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THE EURO AND THE US DOLLAR:

Historical Analysis and Contemporary Review of Exchange Rate Dynamics

AN LCR WEALTH WHITE PAPER

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The Euro and the US Dollar: Historical Analysis and Contemporary Review of Exchange Rate Dynamics

The euro has weakened by almost 12% against the US dollar in 2022, falling slightly below parity to a value of 0.9998 USD per euro. The last time there was parity, or a 1:1 exchange rate, between the US dollar and the euro was July 2002. This speed and magnitude of change in the exchange rate between the two most common currencies is exceedingly rare. According to Reuters, "The euro is the second most sought-after currency in global currency reserves, and daily turnover in the euro/dollar is the highest among currencies in the global $6.6 trillion market per day."

In this paper, LCR Wealth Management analyzes the historical relationship between these leading currencies. After exploring the relationship traditionally used to explain exchange rate fluctuations, we evaluate new factors used in modern analytical models. While analyzing the various forces acting on the exchange rate, we apply the concepts to current market conditions. Using this information, we delve into the impacts that these different economic forces have on exchange rates. We use this understanding to evaluate potential future outcomes for the exchange rate between the two currencies.

The euro is the second most sought-after currency in global currency reserves, and daily turnover in the euro/dollar is the highest among currencies in the global $6.6 trillion market per day.

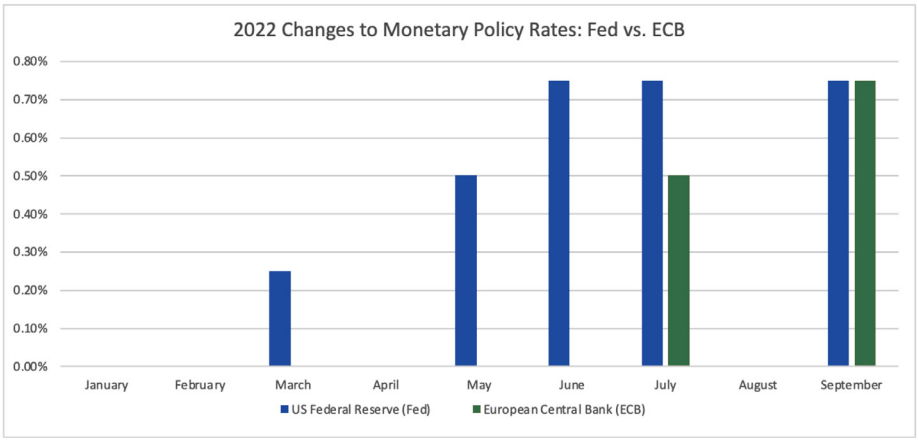
Many factors affect foreign exchange rates, but historically the biggest factor has been differentials in interest rates. To understand this concept, it helps to start with a simple description of the global market for sovereign debt. Every country or government entity that issues a currency also issues sovereign debt in the form of bonds and notes. Bonds have a maturity that is 1 year or more, notes have a maturity that is less than 1 year. The United States issues the US dollar, and the United States also issues Treasury bonds/notes denominated in US dollars. The European Union issues the euro, and the European Union member countries each issue bonds/notes denominated in euros. The largest EU member country, and the most comparable to the United States, is Germany.

Imagine a risk-averse European investor examining the entire universe of hypothetical investment opportunities. He/she is presented with the following two debt offerings:

Issuer: United States Government	Issuer: Germany
Maturity: 2 Years	Maturity: 2 Years
Chance of Default: 0%	Chance of Default: 0%
Price as % of Par Value: 100%	Price as % of Par Value: 100%
Coupon Interest Rate: **1.5%**	Coupon Interest Rate: **1.0%**

