Negative Interest Rates

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International Association of Credit Portfolio Managers

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Today's Agenda


Pension funds need to make the case against negative interest rates

Funds are feeling the pain and should urge governments to do more on fiscal stimulus

ROBIN WIGGLESWORTH + Add to myFT

Warren Buffett: 'You've got . . . less for your money from the US Treasury than you got from sticking it under a mattress . . . I'm not sure you'll see that again in your lifetime' © Bloomberg

Negative Rates: Facts

- **Dr. Donald R. van Deventer**

Negative Rates: Theory

- Prof. Robert Jarrow

Negative Rates: Implications

- Martin Zorn

Fischer Black on Negative Rates

THE JOURNAL OF FINANCE • VOL. L, NO. 7 • DECEMBER 1995

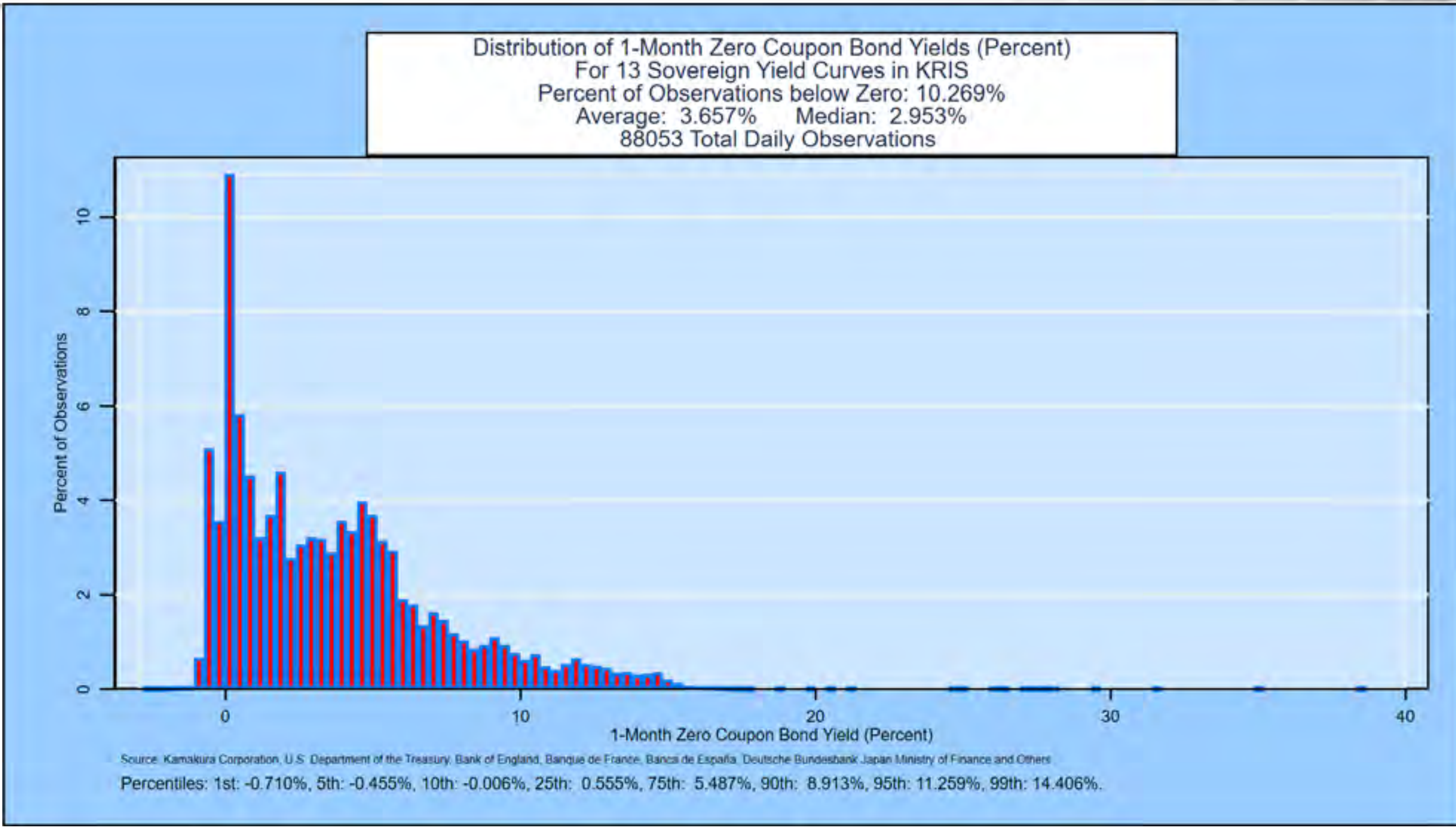
Interest Rates as Options

FISCHER BLACK*

ABSTRACT

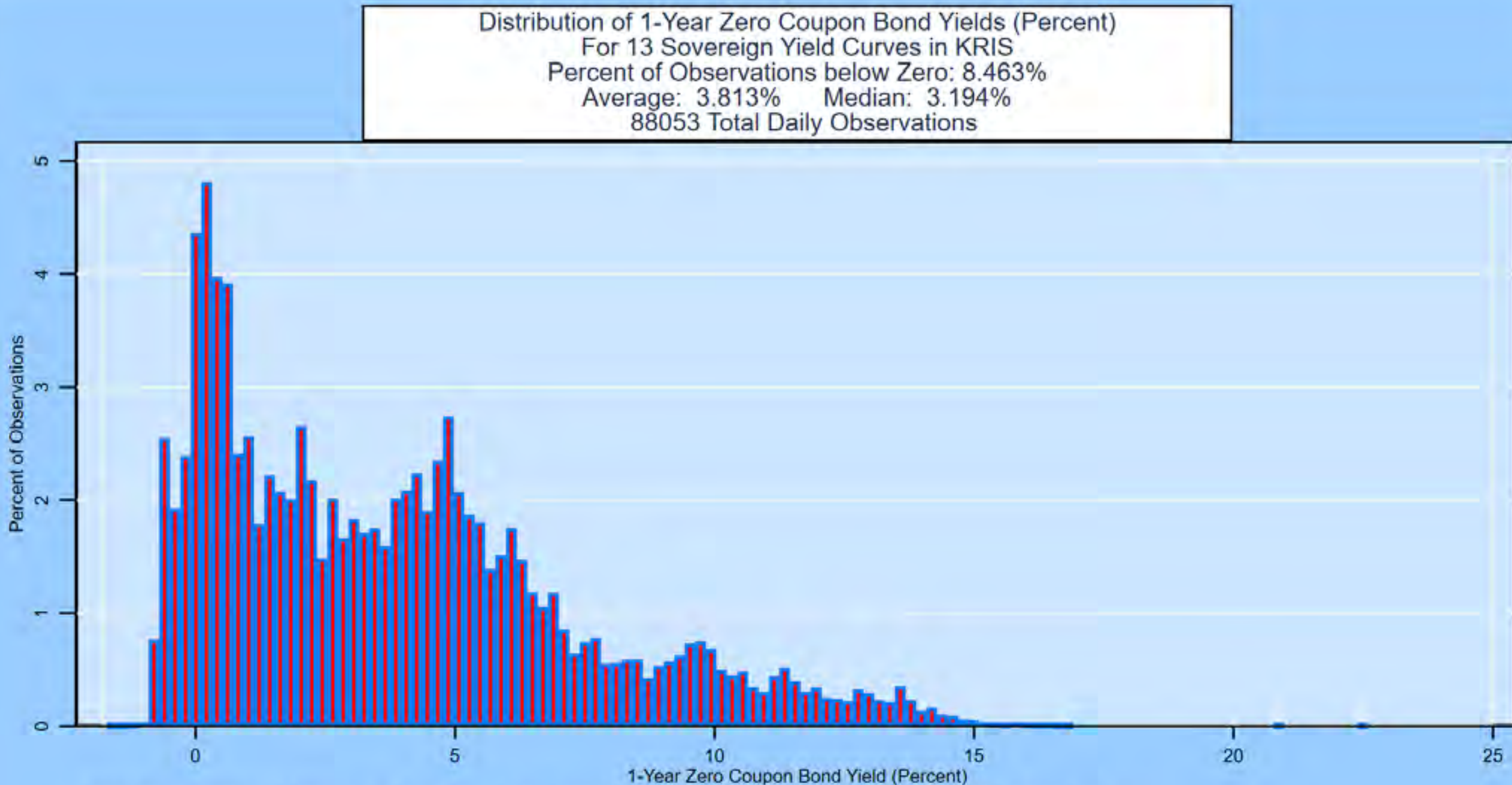
Since people can hold currency at a zero nominal interest rate, the nominal short rate cannot be negative. The real interest rate can be and has been negative, since low risk real investment opportunities like filling in the Mississippi delta do not guarantee positive returns. The inflation rate can be and has