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Why is yield-curve inversion such a good predictor of recession?

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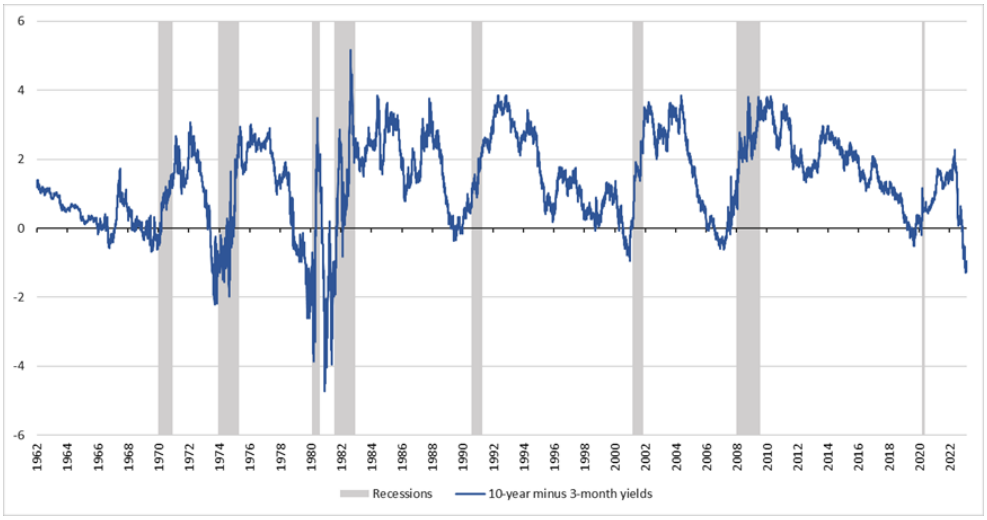
Abstract
Yield curve inversion has traditionally been ascribed to investor expectations. This paper shows instead that it is the result of changes in real variables like investment and consumption, and that these changes are set in motion by central bank actions.

1. Introduction

For several decades it has been observed that when the long-term interest rate (typically the yield on 10-year treasury bonds) falls below the short-term interest rate (typically the yield on 3-month treasury bills) a recession follows after a period ranging from a few months to a couple of years.

The figure below depicts the phenomenon. Each of the past eight recessions has been preceded by a yield curve inversion. There is also one "false positive". A yield curve inversion in 1966 was not followed by a recession. It would not be out of place, though, to mention that the credit crunch of 1967 has sometimes been described as a "mini-recession", notably by Milton Friedman. The yield curve inversion of 1966 may not be therefore be so false a positive as it seems.



For plotting the above graph, the daily market yield on US treasury securities at 10-year constant maturity is taken from https://fred.stlouisfed.org/series/DGS10. The daily secondary

market rate on 3-month treasury bills is taken from https://fred.stlouisfed.org/series/DTB3. Since the yield on treasury bills is calculated assuming a year of 360 days, this was adjusted to give the bond equivalent yield. The formula for the conversion is taken from a New York Federal Reserve Bank paper (Estrella, Trubin, 2006) which also usefully summarises the evidence and proffered rationale for yield curve inversion. The dates of recessions are taken from https://fred.stlouisfed.org/series/USRECD.

2. The usual rationale

Yield curve inversion is generally sought to be explained in terms of investor expectations. For example, it could be the result of investor expectations of monetary policy. The central bank raises short-term interest rates to curb inflationary pressures. But investors expect this tightening to reduce inflation in the long term and cause the central bank to ease short-term interest rates in the future. These expectations of central bank monetary policy lead to a reduction in long-term interest rates and cause a flattening or inversion of the yield curve.

Another argument is that expectations of future short-term interest rates depend on expectations of future real demand for credit and future inflation.