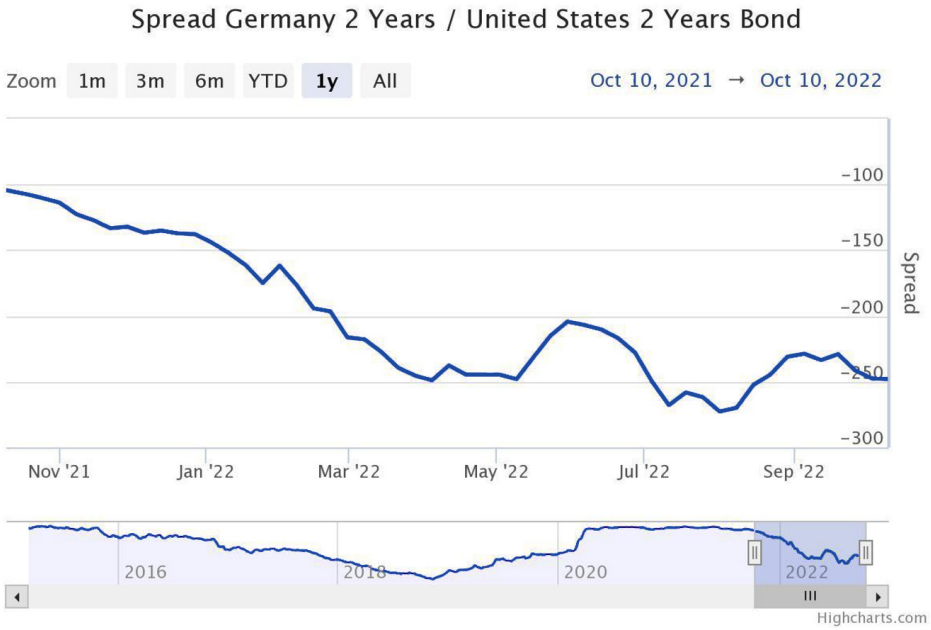
Since all else is equal, the investor would likely choose to purchase the debt security with the higher interest rate, the US bond. To make that purchase, the investor must convert his/her euros to US dollars. This is, in essence, the concept of interest rate differentials as a factor in exchange rates. As investors exchange one currency for another in order to invest in foreign sovereign debt (the second currency), they affect the supply and demand for the currencies they are exchanging. By seeking US dollars in exchange for euros, these investors increase demand for and lower the supply of US dollars, while increasing the supply of euros. This marginal impact on the supply and demand for the two currencies is a force acting to depreciate the value of the euro relative to the US dollar. In summation: if one country's sovereign debt has a higher interest rate than another, then the higher-yielding country's currency is expected to appreciate.

The US Federal Reserve (Fed) is the US central bank, tasked with a dual mandate: to keep unemployment low and to keep inflation near the 2% annual target. Its primary tool for influencing the economy, in an attempt to fulfill the dual mandate, is to adjust the Discount Rate and the Fed Funds target range. The Discount Rate is the interest rate that the Fed charges to banks on short-term loans. The Fed Funds target range is the Fed's desired market rate for banks lending to one another. By raising the Discount rate and the Fed Funds target range, the Fed indirectly raises market-driven interest rates across the US markets. There are complex relationships underlying the way in which the Fed's actions cause this impact, but this simplified understanding works for our purposes. If the Fed adjusts the Discount Rate and Fed Funds Rate, or "policy rate" for short, it is almost a certainty that there will be a corresponding change to yields on US Treasury debt securities. In other words, there is an indirect, but strong, correlation between the policy rate set by the Fed and the market interest rate on US Treasury on bonds and notes.



The Fed has been raising the policy rate rapidly in 2022 in an attempt to combat high inflation. Typically, the Fed changes the policy rate in increments of 0.25%, because small changes can have large impacts on the economy. The Fed has raised rates five times in 2022, with three of the five rate hikes being 0.75% in size. The European Central Bank (ECB) has only raised rates twice in 2022; once by 0.50% and once by 0.75%.

As a result of the Fed raising rates faster and by a larger amount compared to the European Central Bank (ECB), US sovereign debt is yielding more than the closest comparable European sovereign debt; German bonds. The difference between the yield on one bond and the yield on another is called a spread. The chart below shows the spread between German and US two-year bonds. The negative spread means that German bonds are yielding less than US bonds, by ~2.5%, as shown below:



If we return to the concept of interest rate differentials, it makes sense that investors would shift investments from lower-yielding European debt to higher-yielding US debt. As explained, this shift causes demand for the US dollar to increase while simultaneously raising the supply of euros, which weakens the euro.

