A Tale of Two Markets Before and After Pandemic: Economy Driven vs Dollar Driven

Joseph Cheng and Seena Houman

Abstract

The correlation between the U.S. equity market and the U.S dollar is intriguing yet complex. In this paper, we dissect the correlation into two opposing driving forces: purchasing power versus economic strength. A weak dollar inevitably will have a lower purchasing power, causing prices of all dollar denominated assets to rise creating an inverse relationship between the value of the dollar and the U.S. equity market. On the other hand, increasing strength in the U.S. economy will boost the confidence in the U.S. equity market and in the U.S. dollar, thus creating a positive correlation between the value of the dollar and the U.S. equity market. These two factors pull the correlation between the dollar and the equity market in opposite directions; whether the actual correlation is positive or negative depends on which factor is dominant in driving the equity market in a particular period of time: the economy or the value of the dollar. Using regression analysis, we discover that the correlation between the dollar and the equity market was negative and significant during the pre-covid period and becomes positive and significant during and after the pandemic period, suggesting that the market was economy-driven before the pandemic and became dollar-driven during the pandemic period.

JEL Classification: E31, E44, G15
Keywords: U.S. dollar, inflation, stock, purchasing power parity

I. Introduction

The correlation between the value of the U.S. dollar and U.S. equity market can reflect interesting underlying economic phenomena. On one hand, a strong U.S. economy normally attracts foreign investments into the U.S., which would boost the value of the dollar and the equity market at the same time, yielding a positive correlation between the value of the dollar and the value of U.S. equity. Therefore, if the dominant force at work during a particular period is the strength of the economy, then there should be a positive correlation between the dollar and the U.S. financial markets. On the other hand, if the dominant force at work during period is the relative value of the dollar, then there should be a negative correlation between the dollar and the U.S. financial markets. A relatively weaker dollar tends to make U.S. exports more competitive in the world market, which benefits U.S. firms and raises share prices. This means that the lowering of the relative value of the dollar tends to raise equity prices of U.S. firms, thus yielding a negative correlation between the dollar and the U.S. financial markets.

In addition, the Purchasing Power Parity, a well-established theorem in International Finance that explains the relationship between currency exchange rates and prices of commodities, hypothesizes that the purchasing power of different currencies on the same commodity at the same

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location should be equal for these currencies when accounted for their respective exchange rates. This means that a weaker dollar, or a lower exchange rate for the dollar relative to other currencies, can reduce the purchasing power of the dollar and thus increase the nominal prices of commodities in dollar terms. Such an effect might spillover to the financial markets where the nominal value of financial assets in dollar terms can likewise be inflated in a similar manner. The study conducted in this paper seeks to explore the correlation between the value of the U.S. dollar and the returns of the U.S. financial markets before and during the pandemic in order to evaluate whether it is the strength of the economy or the weakness of the dollar that was the dominant driving force during these different periods.

II. Literature Review

There have been many empirical studies conducted for analyzing the effect of the pandemic on the economy and the financial markets. Economics, financial markets, and technology inevitably intertwine. Ndiaye, Oyewobi, Abu-Mahfouz, Hancke, Kurien, Djouani (2020) conducted a thorough survey of studies on how the pandemic has brought about the rapid development of Internet of Things (IoT) technology for monitoring and tracking virus spread. While such development certainly impacted the operation the economy, it was unclear how such development might affect the correlation between the returns of different assets, such as that between the value of the U.S. dollar and the financial markets. The study in this paper addresses this specific issue during the pandemic period when such technology began to emerge.

Dash and Maitra (2022) used data on the volume in Google search engine searching for Covid related terms to generate an index (GSVI) to measure the level of pandemic uncertainty which is used for evaluating its effect on stock market return and volatility. As expected, they found that there was a strong correlation between GSVI and the Financial and Economic Attitudes Revealed by Search (FEARS) Index. The study was innovative in that the empirical design was based on wavelet-based time–frequency analysis which allows the frequency to be varied within a time period. Their study showed that even after controlling the effect of investor's FEARS sentiment, the pandemic affected the equity markets negatively while increasing volatility and illiquidity.

