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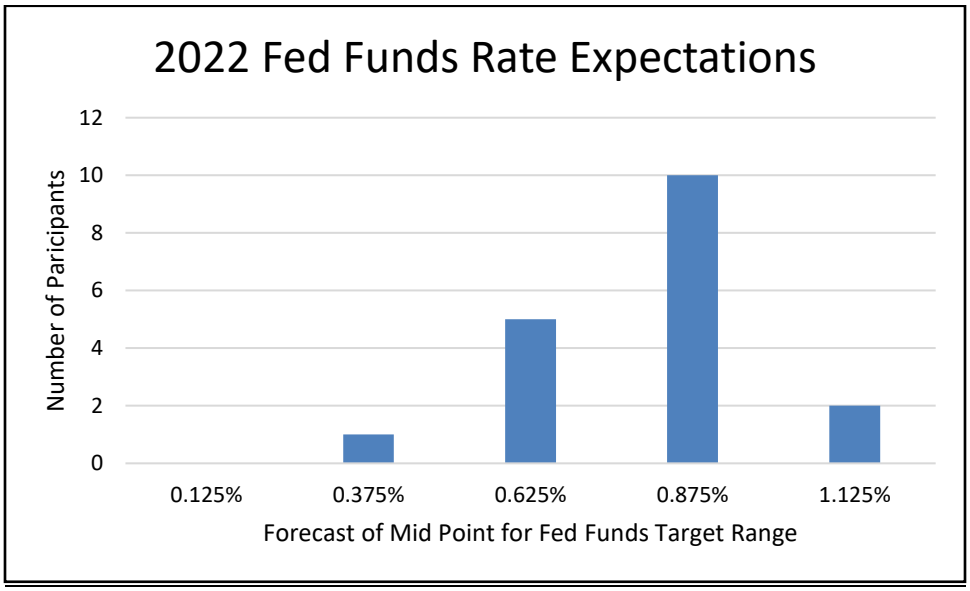
Investment Newsletter – December 2021

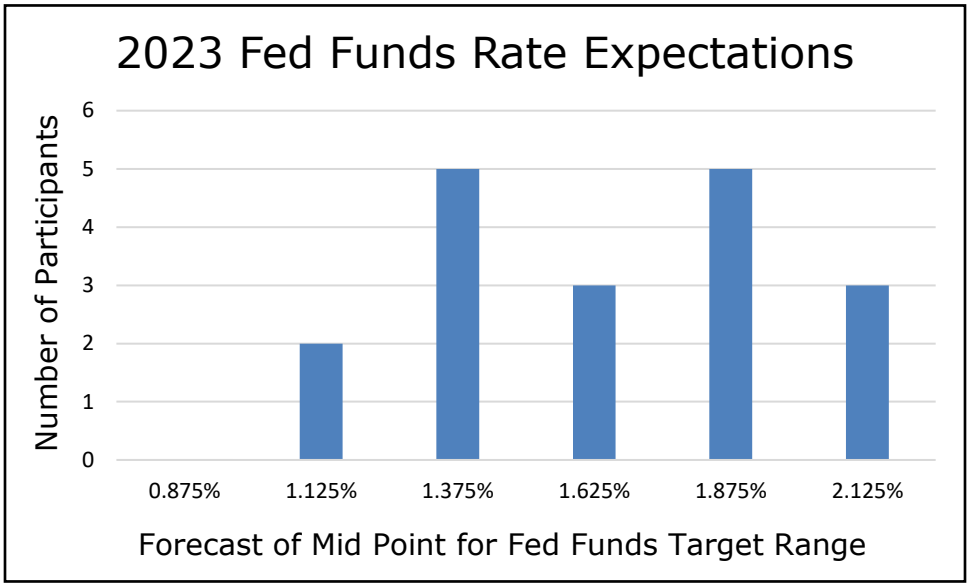
Interest rates are expected to rise in 2022. We'll start with a discussion of what we can expect and why. Then we'll delve into how rising rates impact bonds and different sectors of the stock market.