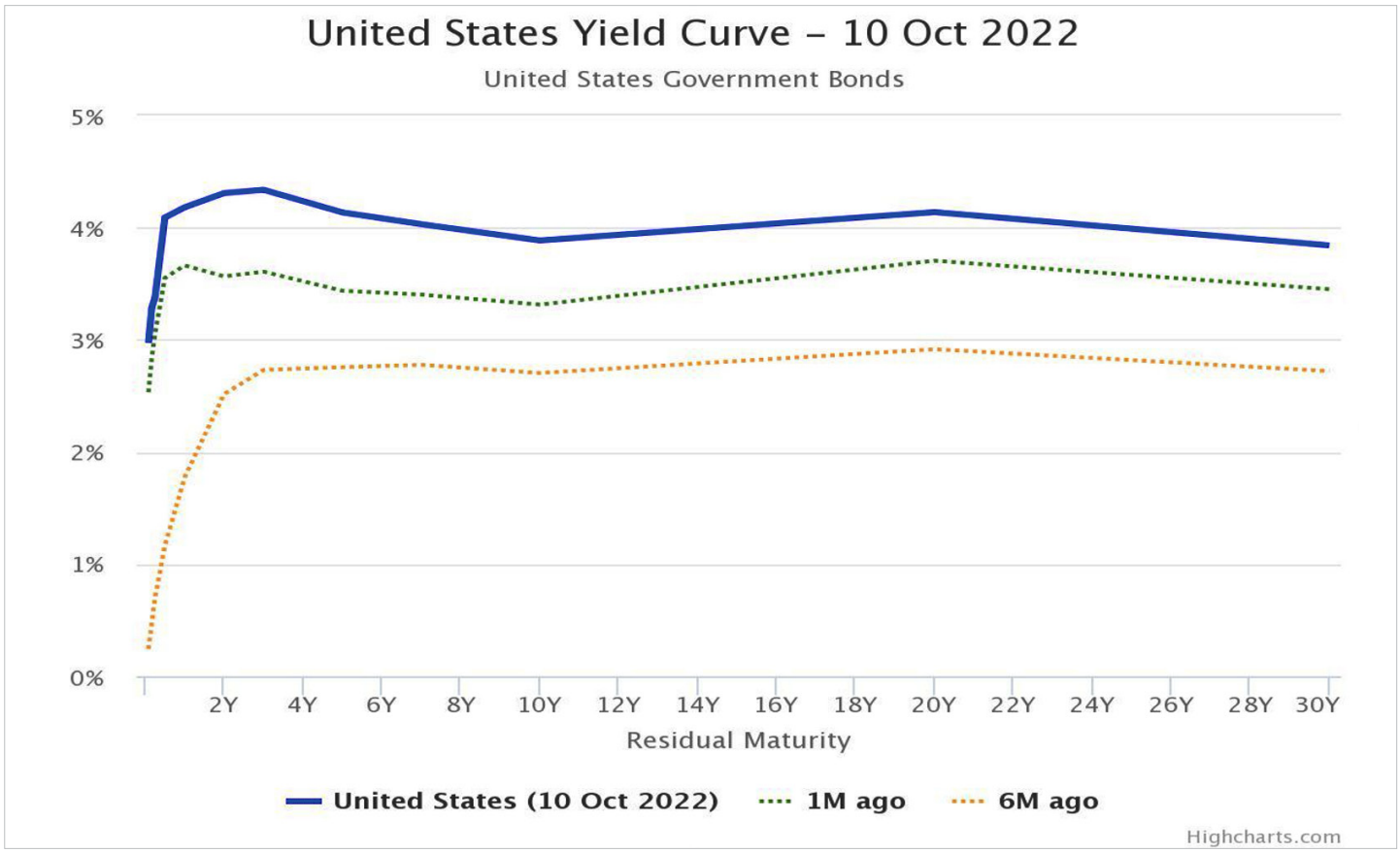
Policy rates are a primary driver of fluctuations in exchange rates, but they do not fully explain all variations. Economists have identified several other factors that, when evaluated in conjunction with policy rates, explain much more of the change in exchange rates. These factors include the term premium on long-term debt securities, oil prices (represented by global Brent crude oil prices), long-term inflation expectations, and sovereign credit risk.

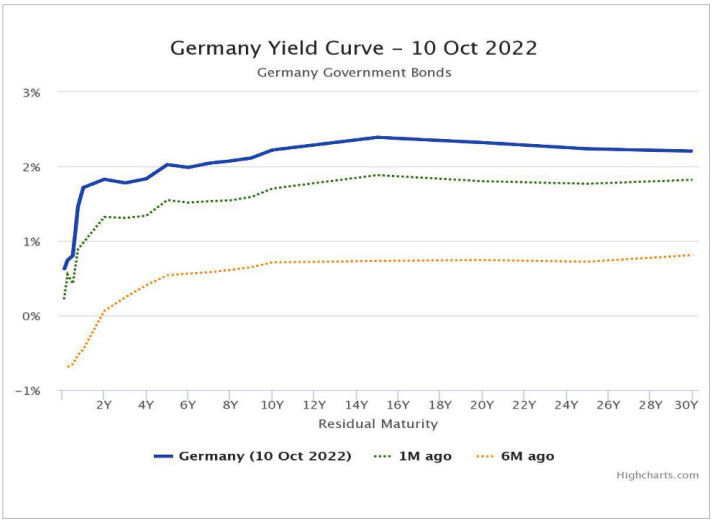
Term premiums refer to the additional yields that investors demand for debt securities with a long maturity over debt securities with a short maturity. Investors generally require a higher interest rate for taking on the risk that comes with the additional duration of long-term debt. Duration risk is the risk that short-term interest rates will rise during the life of a long-term bond, causing the market price of the long-term bond to fall. When one market offers a higher premium for holding long-term debt securities, investors are