been negative, most recently (in the United States) during the Great Depression. The nominal short rate is the "shadow real interest rate" (as defined by the investment opportunity set) plus the inflation rate, or zero, whichever is greater. Thus the nominal short rate is an option. Longer term interest rates are always positive, since the future short rate may be positive even when the current short rate is zero. We can easily build this option element into our interest rate trees for backward induction or Monte Carlo simulation: just create a distribution that allows negative nominal rates, and then replace each negative rate with zero.

Negative Rates: Evidence from 13 Countries



Nobel Prize winner Eugene Fama and the late Black-Scholes legend Fischer Black were wrong when they argued over the last few decades that rates can never be negative because investors "can just store cash for free."

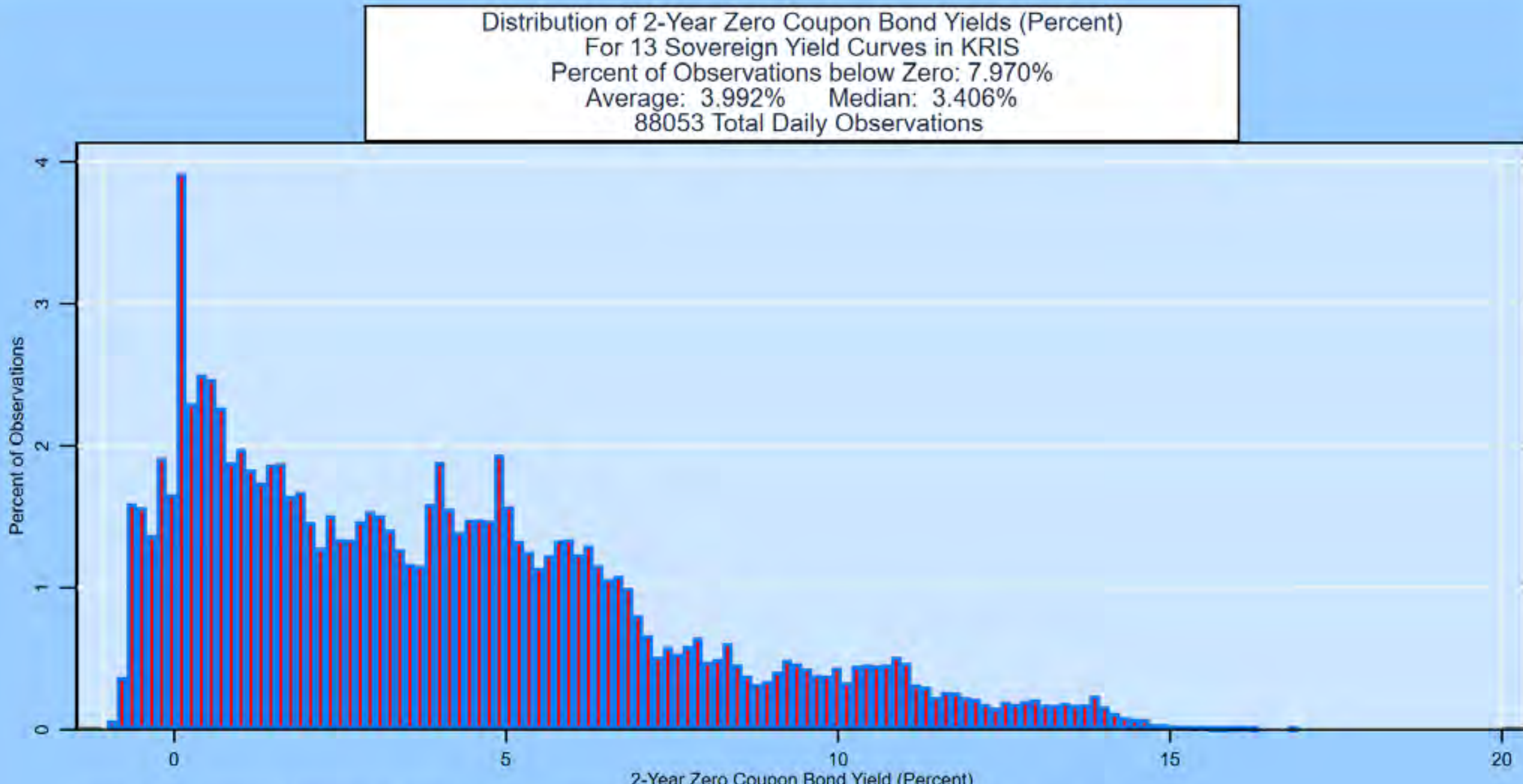
Evidence: 1 Year



Source: Kamakura Corporation, U.S. Department of the Treasury, Bank of England, Banque de France, Banca de España, Deutsche Bundesbank Japan Ministry of Finance and Others

Percentiles: 1st: -0.682%, 5th: -0.318%, 10th: 0.030%, 25th: 0.733%, 75th: 5.769%, 90th: 9.200%, 95th: 11.092%, 99th: 13.666%.