The Federal Reserve Plan to Raise Interest Rates

Despite a booming economy and persistent inflation, the Federal Reserve (the Fed) called inflation transitory for most of the year. Life is also transitory, yet it may last more than 80 years. This wording was interpreted by most as a forecast that inflation would revert to 2% in a short time. By the end of November, the Fed's forecast had been proven wrong and they "retired" the word transitory for describing inflation. With inflation no longer deemed short-lived and voters becoming alarmed by rising prices, the Fed pivoted to promising faster rate increases in order to convince the public that it will act to bring inflation back under control. Below are the December Fed meeting participants' expectations for increase in short term interest rates:



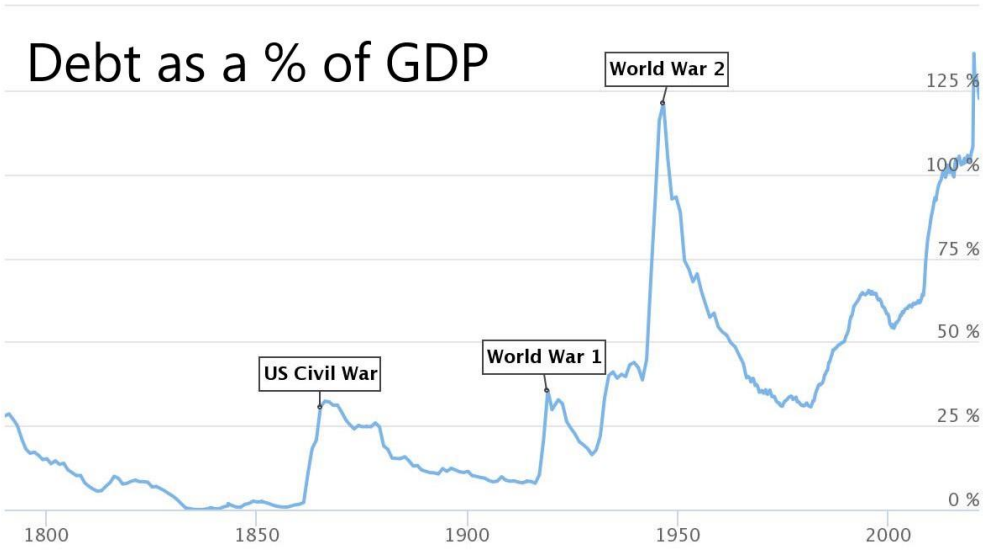
The chart above shows that a majority (10 of 18) expect a year end rate of 0.875% for 2022. The chart below for the end of 2023 rates shows the highest expected rate is still just 2.125% (but most expect a lower rate).



Given that their stated long run average target for inflation is 2%, they don't expect to get to a positive real interest rate (adjusted for inflation) even by the end of 2023! If inflation comes back down, it won't be because of anything the Fed expected to do: negative real interest rates (rates below the inflation rate) do not reduce inflationary forces in the economy.

Meanwhile, government fiscal, trade, and regulatory policies are increasing demand while holding back supply. These are inflationary policies.

I don't believe the Federal Reserve or the government is willing to take action to reduce inflation because they see the cost as too high relative to their main goals. As the chart below shows, government debt is very high.



Increases in interest rates will increase the interest costs the government must pay, which in turn will increase the rate of new borrowing, while simultaneously slowing economic growth. Other negative impacts of rising rates include:

- Lower employment
- Lower tax collections
- Higher government debt as a percent of gross domestic product.

If rates were raised above the inflation rate, there is the potential for a feedback loop of higher and higher debt and interest payments which could lead to a fiscal crisis that could only be solved by high inflation[1].

Although neither I, nor the Federal Reserve, expects them to raise rates above inflation in the next 2 years, we may still see significant rate increases. Next, we'll consider how rate rises may impact bonds and different types of stocks.