In a similar vein, Huynh, Foglia, Nasir, and Angelini (2021) conducted a study on investor sentiment during the pandemic and its effect on the global financial markets. They developed a sentiment index (Feverish Sentiment Index) derived from factors measuring degrees or volume of media coverage, fake news, panic, sentiment, media hype and infodemic in the largest economies. Using a time-varying parameter-vector auto-regression (TVP-VAR) model, they found that the U.S., along with UK, Germany, France, Italy and China, tend to transmit such sentiments to other economies. Furthermore, the U.S. markets were likely to suffer more with the high level of feverish sentiment during the pandemic. Their study also indicated that investor sentiment was a good predictor of both stock return and volatility.

They recommended that policymakers should pay attention to not promoting the "panicky feelings", and to containing the virus transmission in the community. They also suggested that the investors might reduce their risk by diversifying across the continents given that the impact of the pandemic on the equity markets might not be uniform across the globe.

The emergence of Covid around the world prompted many governments to adopt extraordinarily loose monetary policy in order to mitigate the adverse economic impact of the pandemic. In their research, Wei and Han (2021) found that the pandemic has weakened the

transmission of monetary policy to financial markets, which suggested that the loosening of monetary policy has a greater impact on asset prices than on actual output. Our statistical analysis should shed additional light on this issue.

To study the effect of the pandemic on the nexus or link between oil and stock price, Salisu, Ebuh, and Usman (2020) utilized a panel Vector Autoregressive (pVAR) model to analyze the effect of the pandemic on oil and stock for periods before and after the announcement of the pandemic. A panel Logit model is also formulated to evaluate the probability of having both negative oil and stock returns in both sample periods**.** While the Logit model suggested that the probability of having both negative oil and stock returns should be higher during the pre-announcement period than the period after; they found that the impact of shocks during the post-announcement of COVID-19 to be more pronounced for oil and stocks than during the pre-announcement period. This led them to think that the large negative returns for both oil and stock in the latter period may be driven by panic/uncertainty in their respective markets. This phenomenon reinforces the importance of policy consistency and uncertainty reduction by policymakers.

Fedlkircher and Pfarrhofer (2021) used a VAR model to analyze time series data of macroeconomic variables and found that the monetary expansion during the pandemic has stimulated stock return but caused a depreciation of the U.S. dollar. This suggests a negative correlation between the U.S. dollar and the equity market during the pandemic and invites further analysis to compare the correlation before the pandemic as well.

Fernandez and Alonso (2021) used Pearson correlation to analyze monetary policy during covid and found that the growth of money supply has been passed on to the financial markets and the prices of assets.

Rao, Gupta, Sharma, Mahendru, and Agrawal (2022) found relatively strong positive correlation between gold and green bond index during their study period beginning from August 2011 to July 2021 (10 year period), with most of this time range falls within the pre-pandemic period and the latter part falls within the pandemic period. Since gold price in terms of U.S dollar is inversely correlated with the value of the dollar, their finding is consistent with our finding in this paper that there was a negative correlation between dollar value and bond returns during the pre-pandemic period, as will be shown in the latter part of this paper. Our paper provides further details by dichotomizing the study period into the pre-pandemic period and the pandemic period.

Interestingly, Elhini and Hammam (2021) used the multivariate generalized autoregressive conditional heteroscedasticity model to analyze the S&P return during the pandemic and found that the U.S. dollar index has a negative effect on the S&P return. Our paper confirms this finding for the pandemic period, but the surprising phenomena that we have found is that the correlation between the dollar and the S&P was actually positive and significant during the pre-covid period, which is opposite to that found during the pandemic period. In addition, this paper offers a logical explanation of the reason for the reversal of this correlation as the U.S. economy transitioned to a post-pandemic environment.

