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Viewpoint

May 2015

Monetary Policy at Warp Speed

An imaginative twist on theoretical physics forms the premise of the science fiction series "Star Trek": An engine called a warp drive enabled the Starship *Enterprise* to travel faster than the speed of light, going beyond known space to uncharted, exciting new worlds. The confounding detail was managing the sheer power inherent in the warp drive, including its potential to behave in unexpected ways.

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In many ways, we could draw a parallel with the purposeful administration of negative interest rates in sovereign bond markets: a somewhat experimental policy tool, now in use in the real world, with a few unstable attributes that could use some careful examination.

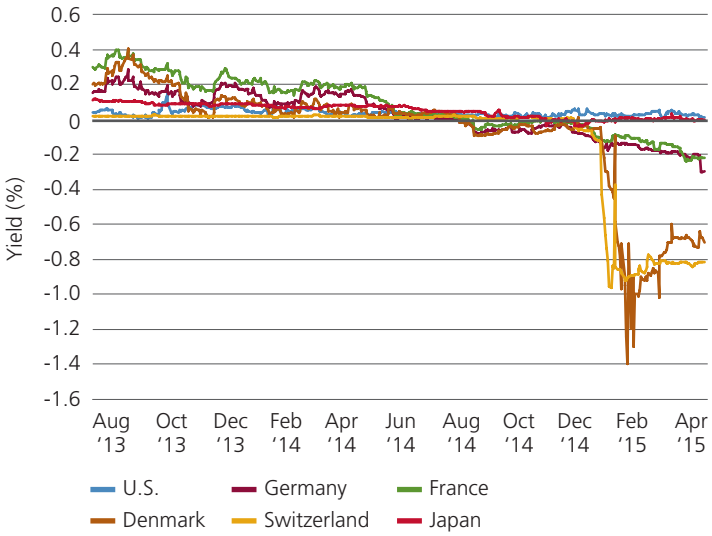
Purposeful negative interest rates: one more nudge

The implicit purpose of quantitative easing (QE) and a zero interest rate policy (ZIRP) is to generate asset substitution – that is, to encourage investors to switch from painfully low-yielding but "risk-free" cash or sovereign assets to other assets that will more fully support economic growth. The Federal Reserve essentially accomplished this feat merely by dumping $4 trillion from the proverbial helicopter and holding overnight rates at one-eighth of a percentage point.

Late to the QE party and impatient with slow economic growth, some central banks are now purposely creating negative rates to provide an extra measure of impetus for investors to move outward along the risk spectrum. As the next step past QE, one might refer to a negative rate policy as "Force Majeure" economics.

Central bank policies have taken different countries along different paths: In Figure 1, notice the *juniper line* of the U.S. and the *harissa line* of Japan have both remained positive despite their central banks implementing massive monetary infusions. This contrasts with the *cayenne line* of Germany, the *parsley line* of France, the *turmeric line* of Denmark and the *saffron line* of Switzerland, which are all now well below zero.

FIGURE 1: SHORT-TERM YIELDS IN SELECT EUROPEAN COUNTRIES DROP BELOW ZERO WHILE U.S. AND JAPAN HOVER ABOVE



Source: CS LOCUS as of 4 May 2015

Given the multifaceted malaise in the eurozone economy, strong medicine such as QE and other atypical methods of financial stimulation appear to be warranted. That said, this particular prescription for negative interest rates could entail some unexpected side effects.

The psychology of going negative

Similar to a starship's warp drive, negative interest rates can be a powerful engine. But on a starship, the entire crew is well aware of the risks involved in engaging this kind of power. On the contrary, while negative interest rates are not new, encountering them on such a grand scale certainly is, and the risks may not be widely understood.

A critical consideration is that zero is not just a number; it is an inflection point between gains and losses. This is important because humans, broadly speaking, are not "risk-neutral" – rather, they are "risk-averse." The joy of winning $100 is not as great as the misery of losing $100.