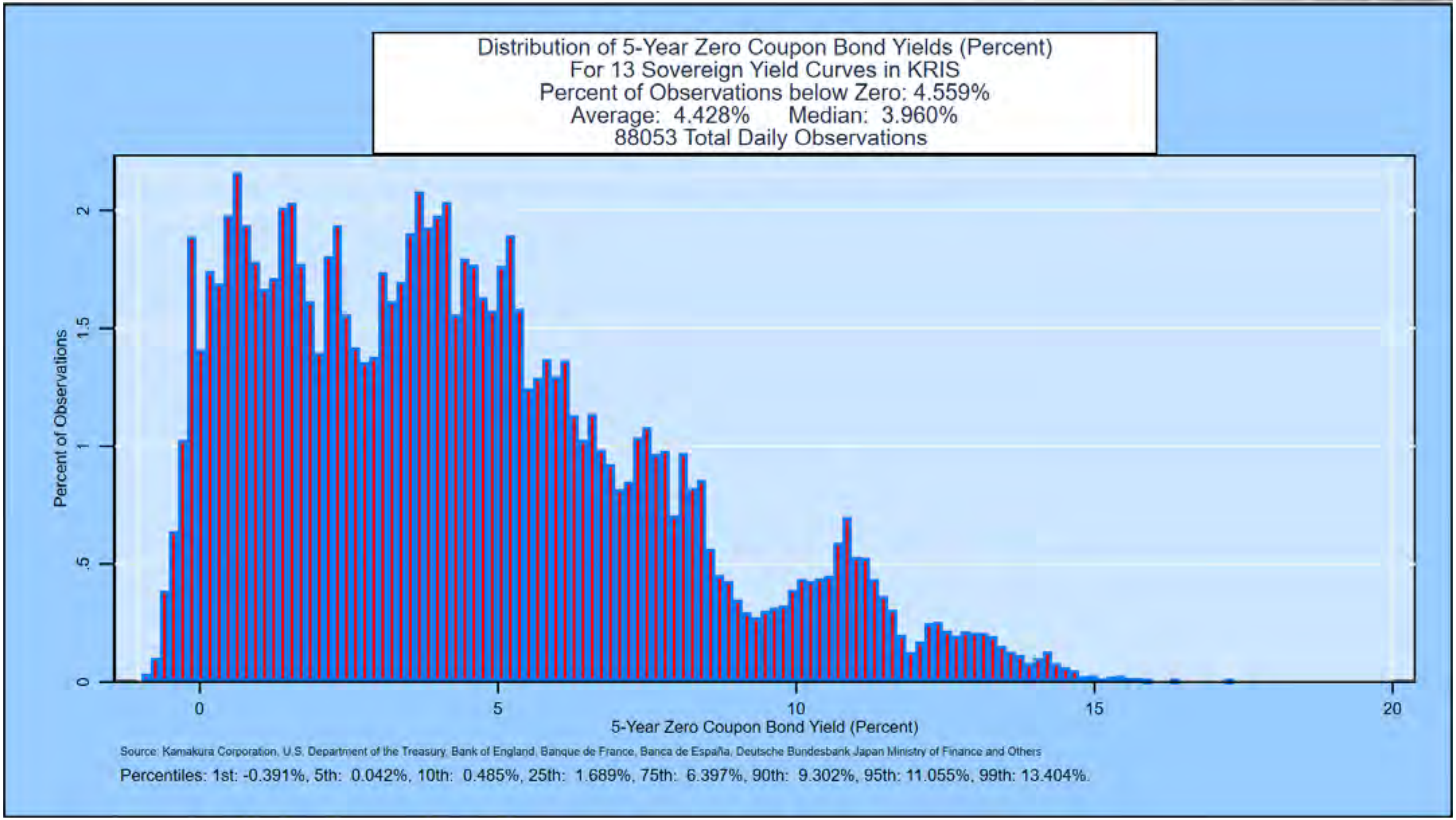
Evidence: 2 Years



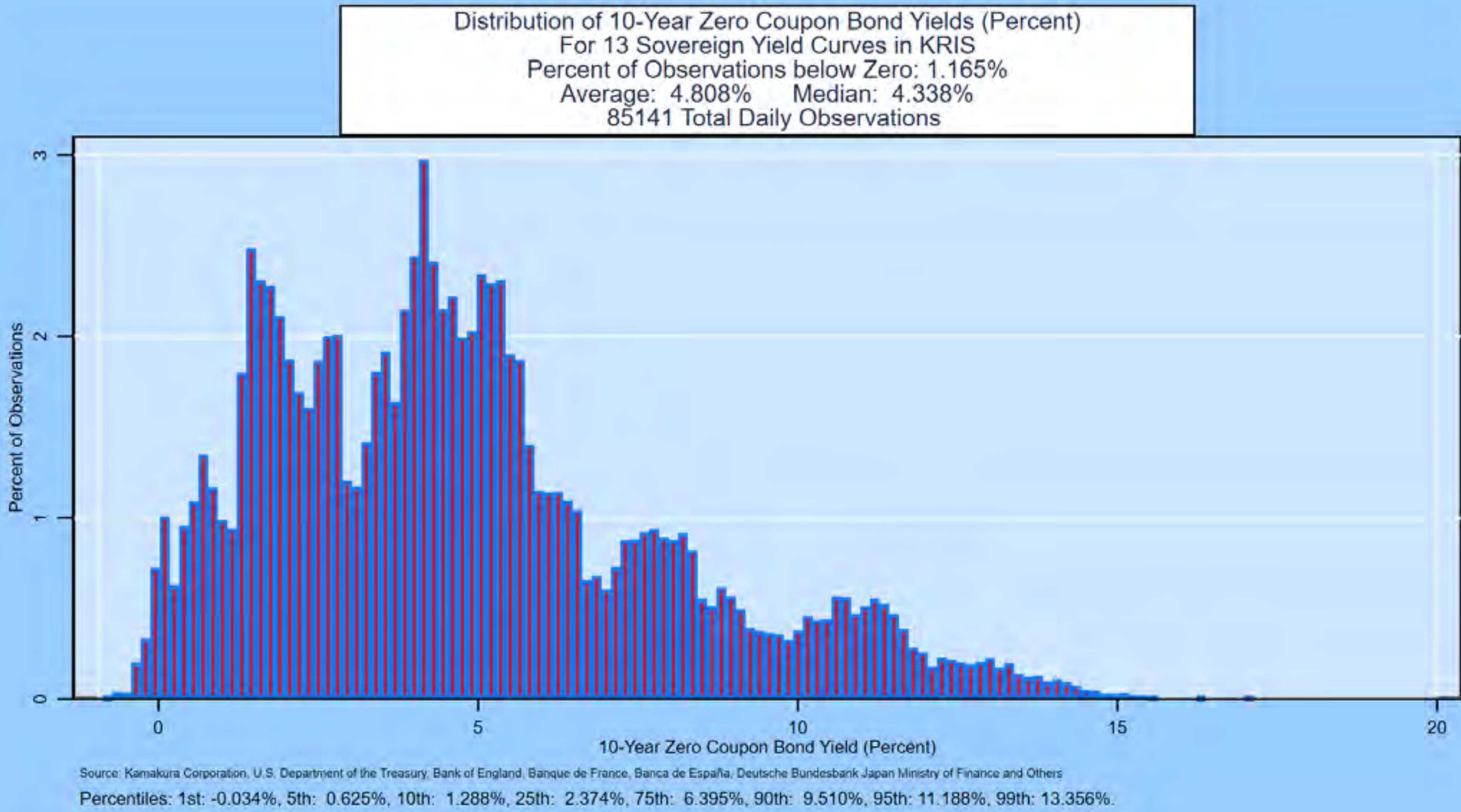
Source: Kamakura Corporation, U.S. Department of the Treasury, Bank of England, Banque de France, Banca de España, Deutsche Bundesbank Japan Ministry of Finance and Others

Percentiles: 1st: -0.652%, 5th: -0.260%, 10th: 0.090%, 25th: 1.022%, 75th: 6.029%, 90th: 9.300%, 95th: 11.022%, 99th: 13.747%.