III. Data

In this paper, we explore the correlation between the value of the U.S. dollar and the U.S. equity market. In particular, we explore how the value of the dollar affects the U.S. financial markets during the pandemic. Interestingly, we found that such correlation varies and depends on which

factor is the main driving force for the equity market: the strength of the economy or the strength of the dollar.

First, let us evaluate the two possible ways for the correlation between the value of the U.S. dollar and the U.S. financial market operate. There are two forces at work which might pull this correlation in opposite directions. The first force is the strength of the dollar, which will be referred to as the Purchasing Power Effect in this paper.

Based on economic theory, the value of the dollar has an inverse relationship with stock price for firms, especially for U.S. firms which are export oriented or are competing with imports. This is because lowering the value of dollar makes U.S. goods cheaper relative to the rest of the world and thus more price competitive abroad. Furthermore, a weaker dollar will translate into higher prices in general by virtue of currency translation. According the Purchasing Power Parity Theorem, prices of goods are inversely correlated with the strength of the currency; a ten percent decline in the value of the dollar, holding everything else constant, would cause prices of commodities denominated in dollars to rise by ten percent. This inverse relationship between the value of the dollar and dollar denominated commodities is well acknowledged in academic and professional worlds. In similar fashion, the Purchasing Power Parity Theorem can also be applied to dollar denominated assets. Accordingly, a weaker dollar can also translate into higher prices for dollar denominated assets, which would cause an inverse relationship between the value of dollar and the price of the equity market. The debate is not whether there is an inverse relationship between the dollar and the equity market, but how strong the inverse correlation truly is.

The second force at work in the U.S. financial markets is the strength of the economy, which can be referred to as the Economic Strength Effect. A strong U.S. economy increases foreigners' confidence in the U.S., making it a more attractive country for others to invest in and thereby increasing the demand for the dollar and strengthening the U.S. financial markets.

The question we want to explore is how the value of the dollar is correlated with the value of U.S. equities before and during the pandemic period. Such correlation can reveal the dominant force at work during these periods. To examine this issue, we regress stock and bond returns on the return of the U.S. dollar for four sample periods: pre-covid, covid with modest stimulus, covid with high stimulus, and the Ukraine crisis period.

These three periods are divided as follows:

Sample Period 1 - The sample period before the pandemic began to have an adverse impact on the U.S. financial market.

Sample Period 2 - The sample period starting with the initial stage of adverse impact on the financial market by the pandemic, which is characterized by modest stimulus administered by the U.S. government to mitigate the negative economic effects of the pandemic.

Sample Period 3 - The sample period reflecting a new administration in office after January 2021 where stimulus grew extensively both in magnitude and in scope.

Sample Period 4 - The sample period reflecting the recent period when the pandemic began to be downgraded while the supply chain challenge emerged as the world began to encounter the Ukraine conflict.

For regression data in all four sample periods, we utilize the ETF for U.S. dollar (UUP), which reflects the appreciation rate for the dollar relative to a basket of major foreign currencies on a daily basis, as a proxy for measuring the daily return of the U.S. dollar. If the dollar strengthens relative to other currencies, then the return on UUP would be positive, and if the dollar weakens relatively, then the return would be negative. We use the ETF for S&P (SPY) as a proxy for the U.S. equity market, the ETF for government bonds (GOVT) as a proxy for the U.S. Treasury bond

market, and the ETF for 7-10 year treasury bonds (IEF) as an alternate proxy for U.S. treasury bond market. For calculating the daily return for these ETFs, adjusted closing price for each day is used in the following equation:

$$\text{Daily Return}_t = (P_{\text{adj close, t}} - P_{\text{adj close, t-1}}) / P_{\text{adj close, t-1}}$$

Examples of daily returns, giving returns for SPY and a generic ETF:

$$R_{SP} = \text{SPY Return}_t = (\text{SPY}_{\text{adj close, t}} - \text{SPY}_{\text{adj close, t-1}}) / \text{SPY}_{\text{adj close, t-1}}$$

$$R_{ETF} = \text{ETF Return}_t = (\text{ETF}_{\text{adj close, t}} - \text{ETF}_{\text{adj close, t-1}}) / \text{ETF}_{\text{adj close, t-1}}$$