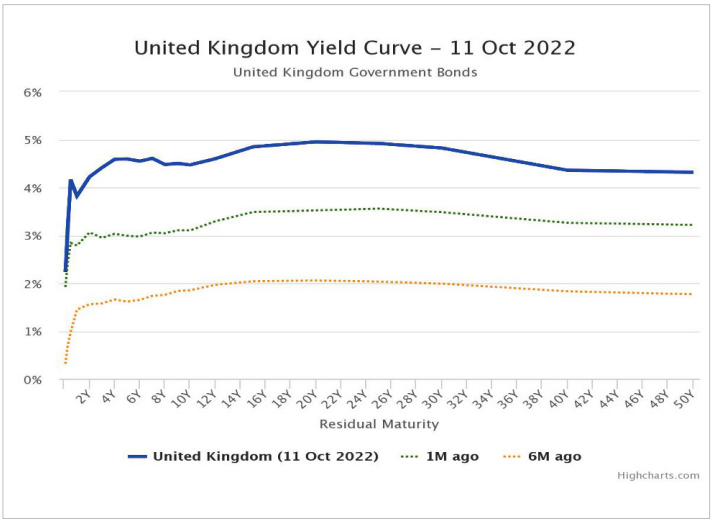
likely to favor that market's debt offering over lower-yielding alternatives. This, in turn, raises demand for the currency used to invest in the debt securities with the higher term premiums.

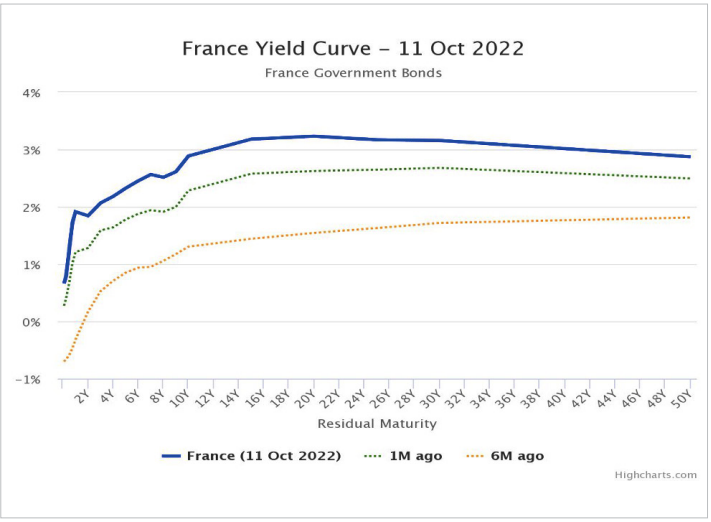
Term premiums gained greater importance during the Global Financial Crisis (GFC) of 2008. During the GFC, policy rates dropped to such low levels that many economists considered them to be an "effective lower bound." This means that, for one reason or another, the central banks in the US and Europe could not lower the policy rates any further. As the world economy started to emerge from the GFC, policy rates remained at these lower bounds. Because policy rates couldn't go lower, investors sought out other factors upon which to base their investment allocation decisions, such as term premium; additional yield on long-maturity bonds.

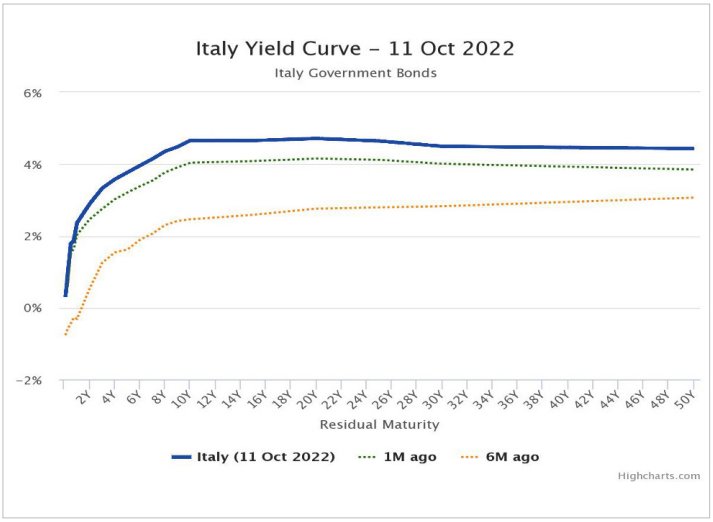
A quick look at the term premiums of US and European debt today (see chart below) reveals that the US has an inverted yield curve. This means that long-term bonds, such as the 10-year Treasury bond, have lower yields than bonds with shorter maturities, such as the two-year Treasury bond. The spread between the 10-year bond and the two-year bond is, in any country, the most closely watched spread; due to its historical correlation to oncoming recessions. There is strong statistical evidence of a correlation between an inverted two-year/10-year spread and the occurrence of a recession six months to a year after the inversion begins. Some of the European yield curves are inverted at the "long end," referring to the portion of the curve related to bonds with maturities greater than 10 years. This is far less important than the spread between the 10-year bond and the two-year bond, since it does not have a history of strong correlation to future economic or market events.