Bond Interest Rate Risks

For bond investors it is important to understand how much bond prices will change as interest rates change. Calculating a bond's duration gives you this sensitivity to interest rate changes. (Actually, modified duration is the precise measure but we'll ignore the difference for this discussion). For the mathematically inclined, this measure is the derivative of the pricing function with respect to the discount rate. The more intuitive version is to calculate duration by weighting the time till each cash flow is received in the future by the discounted present value of each period's cash flow. Our Long-Term Income portfolio currently has a duration of 5.2. Ignoring other risk factors, if interest rates rose 1% the portfolio value can be expected to drop 5.2%.

This does not, however, necessarily mean that when the Fed raises rates next year that the portfolio will go down. The Fed only controls short term rates directly. Because these are longer term bonds, the relevant interest rates are long-term rates, not the short-term rate the Fed intends to raise. Generally, we should expect long term rates to rise as short-term rates go up, but this does not always happen. Long-term rates might not move with short-term rates while the Fed is buying long-term bonds to keep long-term rates low. It is also possible that other market participants conclude that the Fed will not be able to raise rates so much because of the risk of recession or for political reasons. In that case, market forces may keep long-term rates low even as short-term rates rise (to a certain point).

If inflation continues to be above interest rates, we should see long-term rates eventually rise once the Fed stops its bond buying program. Although this will tend to push down long-term bond prices, other factors such as lower credit risk may mitigate the effect. More importantly, as bonds mature and are reinvested into new securities, cash flows, and thus returns to bond investors, will rise over

[1] Defaulting on government obligations is another option but this would be an insane choice.

the long run. For anyone with an investment horizon beyond 5.2 years, this will be a good thing for our Long-Term Income strategy.

Interest Rates and Stock Prices

Nominal interest rates determine bond prices – meaning the actual observed rate of interest. In considering the impact of rates on stocks it is helpful to look at real interest rates – adjusted for the portion of the nominal rate that compensate for inflation. If I simplify my math by assuming continuous discounting as opposed to periodic discounting, I can approximate the real interest rate by subtracting inflation from the nominal rate. We cannot know with certainty what future inflation will be and thus we can only estimate the inflation and real rate components of the nominal interest rate. Using the approximate 10-year treasury rate as the nominal rate (1.5%) and assuming inflation is expected to average 3.5% over the next 10 years, we would estimate the real rate of interest as -2.0%.

Unlike bonds, stocks' cash flows to investors are not deterministic. Furthermore, when discounting back expected future cash flows for stocks to determine the current intrinsic value, the discount rate should include a risk premium on top of the interest rate component. These dynamics mean that duration of stocks as measured by the present value weighted average timing of cash flows will not necessarily turn out to be the price sensitivity to interest rate moves as it was for bonds. To illustrate, I'll need a bit of math but I'll also explain in words how to interpret the math so that it makes sense intuitively (I hope).

Below is a mathematical model of how cash flows to investors interact with inflation, the real interest rate and risk premiums to determine a stock's intrinsic value, denoted as P. This is a simplified[2] description of the model set forth in an academic paper titled "A Total Differential Approach to Equity Duration"[3].

$$(1) \quad P = \sum_{t=1}^{\infty} CF_0 \frac{1+g_t}{1+k_t} \quad \text{where:}$$

CF_0 = Cash Flow to investors at time t= 0,
t = the time period,
r_t = the real interest rate at time t,
I_t = the inflation rate at time t,
i_t = the nominal interest rate at time t = r_t + I_t,
g_t= growth rate at time t, and
k_t = the equity discount rate at time t.

This says a stock's intrinsic value is the discounted value of future cash flows – just like a bond – except that cash flows grow over time and the discount rate may vary over time. The other difference is that cash flows may go on forever.

[2] I'm changing from continuous time math to discrete time math here. It's not quite proper but it is useful for illustrating the idea.
[3] Written by Martin Leibowitz, Eric Sorenson, Robert Arnott and H. Hanson in 1989.