The general formula for linearly regressing a generic ETF against UUP is therefore:

$$R_{ETF} = a + b * (R_{UUP}) + e$$

The regression coefficient b captures both the direction and degree of the correlation between the U.S. dollar and the U.S. financial markets for the three sample periods. A positive value for the coefficient indicates a positive correlation and a negative value for the coefficient indicates a negative correlation. Performing linear regression on the returns of the ETFs during these time periods yields the coefficient results summarized in the tables below. Note that if the p-value corresponding to the coefficient is less than .05, then the correlation is considered statistically significant as this means the corresponding coefficient would be more than 95% significant. All significant p-values are indicated by an asterisk in the tables.

IV. Regression Results

Based on the positive and statistically significant coefficient b in the regression result for S&P ETF and UUP, we can state that the U.S. stock price generally moves in the same direction as the U.S. Dollar during the pre-covid period, period 1 (summarized in Table). Positive correlations such as this can be explained by a vibrant economy before the pandemic, which contributes to a stronger dollar as well as higher returns for the equity markets. At the same time, healthy growth in the U.S. economy pushes interest rates higher and thus makes the bond markets' returns lower. This phenomenon is consistent with the positive correlation between the dollar and S&P and with the negative correlation between the dollar and the bond market during the pre-covid period. The results here show that economic strength was the dominant driving force behind the observed correlations before the pandemic.

Table 1. Summary of Results for Sample Period 1
(Pre-Pandemic : Jan 2, 2018 – March 31, 2020)

Dependent	Independent	Intercept (p-value)	Coefficient b (p-value)	R^2
SP	UUP	-4.2e-5 (0.9451)	0.5626 (4.6e-5) *	0.02912
SHY	UUP	0.0001 (1.2e-5)	-0.0349 (2.6e-6) *	0.03856
IEF	UUP	0.0004 (0.0077)	-0.2620 (3.9e-13) *	0.08960
GOVT	UUP	0.0003 (0.0069)	-0.2191 (7.3e-14) *	0.09492

However, the positive correlation did not last and is only statistically significant during the pre-covid period. As the nation entered into the covid period in earnest, beginning in April 2020, the correlation between the U.S. stock market and the dollar turned negative and the negative correlation coefficient was statistically significant (Table 2). Note that this is a dramatic shift to go from a statistically positive correlation to a statistically negative correlation in such a short time span. During the early covid period, the stock market was gradually recovering from the trough with the help of a looser monetary policy that lowered the interest rate in the U.S. while weakening the dollar at the same time. Since there is an inverse relationship between interest rate and bond price, the lowering of the interest rate caused the prices of Treasury bonds to rise. This explains the negative correlation between the stock market and the dollar as well as the positive correlation between the bond market and the dollar and indicates that the pandemic has changed the market from an economy-driven market to a dollar-driven market.

Table 2. Summary of Results for Sample Period 2
(Pandemic with Modest Stimulus: April 1, 2020 – Jan 20, 2021)

Dependent	Independent	Intercept (p-value)	Coefficient b (p-value)	R^2
SP	UUP	0.0015 (0.0950)	-1.2709 (3.7e-7) *	0.12096
SHY	UUP	1.5e-5 (-2.6e-5)	0.0006 (0.9197)	0.00051
IEF	UUP	0.0000 (0.8911)	0.1108 (0.0202) *	0.02656
GOVT	UUP	-2.2e-6 (0.9893)	0.1371 (0.0019) *	0.04694

The result for Sample Period 3 interestingly showed a negative correlation between the U.S. dollar and the equity market as well as the bond market (Table 3). We think that this is due to the more recent pandemic period being marked by an even stronger dollar-driven market that not only drives up the equity market, but also drives up the bond market with the astonishingly low interest rate.