Not only does risk aversion partially explain such options phenomena as put versus call skew, but also it is a primary source for the entire field of behavioral economics.

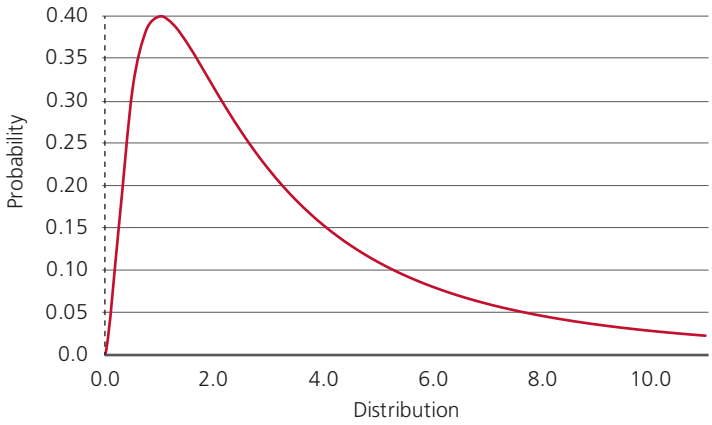
As applied here, investors may have a somewhat linear emotional response to rates declining from 5% to 4% to 3%, but it is unlikely the change from zero to –1% will follow this same path. Thus the proposition that the non-linearity of risk around the zero rate should create a locally unstable investment environment. Stated differently, the investment proclivities of risk-averse financial managers will not be symmetric around the zero rate; as such, both implied and realized volatility should be higher than what risk models might expect for this rate level. Fundamentally, the instability around the zero rate is similar to the "Convexity Vortex," a popular Wall Street description of the rate level where MBS prepayment risk is concentrated.

This does not compute: a model breakdown

Another unconsidered consequence to the introduction of negative rates concerns the risk management of the vast array of financial derivatives. Presently, most models cannot readily accommodate the negative rate dynamic.

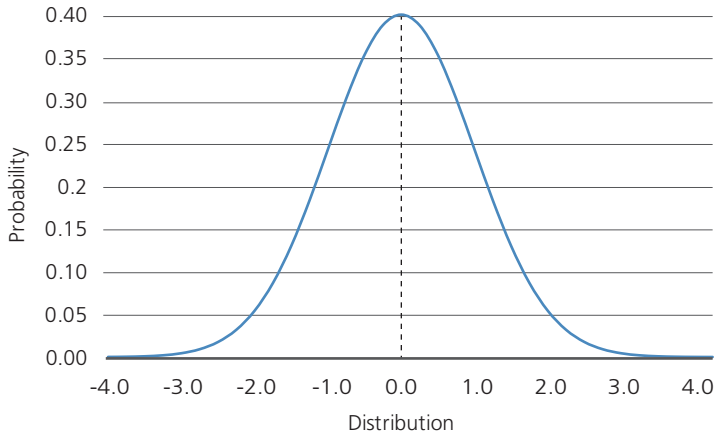
There are two types of standard models for interest rate derivatives. A "lognormal" model (see Figure 2) assumes that rate movements are proportional to the underlying yield level – i.e., a 5 basis point (bp) change in the interest rate in a 5% environment is as likely as a 10 bp move in a 10% environment. This is why lognormal volatility is also known as yield volatility. In contrast, a "normal" model (see Figure 3) assumes that the rate level is not a factor in the risk process. In a normal world (no snickers, please), a 5 bp change in rate has the same probability in either a 5% or a 10% interest rate landscape. The normal model's distribution is often referred to as basis point volatility.

FIGURE 2: LOGNORMAL DISTRIBUTION MODEL



Source: Standard Probability Theory
Sample for illustrative purposes only.