Using equation (1) above we can calculate the duration of a stock. Without going into the mathematical details, it turns out that if g_t and k_t are constants: g and k, then duration (D) is:

$$D = \frac{1}{k - g}$$

This stock duration measure is interesting because it provides some initial insights about the relative riskiness of stocks when discount rates are changing. As an example, consider two stocks with different growth characteristics: Fast Company is growing at a long-term rate of 9% while Slow Company is growing at 3%. Assuming the discount rate k is 11% for both, then the duration of Fast Company stock is 50 = 1/(.11-.09) while the duration of Slow Company stock is 12.5 = 1/(.11-.03). This illustrates that, all else equal, high growth companies are also high duration stocks that should be more sensitive to changes in interest rates. This makes some intuitive sense because this type of company is generally priced on the basis of cash flows far in the future and those cash flows would be worth less today as interest rates rise (just like long-term bonds).

The above assumption about constant growth and discount rates is useful to illustrate that growth stocks are likely to be more sensitive to changes in the discount rate. Now let's move on to a more realistic (and complex) version of the stock price model above where we can analyze the differing impact of changes in inflation and real interest rate components of the discount rate. We also want to take into account the effects of inflation and real interest rates on cash flow growth. To do that we elaborate our model by specifying growth and the discount rates as functions of these variables. The growth rate at time t becomes:

(2) $g_t = g_0 + y * r_t + F * I_t$ where:

g_0 = a constant growth parameter,
y = the growth rate sensitivity to real interest rates, and
F = an inflation flow-through parameter.

The functional form for the discount rate at time t becomes:

(3) $k_t = i_t + h(I_t, r_t, X)$ where:

$h()$ = the risk premium as a function of I_t, r_t, & other unspecified variables X.

In words: g_t, the growth in time period t, is the long run growth rate constant, plus an adjustment proportionate to the real interest rate, and an adjustment for the portion of inflation that flows through to cash flows on the stock. The stock discount rate k_t is the nominal interest rate (real + inflation) plus a risk premium which is also related to inflation, the real interest rate, and other variables such as investor sentiment.

This elaboration of the various ways that inflation and real interest rates influences stock prices provides a framework for analyzing the impact of rate increases due to inflation versus interest rate changes that reflect changes in real interest rates. Now we are dealing with a price equation that no longer is analogous to a bond price equation in that the calculation of the rate of change in price with respect to changes in the interest rate (via calculus) no longer gives us the intuitively appealing present value weighted time to receipt of cash flows. I will call

this modified measure of a stock's sensitivity to interest rate changes its elasticity, and denote it E.

Using calculus[4] we find the elasticity by taking the total derivative of the price function so that:

(4) $E = -D * \left(1 - y + \frac{\partial h}{\partial r}\right) * \Delta r - D * \left(1 - F + \frac{\partial h}{\partial I}\right) * \Delta I$ where:

$\frac{\partial h}{\partial r}$ = the rate of change in the risk premium for changes in the real rate,

$\frac{\partial h}{\partial I}$ = the rate of change in the risk premium for changes in inflation,

Δr represents a small change in the real interest rate r,

ΔI represents a small change in inflation, and

$D = \frac{1}{k-g}$ as above.

The first term in equation 4 tells how the stock price changes as real rates change, while the second term describes the impact of inflation.

The above is a complicated looking equation, but the interpretation turns out to be somewhat intuitive. The basic interest rate duration term (D) applies to both terms so that the higher is D, the higher the stock's sensitivity to interest rate changes. Looking at the right-hand term showing sensitivity to the inflation rate, we see that firms with an ability to pass on prices increase such that cash flows grow with inflation will have F close to 1 and will have low sensitivity to inflation-driven interest rate increases. For example, we should expect consumer staples companies to pass through price increases and thus changes in inflation would have lower impact on such companies. The change in the risk premium due to inflation $\frac{\partial h}{\partial I}$ is likely positive but small and we will ignore it for this discussion.