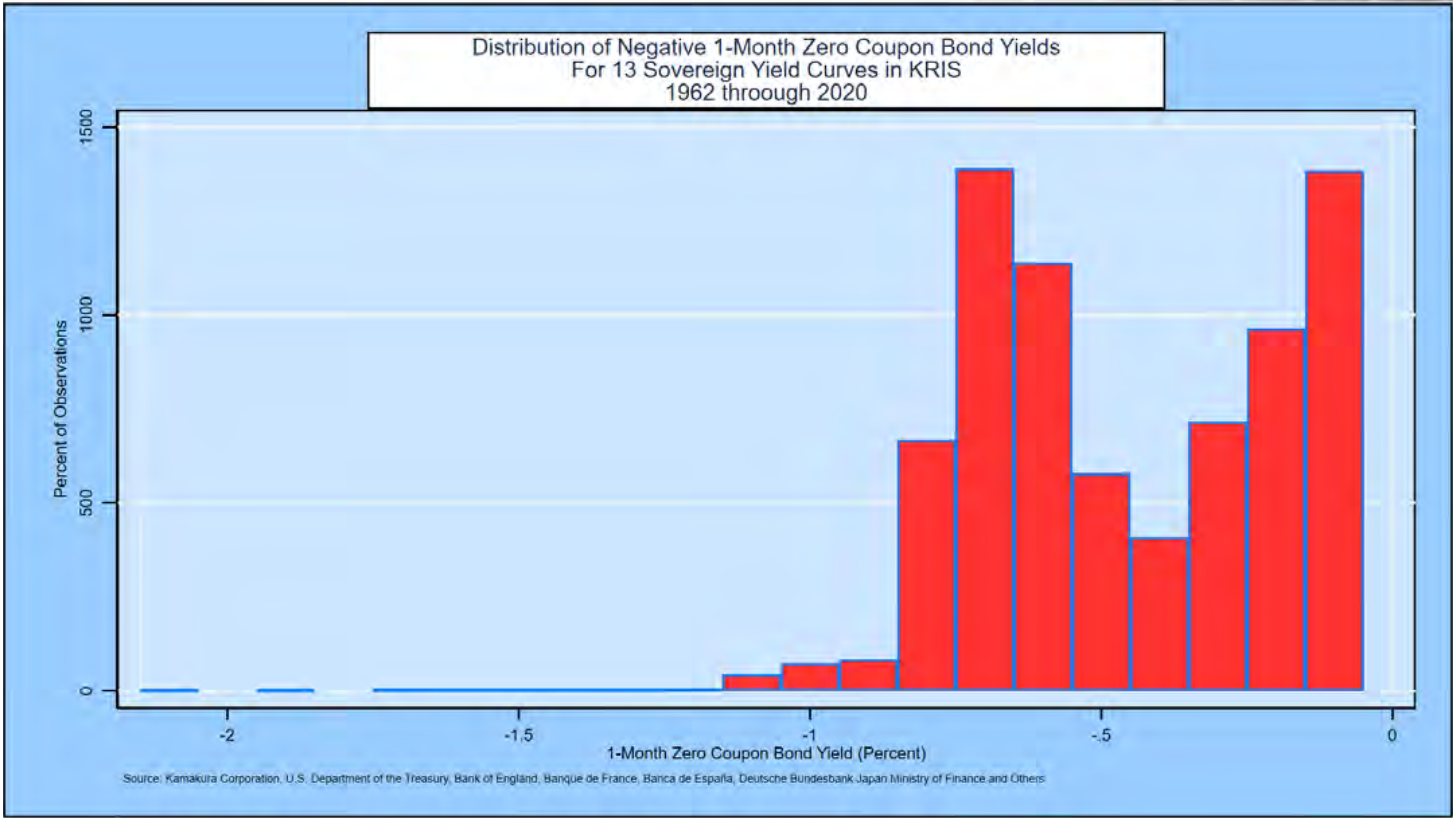
Evidence: 5 Years



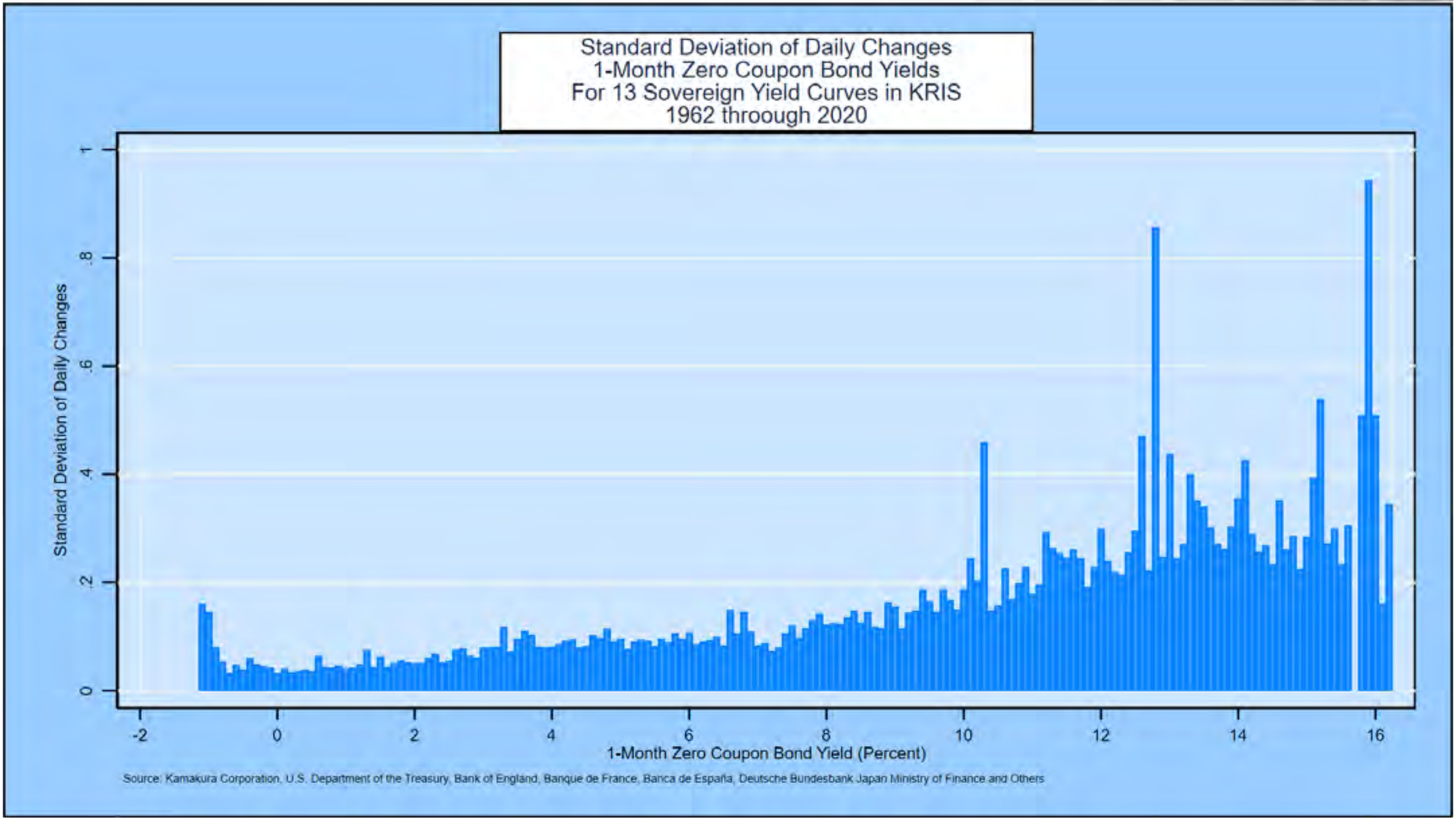