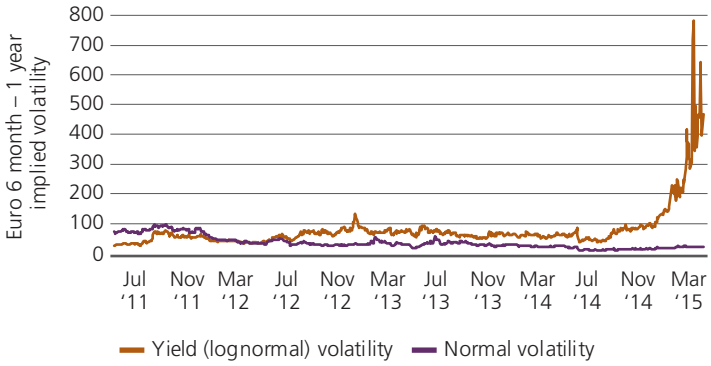
FIGURE 3: NORMAL DISTRIBUTION MODEL



Source: Standard Probability Theory
Sample for illustrative purposes only.

The problem is that neither of these standard models can properly capture the risk dynamics of negative rates. A standard lognormal model, originally designed for equities, is now inadequate for bonds as it hardcodes that rates cannot decline below zero. Notwithstanding that small detail, there is the added problem of massive vector instability as rates become tiny. See Figure 4, where both the *sumac line* of lognormal volatility (aka yield volatility) and the *achaar line* of normal volatility were stable until interest rates began to approach zero late in 2014. Quoted yield volatility basically exploded: A 1 bp rate move on a bond that yields a mere 8 bps implies a 12% daily change.

FIGURE 4: LOGNORMAL VOLATILITY ROCKETS AS INTEREST RATES APPROACH ZERO



Source: CS LOCUS as of 7 April 2015

While the bell-shaped normal model does avert the problem of boundaries and proportionality, it has its own disqualifiers. Consider a German 10-year sovereign note recently centered near a zero yield; a normal distribution would have posited the probability of a 500 bp rate increase to 5% to be identical to a 500 bp rate decline to –5%. This seems absurd: There is a rate level below which most investors would simply convert their bonds to cash and shove it into a vault.

To that point, some creative financial minds on Wall Street have suggested the use of a "shifted" lognormal model where the left boundary is placed at the marginal cost of renting space in the Fed's basement depository for gold storage.

A negative interest rate policy represents one more tool in a central bank's arsenal, and it may well be part of the solution for stimulating an economy (see the April 2015 *Viewpoint*, "An Open Letter to the Eurozone"). I would just offer the suggestion that greater consideration should be given to the rational (and irrational) consequences for both savers and investors of government-sponsored negative interest rates.

Investment implications of an experiment put into practice

1) While the Fed, the Bank of Japan, the Bank of England and the European Central Bank have all engaged in major asset purchase programs, the Fed, the BOJ and the BOE have relied solely upon the "carrot" of superior alternative investment opportunities to encourage asset substitution. They have yet to emulate the ECB and resort to the "stick" of punitive interest rates. As such, be prepared for greater volatility in other asset markets.

2) Financial managers are now highly regulated. U.S. investment banks must conform to both Dodd-Frank and CCAR (Comprehensive Capital Analysis and Review) stress tests while long-liability managers in Europe must manage to Solvency II. However, it is not clear that the risk profile around negative rates can be readily ascertained. Consider the simple exercise of determining the delta (probability) of an option struck at –1%. It's all in how you look at it: Pivoting between a modified lognormal model and a normal model will greatly alter one's expected risk exposure.

3) Negative interest rates have the potential to become a political issue, and political risk tends to be difficult to model.

4) Increased regulation has narrowed the escape valve in the eurozone for the extreme pressures of QE. In other regions, funds have flowed into the competing assets of equities, real estate, commodities, etc. In contrast, eurozone pension and insurance regulations mathematically can encourage fund managers to buy more bonds as rates decline, despite the fact the yield is well below their cost of liabilities.

Negative interest rates are an interesting theoretical construct, a powerful but potentially unstable policy tool … and one that may well work. We could say central bankers have become modern-day Captain Kirks as they "boldly go where no one has gone before."

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