Table 3. Summary of Result for Sample Period 3
(Pandemic with High Stimulus: Jan 21, 2021 – Sep 9, 2021)

Dependent	Independent	Intercept (p-value)	Coefficient b (p-value)	R^2
SP	UUP	0.0010 (0.2628)	-1.0136 (0.0001) *	0.15889
SHY	UUP	2.9e-6 (0.9022)	-0.0234 (0.0011) *	0.06467
IEF	UUP	-1.7e-5 (0.9470)	-0.1642 (0.0267) *	0.03051
GOVT	UUP	-8.6e-6 (0.9688)	-0.0923 (0.1554)	0.01266

One possible explanation for this situation is that during the more recent covid period there were economic stimulus packages provided by the government that were extensive both in magnitude and in scope to counter the severe economic downturn caused by the pandemic. The economic stimuli were not financed by tax revenue, but by quantitative easing. The large amount of monetary easing might be having a negative impact on the value of dollar and consequently generating inflationary expectations in the minds of investors. By virtue of the Price Parity Theorem, the lower value of the dollar will translate into higher prices of goods, services and even investment assets; the lowering of the value of dollar due to quantitative easing directly drove up the value of stocks. This is consistent with the rising prices of commodities and real estate during

the covid period. The results demonstrate that the currency effect became more dominant during the covid period and that the market is paying more attention to the value of the dollar during this period of unprecedented quantitative easing.

For the most recent period of Ukraine conflict, whose results are summarized in Table 4, the coefficient that reflects the effects of the dollar on the S&P is -1.42 with virtually zero p-value. This implies a strong dollar yields a lower value for the equity market. Compared to other coefficients in the Table, the statistical significance for the correlation between the dollar and the S&P during the Ukraine period is much stronger than that between the dollar and the bond market, suggesting that the stock market is strongly inversely correlated with the dollar, even more so than the inverse correlation between the bond markets and the dollar. This implies that inflation might play a significant though not obvious role in the nominal pricing of the stock market. This is not obvious because the inflationary effect on the equity market is veiled by the raising of interest rate by the Fed, as it has done several times during this period. Such action props up the value of the dollar while pressuring the value of the equity market.

Table 4. Summary of results for Sample Period 4
(Post Pandemic and Ukraine Conflict: Feb 24, 2022 - Jul 31, 2022)

Dependent	Independent	Intercept (p-value)	Coefficient b (p-value)	R^2
SPY	UUP	0.001239 (0.39)	-1.426636 (7.78e-07)*	0.2065
SHY	UUP	-0.00005816 (0.6981)	-6.311e-02 (0.0279)*	0.04481
IEF	UUP	-0.0002538 (0.696)	-0.1556410 (0.206)	0.01501
GOVT	UUP	-0.0002959 (0.538)	-0.1216101 (0.183)	0.01668

The inverse relationship between short term bond and the dollar also hold during this period, suggesting that the raising of interest rate by the Fed has caused the price of bonds to drop while strengthening the value of the dollar. This is the normal effect of higher interest rate in the U.S. on bond price and the value of the dollar, which is manifested during this period. In sum, the Ukraine period is a period where the equity markets are driven predominately by the strength/weakness of the dollar (which reflects inflation through the Purchasing Power Parity) and interest rate, rather than by economic growth.

V. Conclusion

Using linear regression analysis, we have discovered a surprising change in the correlation between the U.S. financial markets and the dollar before, during, and after the key pandemic period. Before the pandemic, the positive and statistically significant correlation coefficient between the performance of the U.S equity market where a stronger dollar accompanied a stronger stock market. This suggested that economic strength was the main driving force in the stock market in the U.S. During and after the pandemic, the correlation between the U.S. financial markets and the dollar turned negative and significant. This indicates a shift in the minds of investors with a stronger focus on inflation and purchasing power of the dollar rather than economic strength; this suggests that the Purchasing Power Parity which normally applies to goods and service can also apply to financial assets.

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