Evidence: 10 Years



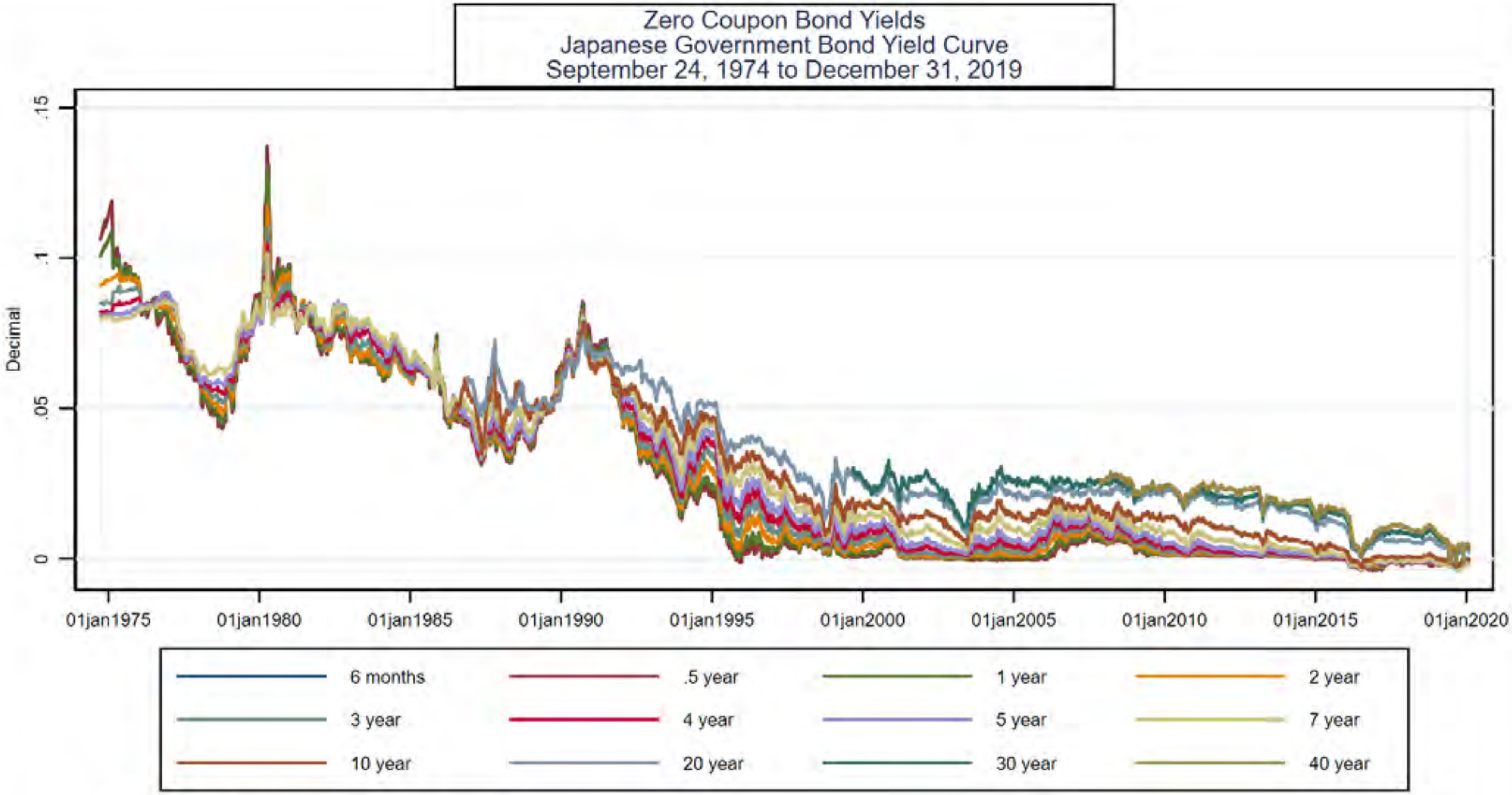
How Negative Do Rates Go?