Inverted yield curves happen when investors are greatly concerned with short- to medium-term economic prospects. In the face of economic uncertainty and investment headwinds, investors seek out safety in long-term bonds. This causes the price of long-term bonds to rise. As the price rises, the yield on those bonds falls accordingly. The opposite happens in the market for short-term bonds; investors sell these riskier debt securities, causing the price to fall and the yield to rise. The 10-year US Treasury bond has a lower yield than the two-year US Treasury bond, so there is currently a negative term premium for US sovereign debt. As stated earlier, the euro-denominated sovereign debt most comparable to that of the United States is Germany's. There is no inversion in the German two-year/10-year spread, instead it boasts a 0.4% term premium. Since Germany has a higher term premium, we would expect this to be a force driving the euro to appreciate relative to the US dollar.

If term premiums act counter to interest rate differentials, then why is the euro depreciating so quickly and by so much? It's important to remember that each factor related to exchange rates plays a role, but the forces caused by one factor can be outweighed by forces caused by other factors.

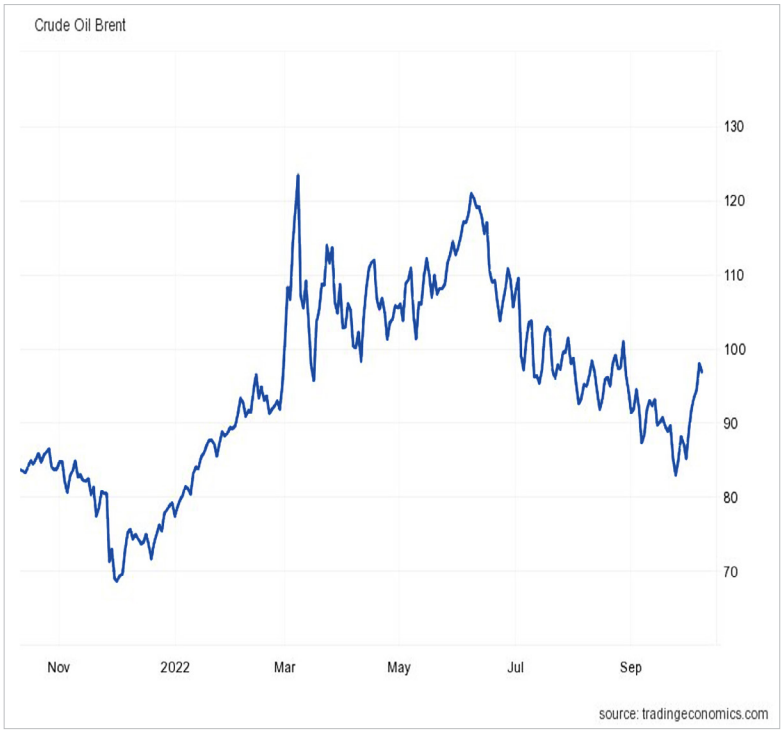
A study conducted by the European Commission found that:

> Empirical results appear to suggest that the term premium component started to play a predominant role in anchoring EUR/USD developments to monetary policy during periods when it was conducted at or close to its effective lower bound but not before (i.e., in the pre-GFC era when traditional monetary policy was being conducted away from the effective lower bound).

It makes sense, then, that as policy rates rise above the effective lower bound, term premiums become less important in determining exchange rate variations.

As we will discover when looking at the non monetary-policy factors (oil prices, credit risk, and inflation expectations), term premium is the only force that incentivizes investor actions that cause the euro's appreciation against the dollar. All other major factors act to depreciate the euro against the US dollar. Investors make allocation decisions; they take all factors into account, and the positive term premium offered by European bonds is not enough to outweigh the other factors pushing down the euro's value.

Oil prices have been widely reported throughout 2022. Most people have experienced the sharp rise in oil prices personally, whether in the form of high prices at the gasoline pump or increasing costs to heat their homes. Oil prices have an impact on the EUR/USD exchange rate, because Brent crude oil is priced in US dollars globally. This means that anyone wishing to purchase Brent crude oil from the global market must do so with US dollars. This requirement creates a dynamic in which the currencies of oil-importing countries tend to depreciate because of increases in oil prices. As oil prices rise, importing countries must exchange more of their currency to purchase the same amount of oil.