> "A rise in short-term interest rates induced by monetary policy could be expected to lead to a future slowdown in real economic activity and demand for credit, putting downward pressure on future real interest rates. At the same time, slowing activity may result in lower expected inflation, increasing the likelihood of a future easing in monetary policy. The expected declines in short-term rates would tend to reduce current long-term rates and flatten the yield curve. Clearly, this scenario is consistent with the observed correlation between the yield curve and recessions." (Estrella, Trubin, 2006)

The trouble with using expectations, an explanatory variable that exists only in people's heads and cannot be measured, is that it can be tortured to fit whatever conclusions one desires. Why does the 10-year yield sometimes rise when the short-term interest rate is raised? Answer: Expectations. Why does the 10-year yield sometimes fall when the short- term interest rate is raised? Answer: Expectations. But an explanation that can account for anything and everything is really no explanation at all.

There is another problem. The inversion of the yield curve is regarded as a result of investor expectations and these turn out to be accurate eight in nine times. But if someone claims to have accurately predicted rain in the coming month eight times out of nine, one would expect him to equip himself with an umbrella to prepare for the rain he predicted. However, in the case of yield curve inversion, which is attributed to accurate investor expectations, it is generally the case that the central bank and government have to step in to supply umbrellas.

One is therefore forced to conclude that yield curve inversion is not to be explained by expectations but by variations in real, measurable variables. That is what the rest of this paper seeks to do.

3. The relationship between investment and long-term interest rates

It is a given in economic theory that investment is a function of interest rates. Specifically, the higher the interest rate the lower the investment and vice versa.

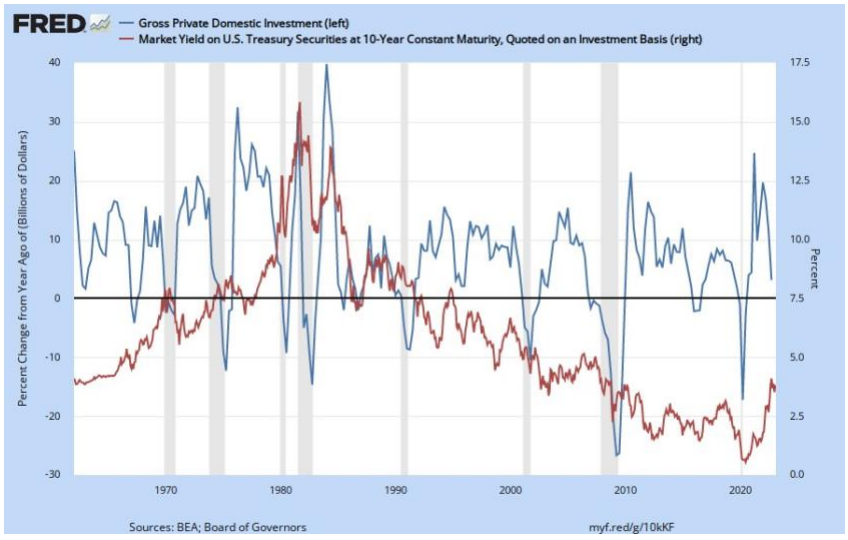
This relationship is one of the equations in J.R. Hicks's famous paper attempting to interpret Keynes's *General Theory* (Hicks, 1937). The assumption of course runs through the *GT* which recommends keeping interest rates low. It is also presumably why central banks cut interest rates each time a recession threatens.

However, Keynes's views are a little more sophisticated than this one-dimensional relationship suggests. His argument runs as follows. A capitalist, while considering whether to invest in a capital asset, estimates the stream of returns flowing from it at various points of time in the future. The marginal efficiency of capital is the discount rate that equates the present value of those returns with the cost of that asset. The capitalist then compares the marginal efficiency of capital with the interest rate. If the marginal efficiency of capital is less than the interest rate then it obviously does not make sense to buy the capital asset. For instance, if he is using his own funds, it would be more profitable to lend them out than invest in the capital asset.

So, it is not the interest rate alone which determines investment. "The schedule of the marginal efficiency of capital is of fundamental importance because it is mainly through this factor (much more than through the rate of interest) that the expectation of the future influences the present." (Keynes, 1936, Chapter 11). Nevertheless, "no one doubts that the investment demand-schedule falls with a rising rate of interest" (Keynes, 1936, Chapter 14).