What About Rate Volatility?



Minus for How Long? Japan



Source: Kamakura Corporation, Japan Ministry of Finance

Can It Happen in the US Market?

FRBSF Economic Letter

2019-27 | October 15, 2019 | Research from Federal Reserve Bank of San Francisco

Yield Curve Responses to Introducing Negative Policy Rates

Jens H.E. Christensen

Given the low level of interest rates in many developed economies, negative interest rates could become an important policy tool for fighting future economic downturns. Because of this, it's important to carefully examine evidence from economies whose central banks have already deployed such policies. Analyzing financial market reactions to the introduction of negative interest rates shows that the entire yield curve for government bonds in those economies tends to shift lower. This suggests that negative rates may be an effective monetary policy tool to help ease financial conditions.

The U.S. Treasury Hides Negative Rates

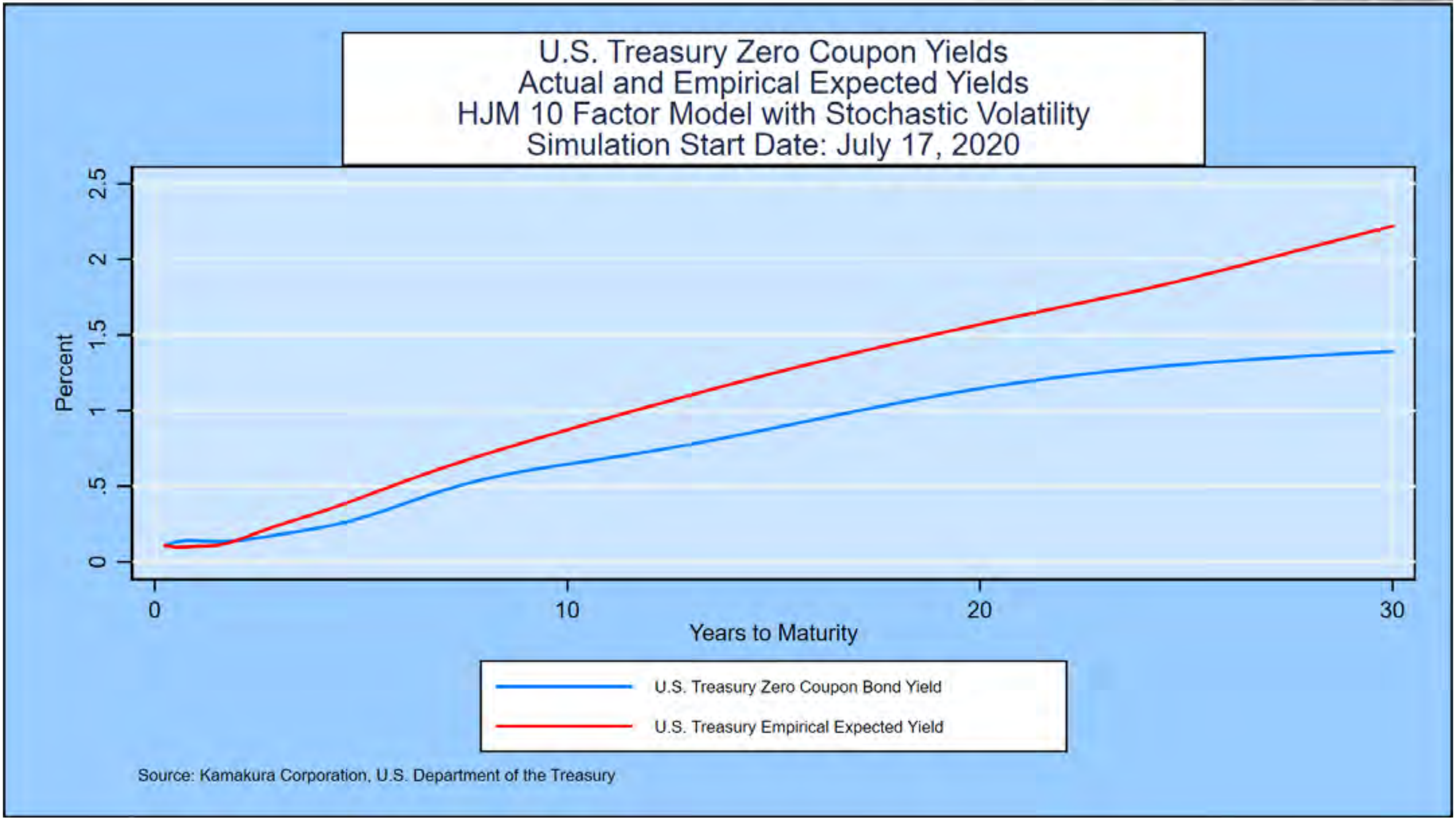
Negative Yields and Nominal Constant Maturity Treasury Series Rates (CMTs): At times, financial market conditions, in conjunction with extraordinary low levels of interest rates, may result in negative yields for some Treasury securities trading in the secondary market. Negative yields for Treasury securities most often reflect highly technical factors in Treasury markets related to the cash and repurchase agreement markets, and are at times unrelated to the time value of money.

At such times, Treasury will restrict the use of negative input yields for securities used in deriving interest rates for the Treasury nominal Constant Maturity Treasury series (CMTs). Any CMT input points with negative yields will be reset to zero percent prior to use as inputs in the CMT derivation. This decision is consistent with Treasury not accepting negative yields in Treasury nominal security auctions.