This dynamic has been a strong force contributing to the recent weakening of the euro. Oil prices have risen from historically low levels. The increase resulted from several factors, mainly driven by supply chain issues as well as the conflict in Ukraine. The Russian invasion of Ukraine has caused Europe and most of the developed world to place strict

sanctions on the purchase of Russian oil and gas, greatly increasing the demand for oil from the rest of the global supply. As the price of oil rose, European purchasers were forced to exchange more and more euros for US dollars to purchase the oil needed to meet their domestic energy demands.

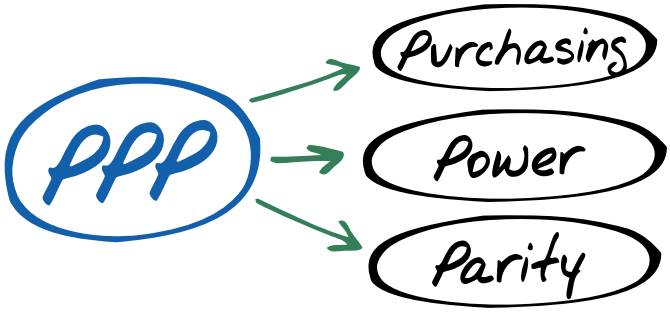
Several recent events may push oil prices higher. In the last few weeks, both Nord Stream Pipelines were damaged, leading to 4 total major leaks across the pipelines. This increases the risk that, entering the winter, the European Union may be completely cut off from Russian energy. If the European Union struggles to find other sources of energy, this could easily lead to much higher demand for oil. Another major current event is the actions of the Organization of Petroleum Exporting Countries and Moscow-led allies (OPEC+). The members of OPEC+ work together to raise or lower oil production to attain the global market price they desire. Due to its combined production power, this organization carries immense power in setting global oil prices. According to the *Wall Street Journal*, on October 5 OPEC+ delegates agreed to "slash output by 2 million barrels per day." This will have an immense impact on the global oil supply and market oil prices. Not only could these events push global oil prices up toward the highs seen in the early summer, but if there is a cold winter in Europe and the United States, oil prices could rise even further than the summer highs.

There has been strong pushback among ESG (environmental, social, and corporate governance) investors in the United States in recent years to stop future oil production exploration and investment, but due to the current pressures on global oil supplies, the United States is attempting to ramp up production. Along with dipping into the Strategic Petroleum Reserve, the attempt to increase production is aimed at combating high oil prices. According to the US Energy Information Administration, crude oil and natural gas production is expected to increase by 5% to 10% in 2022 over 2021. Regardless of whether these current events actually cause an increase in oil prices, the rapid rise and persistently high market price of oil have undeniably exerted great depreciative pressure on the euro.

It is logical to focus next on the impact of long-term inflation expectations on current exchange rates. Oil prices, and energy prices more broadly, have put intense inflationary pressure on most developed economies, including the United States, throughout 2022.

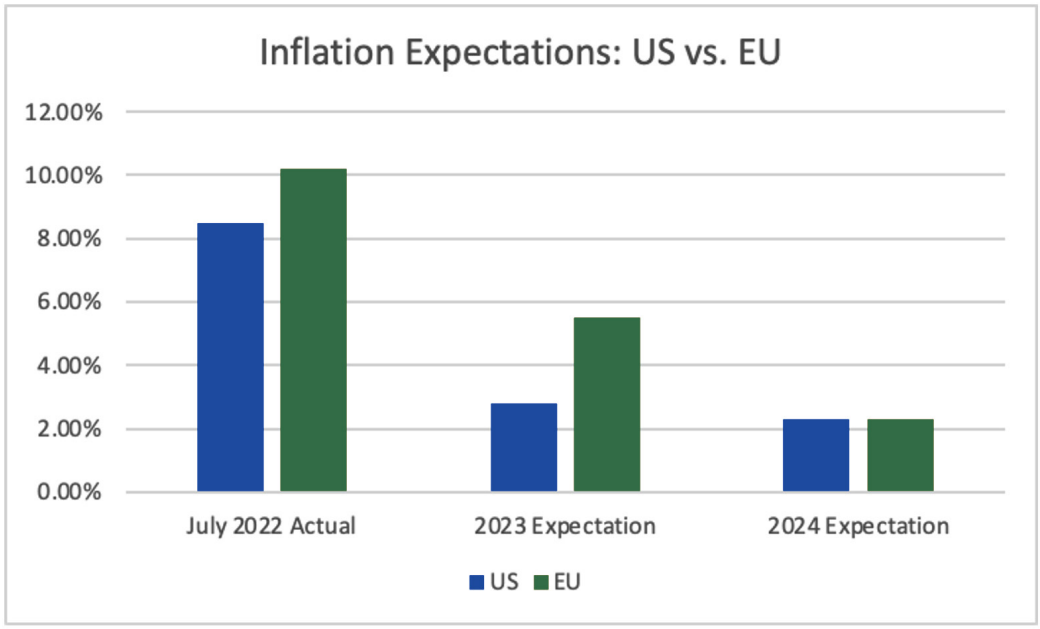
When expectations of inflation rise more in one country than another, they exert depreciative forces on the currency that experiences those higher expectations. Without going into a deeper description of inflation, if inflation expectations increase for a particular currency, this means the purchasing power of a unit of that currency is expected to be lower than previously forecasted. This is