However, even among those economists who agree with Keynes that effective demand drives the business cycle, not everyone agrees that interest rates determine investment. Michal Kalecki, for instance, "held that the rate of interest is not a significant influence on investment". (Toporowski, 2013)

But what does the empirical data reveal about the connection between interest rates and investment? The graph below shows the YoY percentage change in gross private domestic investment for the US vs the 10-year treasury yield. It shows, for the most part, that investment is high when the interest rate is high and low when the interest rate is low.



This seems to fly in the face of common sense until we realise that we are simply looking at the arrow of causation in the wrong direction. It is not that companies are raising their investments when long-term interest rates are high. It is that long-term interest rates rise when companies increase their investment. This was clear to Kalecki: “Thus changes in the rate of interest are determined by the mechanism of the business cycle rather than determining it.” (Toporowski, 2013).

So, the long-term interest rate is really an indicator of the volume of investment. When capitalists invest more, the long-term rate of interest rises; when they invest less, the long- term rate of interest falls.

4. The effect of changes in short-term interest rates on consumption

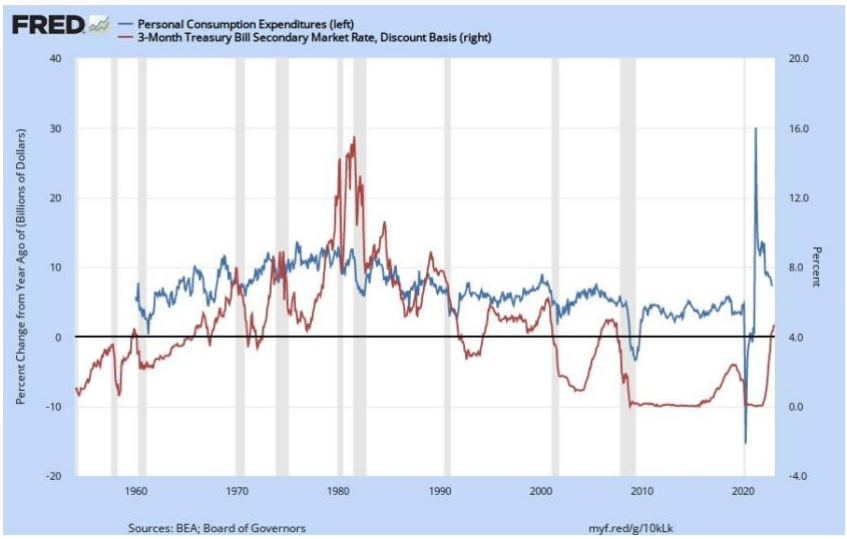
Changes in the short-term interest rate affect the economy primarily due to their effect on leverage and thus on the prices of financial assets, and through them, on personal consumption.

Consider a hedge fund with an equity capital of $5 that borrows $95 and invests the money ($100) in the stock market.

At an interest rate of 0%, when the market rises 1% the fund earns a return of 20% on equity.
When the interest rate is 1% the annual cost of financing is 0.95%. So the market needs to rise nearly 2% to give a return of 20% on equity. If the market remains stationary, the fund suffers a loss of nearly 20% on equity.When the interest rate is 2% the annual cost of financing is 1.9%, so the market needs to rise nearly 3% to give a return of 20% on equity. If the market does not rise, the fund suffers a loss of 38% on equity.

