Function

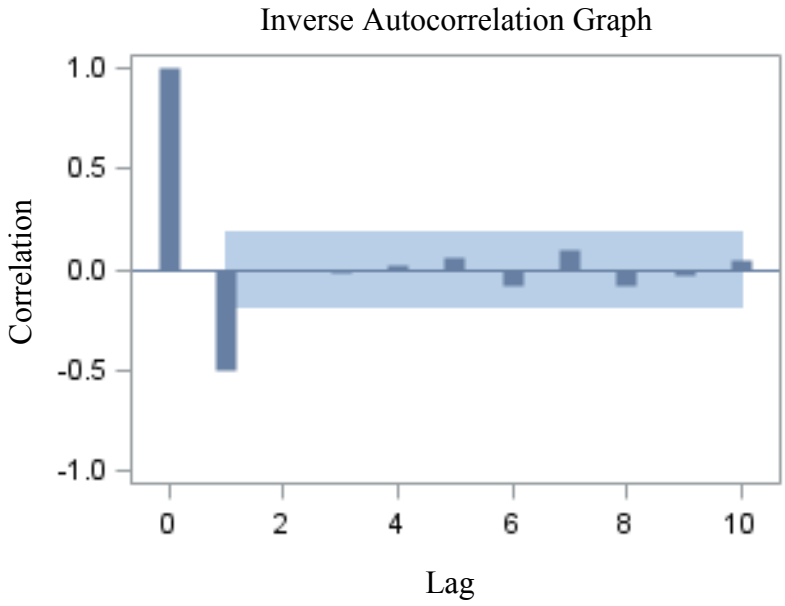


Unlike the regular Autocorrelation Function, the Partial Autocorrelation Function does not graph any correlations at lag 0. First, we note that the Partial Autocorrelation Function looks drastically different than the regular Autocorrelation Function. This is because the Partial Autocorrelation Function attempts to measure the direct correlation between lags, without the influence of any lags that may fall in between. Thus, we see that the correlations drop off quite dramatically after lag 1, which is something that did not happen in our regular Autocorrelation Function. This indicates that the true relationship between lag 1 and the proceeding lags might not be nearly as strong as originally anticipated.

The lag for the Partial Autocorrelation Function is .90, which is the exact same as the regular Autocorrelation Function. This is because there is no time lags in between lag 1 and lag 2. Therefore, the interpretation that lag 1 and lag 2 are highly correlated also remains the same.

Inverse Autocorrelation Function

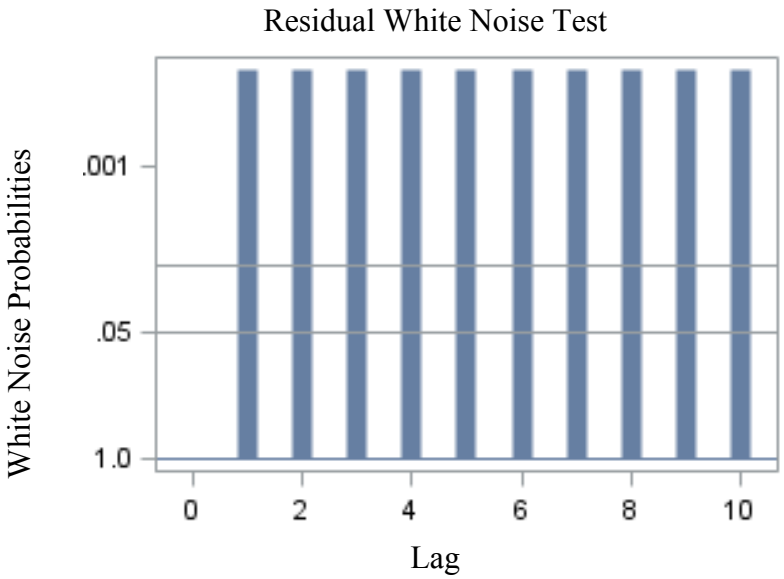
Just as the name implies, the Inverse Autocorrelation Function is nothing more than the inverse of the Partial Autocorrelation Function from earlier in the report. The graph for the Inverse Autocorrelation Function is shown below:



The Inverse Autocorrelation has the exact same patterns as the Partial Autocorrelation Function, except now they are inverted. So instead of seeing a very strong positive relationship between lag 1 and lag 2, we see a very strong negative relationship. After the first two lags, we see very minimal correlations.

Testing for White Noise

In order to determine whether or not the USD/JPY exchange rate can be modeled, the Ljung-Box test for White Noise is applied to the data. This test reveals whether or not there are any distinguishable patterns in the data over time. If the observations are independent of themselves, there is nothing to model. The Ljung-Box chart is shown below:



By plotting the residuals of Y against itself, the test for white noise proves that there is very strong statistical evidence that the residuals are not independent of each other (as shown by the very small p-values in the chart above). This indicates that there is variation in the USD/JPY exchange rate that can be modeled in the future.

Conclusions

After examining the historical exchange rate data, there is strong evidence to support that there is information in the USD/JPY exchange rate that can be modeled. When the charts are examined in light of past political events, we see strong correlations between volatile movement in the exchange rate that correspond with political and monetary policy. The charts also reveal possible levels of support and resistance which could be modeled with more advanced techniques.