true regardless of exchange rate fluctuations among currencies. If another currency is expected to have less inflation, then, all else being equal, it will outperform the currency with higher expected inflation.



This follows purchasing power parity (PPP) theory, which posits that commodity prices should be the same in all markets. If the price of a commodity is higher in one market than another, then investors would purchase the commodity for a lower price in one market and sell it for a higher price in the other market. This arbitrage activity would increase demand and price in one market, and vice versa in the other market, until PPP is restored. When inflation is higher in one currency and lower in another, without adjustments to the exchange rate, then commodities would end up creating arbitrage opportunities. This explains why inflation expectations have an effect on exchange rates. Investors get ahead of the arbitrageurs and trade the currencies based on inflation expectations; preventing an arbitrage opportunity from being created.

The ECB, for reasons including the recent rise in energy prices, expects Europe to experience higher inflation than analysts are forecasting for the United States over the next two years, as shown in the graphic below.



If the inflation expectations are accurate, European inflation will be higher for longer than in the US. Without a change in the exchange rate, commodities priced in euros will be cheaper than those priced in USD. When currency traders see this dynamic, they sell euros and purchase US dollars, placing further depreciative forces on the market for euros.

The last factor in our evaluation is sovereign credit risk. In our first example of interest rate differentials, we assumed that investments in US Treasury debt or European Union member-country debt were equally risk-free. This common assumption is used to simplify economic concepts and models, but there are stark differences among the real credit risks attributable to various debt-issuing countries.

If one country has a higher default risk than another, investors will be more cautious investing in that country's debt. As a result, investors will tend to favor the sovereign debt that has less credit risk, all

else being equal. The United States has ~$30 trillion in debt, with an estimated 2022 GDP of just over $25 trillion, giving a debt-to-GDP ratio of about ~120%. The European Union has a total debt of ~€13 trillion and an expected 2022 GDP of about €12.5 trillion, giving a debt-to-GDP ratio of ~104%. Since higher debt-to GDP is often equated with higher credit risk, this would suggest that the European Union has less sovereign credit risk than the US; but there are other factors at play. The United States has never defaulted on its debt. This high-quality credit history carries a lot of weight in terms of instilling investor confidence in US debt securities. This is especially true when the US is compared to European countries such as Greece that have a rocky history of debt repayment. Regardless of the rationale behind each individual investor's decision, the US is widely acknowledged as having the lowest sovereign credit risk in the world. As with most of the other factors, the aggregate determination that the US has a lower credit risk than European debt issuers increases the demand for US debt, subsequently increasing the demand for US dollars and bolstering the depreciative forces on the euro.

So far we've evaluated five factors that contribute to the price of the euro relative to the US dollar: ***policy rates, term premiums, oil prices, inflation expectations, and sovereign credit risks***. We've analyzed current market conditions in relation to those primary factors to see how each factor contributes to the overall forces acting on the EUR/USD exchange rate. Policy rates, oil prices, inflation expectations, and sovereign credit risk all exert strong depreciative forces on the euro. Term premium, the only force that we identified as acting to bolster the euro's value relative to the US dollar, is not strong enough to combat the downward pressure from the other four factors. At this point, we turn our attention to potential outcomes for the EUR/USD exchange rate in the future. With this information, we can position investments to benefit from the sharp decline in the euro's value relative to the US dollar.

One way to think about the euro's drop in value, with forecasting in mind, is to use the so-called asset market approach. This approach looks at the exchange rate for a currency as simply the current market

price of an asset—with the asset being, in this case, the foreign currency. As with all asset prices, there is a long-term market equilibrium, also called the mean. When prices deviate from this long-term equilibrium, due to short-term supply or demand shocks, there is strong statistical evidence that the price will nonetheless revert to the mean. But if there are changes to the long-term supply or demand, then the long-term equilibrium can shift. This brings up an important question. *Is the drop in the euro a deviation from the mean, or a correction to the new long-term equilibrium?* Based on the forces that we have evaluated, an argument can be made for both possibilities.