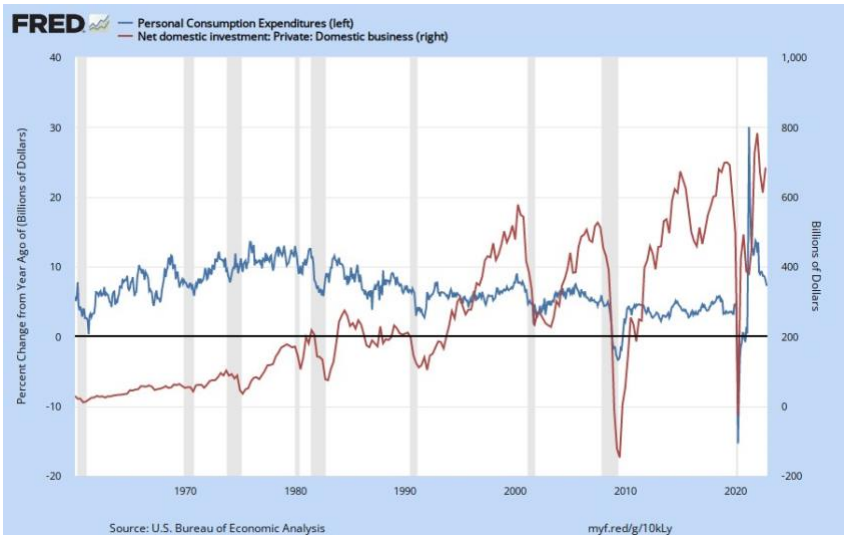
When the interest rate is 5% the annual cost of financing is 4.75%, so the market must rise 5.75% to give a return of 20% on equity. If the market does not rise, almost all the fund’s equity gets wiped out.

When the short-term interest rate rises, inflows into financial asset markets fall, causing a fall in asset prices, and through them, a reduction in personal consumption or, at least at first, a reduction in its growth rate. In the US, home ownership is far wider than equity ownership.
So, the primary effect of an increase in the Fed rate on consumption is through the fall in home prices, the rise in monthly mortgage payments, and the drying up of refinance options.
The figure below shows YoY changes in personal consumption expenditures against the 3-month treasury rate. To cool down a heating economy, the Fed keeps raising the Fed rate with consequent effects on other short-term rates like the 3-month treasury. This brings down personal consumption expenditure, though often with a lag. Fear of an oncoming recession then forces the Fed to reduce interest rates but by then the fall in asset prices becomes uncontrollable and personal consumption expenditure continues to fall.



5. The effect of changes in consumption on private investment

Investment is strongly responsive to changes in personal consumption expenditure. Capitalists invest in anticipation of increases in consumption. If consumption falls considerably net investment may even turn negative, as the figure below (net domesticprivate investment vs YoY change in personal consumption expenditure) shows. Investment is a function of changes in consumption or, more accurately, the rate of change of consumption.



6. Why is yield curve inversion a good predictor of recessions?

The question above can be rephrased as: Why is it that recessions are best predicted not by the short-term rate of interest alone nor by the long-term rate of interest alone but by a combination of the two? In light of what we have said above, the answer is that the long-term rate of interest is linked to the short-term rate of interest. The mechanism too is clear. A rise in the Fed rate raises the cost of leverage and affects markets for financial assets. This causes a

fall in personal consumption, though with a lag. In response capitalists cut back on investment, which causes a fall in the long-term interest rate, and thus an inversion of the yield curve.

At the point where the yield curve inverts, the long-term interest rate is equal to the short- term interest rate. At that point, investment and thus the demand for long-term funds has fallen so far that it is no longer profitable to borrow short-term funds to lend them long-term. Eventually, the continuing fall in investment combines with the continuing fall in the growth rate of personal consumption to cause a fall in GDP, which is of course what a recession is.

From this several policy recommendations can be derived. Reducing short-term rates to near-zero levels each time a recession threatens does nothing to stimulate investment because investment is driven by considerations of profit which in turn is driven by personal consumption expenditure. Ultra-low interest rates mainly help financial market participants and cause asset bubbles. A subsequent rise in the short-term interest rate bursts the bubbles that have been caused by low interest rates and sets off recessions, ranging from mild to severe, and short to long-lasting, depending on how much the accumulated savings of ordinary consumers have been eroded by the bursting of asset bubbles.

7. Conclusion

If yield-curve inversion is a good predictor of recessions it is not because of expectations but due to the effect that short-term interest rate increases have on real variables like consumption and investment and thus on long-term interest rates.

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