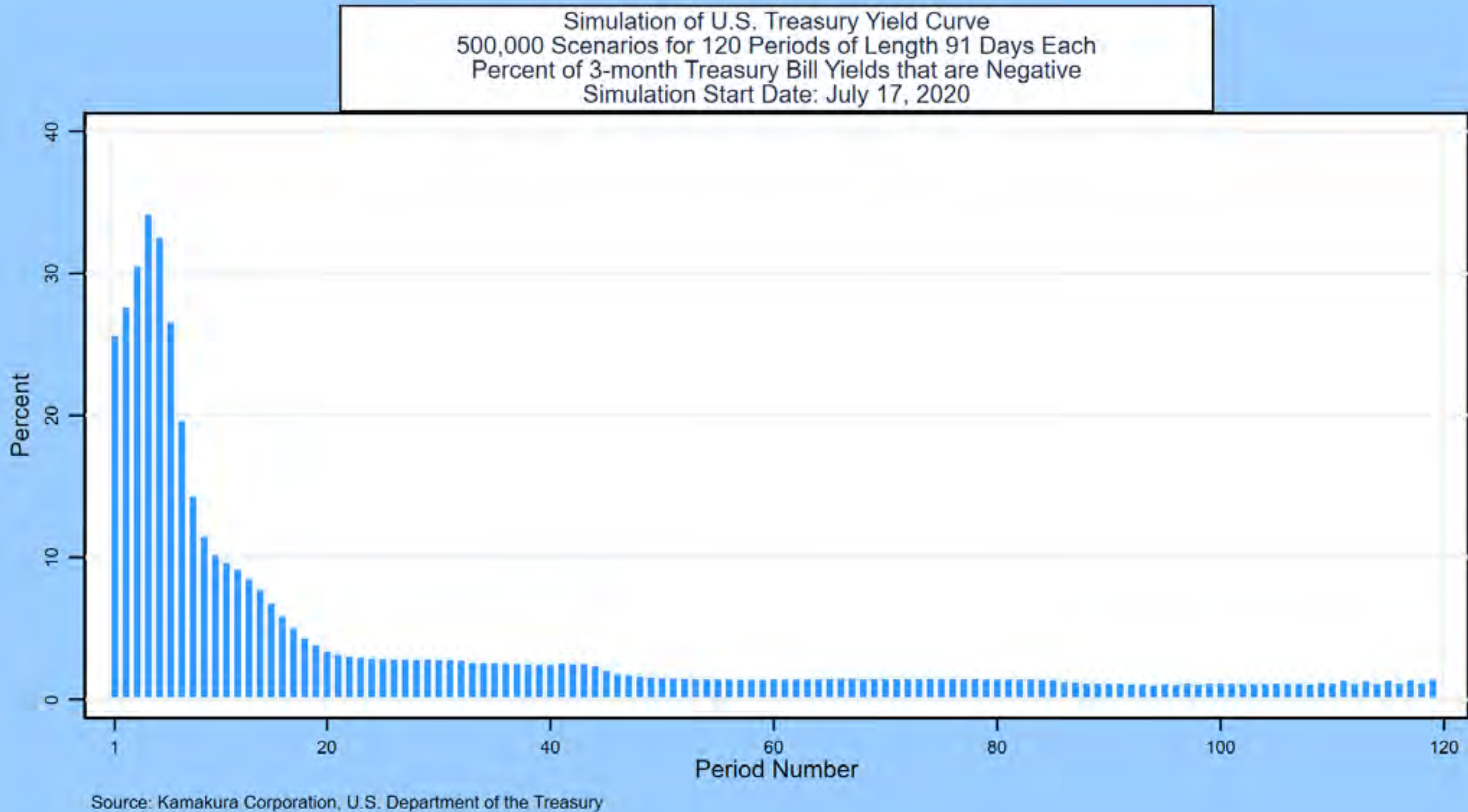
In addition, given that CMTs are used in many statutorily and regulatory determined loan and credit programs as well as for setting interest rates on non-marketable government securities, establishing a floor of zero more accurately reflects borrowing costs related to various programs.

For more information regarding these statistics contact the Office of Debt Management by email at debt.management@do.treas.gov.

Yields are Below Rational Expectations: 500,000 Scenarios



Probability of Negative 3-Month Bill Rates: 500,000 Scenarios



Today's Agenda

Econometrica, Vol. 60, No. 1 (January, 1992), 77–105

BOND PRICING AND THE TERM STRUCTURE OF INTEREST RATES: A NEW METHODOLOGY FOR CONTINGENT CLAIMS VALUATION[1]

By David Heath, Robert Jarrow, and Andrew Morton[2]

This paper presents a unifying theory for valuing contingent claims under a stochastic term structure of interest rates. The methodology, based on the equivalent martingale measure technique, takes as given an initial forward rate curve and a family of potential stochastic processes for its subsequent movements. A no arbitrage condition restricts this family of processes yielding valuation formulae for interest rate sensitive contingent claims which do not explicitly depend on the market prices of risk. Examples are provided to illustrate the key results.

Keywords: Term structure of interest rates, interest rate options, contingent claims, martingale measures.

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Popular Models

Hull and White (HW)

$$dr_t = k(\theta_t - r_t)dt + \sigma dW_t$$

Negative rates

Black-Karasinski (BK)

$$dr_t = r_t[\eta_t - a ln(r_t)]dt + \sigma r_t dW_t$$

Non-negative rates (use shifted to get negative)

Cox Ingersoll Ross (CIR)

$$dr_t = k(\theta_t - r_t)dt + \sigma\sqrt{r_t}dW_t$$

Non-negative rates (use shifted to get negative)

All models:

- Spot rate models – describe term structure evolution via specifying evolution of r_t
- One-factor models

Problems: Spot Rate Models

- To describe evolution of term structure $f(t,T)$ for all $T \in [t,\tau]$, must know (r_t, Q) where Q is the risk neutral probability. Why? Because $P(t,T) = E^Q\left(e^{-\int_t^T r_s ds}\right)$.

- If specify under Q, essential to choose parameters of the evolution to match initial curve $f(t,T)$ for all $T \in [t,\tau]$, or INCONSISTENT with no-arbitrage, when using the r_t evolution. Subtle (often done incorrectly).

- For use in risk management (e.g. computing VAR), need to estimate the empirical drift. Often not done or done incorrectly.

- Estimating the volatility is the same under both Q and P.

Problems: One-factor Models

- One-factor models have only one risk affecting the term structure evolution.
- This is inconsistent with the evidence. Short, middle, long sections behave differently at different times.
- Cannot price swaptions or different maturity caps and floors simultaneously.
- Cannot do risk management (e.g. compute VAR) because do not have the correct evolution.