One can posit that the factors evaluated above have, pursuant to PPP rules, created a change in the real exchange rate between the dollar and the euro, a change that was then priced into the market, leading to the weakening of the euro. According to a study in the *International Economic Review*, "estimates of PPP exchange rates are important for practical purposes such as determining the degree of misalignment of the nominal exchange rate."

It is plausible that foreign exchange traders recognized a misalignment of the nominal exchange rate relative to the PPP exchange rate and traded down the euro to what is now the new real exchange rate. Investors who subscribe to this argument would have no need to forecast future changes in the exchange rate. Instead, they would make investment decisions based on the assumption that the exchange rate will remain close to this new long-term equilibrium. If new shocks arise that change the investment thesis, those investors would then adjust accordingly.

On the other hand, investors looking closely at the inflation expectations from the ECB and US analysts can see that both the European Union and the United States are forecasted to have inflation fall to 2.3% by 2024. This may suggest that the inflation differential is short term and imply that the ECB will likely raise rates to match the Fed. Furthermore, oil prices have been falling, and improvements to global supply chains could further decrease global oil prices—thus bolstering the argument that shocks are short term and reversion to the mean is likely. If an investor subscribes to this argument, then there are opportunities to profit from the euro's reversion to its mean.

If we assume the euro has fallen below its long-term equilibrium, another question arises: When will the euro revert to the mean? *As the influential American financial analyst Gary Shilling famously quipped, "The market can stay irrational longer than you can stay solvent."* In other words, even if you believe that the

euro is substantially below the true long-term equilibrium, this does not imply that there is a strong investment thesis for buying euro futures. As discussed, many potential events could emphasize the depreciative forces acting on the euro relative to the US dollar. Or, the euro could stay at its current low levels for longer than expected. If one were to simply bet on the euro's appreciation using a futures contract, any further decline would be detrimental to that investment position. If the euro stayed at its current exchange rate, a futures position would take up investment capital and add tremendous risk to a portfolio, without providing a consistent return.

It is an extremely difficult proposition to accurately predict the direction of future exchange rates. That said, there are still reasons that investors would want exposure to assets denominated in euros. Euro exposure can provide strong diversification benefits through both asset returns and currency risk. A more conservative approach to gaining euro exposure, without adding the excess risk associated with a futures contract, is alternative investments.

Real estate is a good example of an alternative asset with the potential to provide strategic exposure to the euro, while also providing diversification as well as income. There are many ways to access the European real estate market such as through private funds, European REITs, and direct real estate investment. It is important to perform normal due diligence in choosing what European real estate to invest in, and how. Investors should seek out quality investments that are uncorrelated to the potential for the euro to revert to the mean. One example could be Lisbon, Portugal. Portuguese real estate, and in Lisbon more specifically, has grown steadily due to its status as an increasingly popular tourism and immigration destination. An investment in Portuguese real estate would provide a relatively long-term asset denominated in euros that is likely to appreciate over time. At some point in the future, when the investment is liquidated, if the exchange rate between the euro and the US dollar has reverted to a long-term equilibrium above the current exchange rate, then any investment gains from the sale of the property would be greatly increased.

One effective method of accessing the Portuguese real estate market, with the help of LCR Wealth, is an investment in the private real estate fund EQTY Capital Fund I, which focuses on Portuguese real estate. Having performed due diligence on the fund, LCR Wealth has entered into a working relationship with EQTY Capital, whose EQTY Capital Fund I comprises four individual sub-funds, each with its own investment strategy. This allows investors to control the allocation of their investment among the four different sub-funds, to match their goals and risk profile. The fund is also the first of its kind to qualify its investors for the Portugal Golden Visa. Over its five- to seven-year term, the fund returns 3% to 5% on average from rental income, as well as having the potential to provide a larger return from principal appreciation when it sells the

portfolio real estate assets. These returns may be slightly diminished if there is a further drop in the euro, but the investment is still very likely to provide both income and principal appreciation, regardless of the direction in which the exchange rate changes. If there is a reversion of the euro up to a mean higher than the current exchange rate, this will greatly improve overall returns from both rental income and principal appreciation. In summation: EQTY Capital Fund I offers LCR-reviewed, professionally managed, and euro-denominated exposure to the European real estate market, with a high likelihood of investment income and the potential for capital appreciation.

In this paper we've evaluated the five major factors impacting the EUR/USD exchange rate and identified four out of the five as exerting depreciative forces against the euro. After analyzing possible future events that could impact the exchange rate going forward, we established two possible outcomes, both of which encourage euro-denominated investment. To gain euro exposure, whether for diversification or to profit from a reversion of the euro to a higher mean, a conservative approach allows for the desired exposure while limiting risk. Real estate, specifically consistent and stable growth areas such as Portugal, are a good example of how investors can position themselves to benefit from euro exposure, regardless of short- and medium-term exchange rate fluctuations.

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