Looking at the left-side term for sensitivity to changes in the real interest rate, we see that companies whose growth is significantly reduced by rises in real interest rates, (where y is significantly negative) will have much higher sensitivity to interest rates than implied by just looking at the D term alone. For example, home builders' cash flows are very adversely impacted when real interest rates rise because it both reduces demand for houses and increases their cost of holding inventory. These companies will therefore be especially sensitive to rises in interest rates (due to the real rate component), more so than measuring sensitivity with D alone would imply. I ignore, for now, the change in the risk premium due to changes in real rates $\frac{\partial h}{\partial r}$ for this analysis so as to focus on the larger and more intuitive impacts.

Looking at the market as a whole, the long-run flow through rate of inflation, F, is probably close to 1. The paper referenced above gave an estimated F = .8. Using this, suppose that the discount rate (k), minus the growth rate (g) is 5%, and the risk premium does not change. Then duration D = 20, but the price drop in such a stock for a 1% rate increase would be only -20*(1-.8) * 1% = -4%.

[4] I've substituted Δr and ΔI for the differentiation notation for ease of understanding.

Now let's apply this to residential real estate investment trusts (REITs). Residential rents generally rise one for one, or better, with inflation. On the cost side, operating costs will also rise with inflation but REITs finance their properties with long-term mortgages at fixed interest rates. Consequently, their mortgage costs take many years to adjust to higher inflation. For this business, the flow through to cash flow growth is greater than 1. Let's suppose it is 1.3 and again we assume D, as above, to be 20. In this example a 1% increase in interest rates due to inflation causes a REIT's price to go up: -20 *(1-1.3) * 1% = 6%. This is why we want to invest in REITs if we expect higher inflation.

Rises in real interest rates are much worse for stocks. Increases in real rates incentivize more savings and thereby reduce economic demand. Rising rates also increase the costs of businesses financed with short term debt without increasing their revenues. Let's assume again that risk premiums don't change and that we look at a stock where D = 20. Further, let's suppose cash flow growth sensitivity to real rate rises, y = -.25. This means a 1% rise in real interest rates reduces growth in cash flows by 0.25%. In this example the drop in price for a 1% increase in interest rates would be -20 * (1+.25) * 1% = -25%. This is dramatically worse than the price impact of interest rate increases driven by inflation.

These dynamics also work in the opposite direction. In 2021 expected future inflation has risen quite a bit while nominal interest rates, as measured by the 10-year treasury have gone up by .58%. If market expectations for inflation are up by say .4% more than the nominal interest rate, that would imply that the real rate of interest has dropped by .4% this year. Applying the real rate sensitivity in the prior paragraph would mean that the drop in real rates could account for a 10% *increase* in stock prices in 2021. So, we can explain a significant part of the jump in stock prices this year as related to lower real interest rates. Correspondingly, it's worth pointing out that in a speculative bubble stock market, the risk premium is, by definition, declining, thus reducing the discount rate k. We observe this as a rise in prices. This drop in the discount rate also operates to increase stock duration D. Thus, when stocks have run up due to a decline in the risk premium, they are particularly sensitive to any component that causes k to rise: inflation, real rates, or the risk premium reverting to its long run norm.

Looking forward, we know that the Fed will raise short term nominal interest rates. But we don't know for sure if the more important long-term rates will rise. Given rising short-term rates, however, it is much more likely that long-term nominal interest rates will rise rather than falling or staying at current levels. I expect inflation to fluctuate in a range of 3.5% to 7%. If a new stimulus bill is passed, it will go higher. Most importantly for stock and real estate prices, I expect that the consensus of investors about inflation will rise over time and that this rise in expected inflation will counteract the rise in nominal interest rates so that real rates do not rise significantly – a benign environment for stocks. On the other hand, if long term interest rates do rise more than expected inflation, it would likely have a large negative impact on high duration stocks – especially the growth stocks that have driven the S&P 500 to record levels this year. I don't expect this scenario but it is a possibility to keep in mind given the high level of uncertainty going into 2022.

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