HJM Models

- HJM models have NONE of these problems – by construction.
- Given $f(0,T)$ for $T \in [0,\tau]$,

$$df(t,T) = \mu(t,T)dt + \sum_{j=1}^{K} \sigma_j(t,T)dW_j$$

No arbitrage

$$\mu(t,T) = -\sum_{j=1}^{K} \sigma_j(t,T)\left[\phi_j(t) - \int_t^T \sigma_j(t,v)dv\right]$$

- Know evolution under Q and P.
- Easy to implement model with negative rates possible when rates are small, and non-exploding non-negative rates when rates are large.
- Easy to estimate parameters.
- Easy to simulate.
- Can use to price swaptions, multiple maturity caps and floors simultaneously.
- Can use to do risk management.

Credit Risk Models

Default intensity

$$\lambda_t = \lambda(t, X_t)$$

Recovery rate

$$\delta_t = \delta(t, X_t)$$

where X_t is a vector of state variables describing the state of the business cycle.

For a reasonable credit risk model, need $f(t, T) \in X_t$ for different and multiple T.

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Warren Buffett: 'You've got . . . less for your money from the US Treasury than you got from sticking it under a mattress . . . I'm not sure you'll see that again in your lifetime' © Bloomberg

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What Can Go Wrong?

- Rate and Default Interaction
  - Impairment to the Banking System
  - Massive challenges to the Insurance Industry and Pension Funds
  - Central Banks cannot force institutions to lend or creditworthy borrowers to borrow
  - Huge overhang for refi in next 5 years
- “Negative Rates Cannot Cure Problems that Caused Rates to go Negative”

The End of the Retail Franchise

German small savers hit with negative rates

Lender in Upper Bavaria to pass on the cost of negative rates

The ECB's negative rates policy has upended Germany's banking sector beyond the large institutions in Frankfurt © EPA-EFE

Threat to Money Market Funds


US money market funds waive fees to stave off negative returns

Decline in yields on short-term debt prompts action from asset managers

Asset manager Fidelity has already waived fees on several products © REUTERS

- Waiver of Fees
- Threat of Clawbacks
- Recall that money funds "breaking the buck" was a tripwire of the financial crisis of 2008
- Implications for corporate funding and liquidity

Threat to Pensions

- Fixed income can become a fixed expense for investors seeking high quality capital preservation or balance sheet management

Netherlands Headed For Unprecedented Crisis: Millions Of Retirees Face Pensions Cuts Thanks To The ECB

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Negative interest rates can be a doom loop for pension investors

Fixed income is turning into fixed expense for those who seek haven assets for capital conservation

U.S. Social Security System, 2034

Long-Range Results

Under the Trustees’ intermediate assumptions, OASDI cost is projected to exceed total income starting in 2020, and the dollar level of the hypothetical combined trust fund reserves declines until reserves become depleted in 2035. Figure II.D2 shows the implications of reserve depletion for the combined OASI and DI Trust Funds. Considered separately, the OASI Trust Fund reserves become depleted in 2034 and the DI Trust Fund reserves become depleted in 2052.[2] In last year’s report, the projected reserve depletion years were 2034 for OASDI, 2034 for OASI, and 2032 for DI.


THE 2019 ANNUAL REPORT OF THE BOARD OF TRUSTEES OF THE FEDERAL OLD-AGE AND SURVIVORS INSURANCE AND FEDERAL DISABILITY INSURANCE TRUST FUNDS

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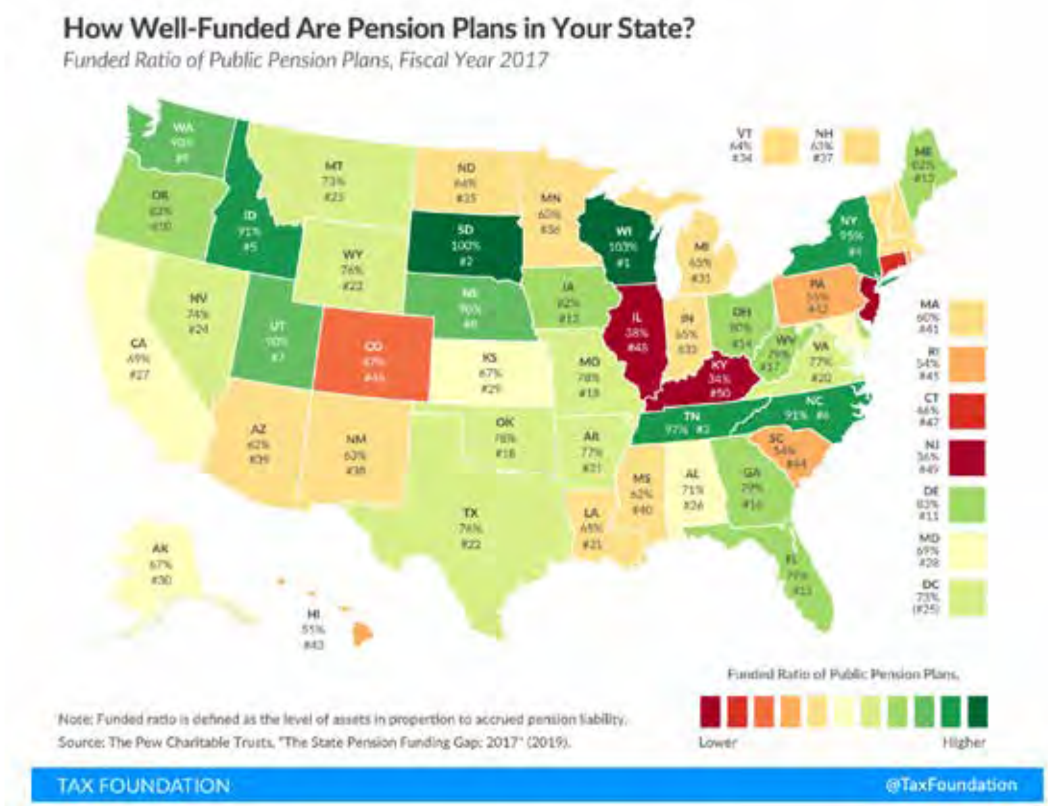
TRANSMITTING

THE 2019 ANNUAL REPORT OF THE BOARD OF TRUSTEES OF THE FEDERAL OLD-AGE AND SURVIVORS INSURANCE AND FEDERAL DISABILITY INSURANCE TRUST FUNDS

Municipal Debt and Public Pension Risk

- Mercer: 64% of plans across Europe were in negative cash flow territory in 2019
- In June the Dutch cabinet proposed that pension entitlements would rise and fall with the market
- The pension promise – how well funded are US public pension plans?



Discussion