



Yield Curve Control

A narrative and graphics telling the story of the ZIRP (zero interest rate policy) and NIRP (negative interest rate policy) experience.

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Source for all data is Bloomberg



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About The Author

David R. Kotok co-founded Cumberland Advisors in 1973 and has been its Chief Investment Officer since inception. He holds a B.S. in economics from The Wharton School of the University of Pennsylvania, an M.S. in organizational dynamics from The School of Arts and Sciences at the University of Pennsylvania, and an M.A. in philosophy from the University of Pennsylvania.

Mr. Kotok's articles and financial market commentaries have appeared in The New York Times, The Wall Street Journal, Barron's, and other publications. He is an occasional guest on Bloomberg TV and Bloomberg Radio, Yahoo Finance, and other media. He writes frequently at Cumberland Advisors and can be found at www.cumber.com.

Mr. Kotok has authored or co-authored four books. They include the 2nd edition of From Bear to Bull with ETFs and Adventures in Muniland. David has also written two monograph pamphlets, "Lessons From Thucydides"^[1] and "Zika"^[2]

Mr. Kotok has served as Program Chairman and currently serves as a Director of the Global Interdependence Center (GIC), www.interdependence.org, whose mission is to encourage the expansion of global dialogue and free trade in order to improve cooperation and understanding among nation states, with the goal of reducing international conflicts and improving worldwide living standards. Mr. Kotok chaired its Central Banking Series and organized a five-continent dialogue held in Cape Town, Chile, Hong Kong, Hanoi, Milan, Paris, Philadelphia, Prague, Rome, Santiago, Shanghai, Singapore, Tallinn and Zambia (Livingstone).

He has received the Global Citizen Award from GIC for his efforts. He is currently on the advisory board of the GIC's College of Central Bankers.

Mr. Kotok is a member of the National Business Economics Issues Council (NBEIC), the National Association for Business Economics (NABE), and previously served on the Research Advisory Board of BCA Research. He is a member of the advisory board of RiskBridge Advisors, LLC, an OCIO firm. Mr. Kotok has served as a Commissioner of the Delaware River Port Authority (DRPA) and on the Treasury Transition Teams for New Jersey Governors Kean and Whitman. He has also served as a board member of the New Jersey Economic Development Authority and as Chairman of the New Jersey Casino Reinvestment Development Authority.



^[1] <https://www.cumber.com/Thucydides> ^[2] <https://www.cumber.com/zika>



This pamphlet, the third I have published, is a report about interest rates, how they change because of market-driven forces, and how they are interlinked worldwide. The interconnection occurs with the derivative markets serviced by the major banking institutions of the world. We compliment Zoltan Pozsar of Credit Suisse for some of the finest analytical work done on the subject. Those derivatives are interest rate swaps and currency swaps. Combinations of them are known as cross-currency interest rate swaps. They exist in the notional quantity measured in the hundreds of trillions of dollars.

The use of those devices enables market agents to take an interest rate policy in one currency that is set by that currency's domestic central bank and link it to another currency and another interest rate in another country and thus to have a funding source in one currency and an application of the funding source in another currency and another country or jurisdiction. I have seen clients use source funding in one foreign country and apply swaps to the funding of a project in the United States. Many times, the clients use their banking relationships for their side of the financing and do not even know the ultimate counterparty because of the intricate linkages among swap parties.

The result is that, over time, interest rates and yield curves gravitate toward parallel term structures. We show that in the statistical section in the last two tables of this pamphlet. Each central bank may think it is determining its domestic yield curve shape by its localized policy. But the global forces are taking that idiosyncratic policy and using it for their purposes. Thus, an analysis of yield curves and yield curve control reveals how these yield curves become aligned and creates opportunity for those investors and portfolio managers who are following this development. Only by managing two points on the yield curve can a central bank control the entire shape of the term structure. When that happens, the volatility is transferred to the currency exchange ratio as described above. Japan is an example, as the Bank of Japan (BOJ) manages the short-term rate and the 10-year JGB rate. The European Central Bank (ECB) accomplishes a similar result by managing the short-term rate and the maturity dates of the TLTRO tranches. TLTRO is the acronym for "targeted longer-term refinancing operations." It is the method used by the ECB to manage interest rates on two points of the yield curve. Note that the methods of the BOJ and the ECB are quite different in form. The substance is essentially the same, as the yield curve comparisons in this pamphlet reveal.



The onset of zero interest rates and then negative interest rates exacerbated this notional derivative activity. It created situations where a commercial venture could be financed in a country that had a positive interest-rate term structure, while the ultimate source funding was a currency and country that had a zero interest-rate policy or even a negative interest rate policy. This is a very attractive condition for an entrepreneur. Borrow at zero, or even below zero, and apply the funds at a positive rate of return. Thus, the stimulus provided by a central bank in one country is transferred to another country by market agents in the other country and by the creativity of market forces.

The use of the swaps has two characteristics. On the loan or investment side, market agents tend to seek matching maturities and parallel terms when it comes to time. Thus a market agent funding a five-year project using a five-year fund source and swaps likes to fix the spreads and therefore focuses the swaps on interest rates on the five-year term. Matching maturities is a time-tested risk-reduction technique.

But for currencies used in the swaps, the calculations are different. Market agents know that the yield on the shortest-term maturity in a single currency is set by the central bank with jurisdiction over that currency. Therefore, the short-term interest rates in currencies are very predictable. So why use the long-term (such as the five-year example above) for the currency side of a cross-currency interest rate swap. Instead, why not “roll” the short-term currency swap portion?

The outcome is more predictable, and the cost is lower. Buy yen and sell dollar. Or buy euro and sell Swiss franc. Use a maturity of three months or even one month. In both cases you can very reliably predict the short-term interest rates; therefore, the market-based prices of the differential of the swaps are used to derive a forecast of the change in the foreign exchange rate with the other currency. Roll the trade in 90-day or 30-day swap maturity tranches. Meanwhile, maintain the financing portion using the five-year term structure. So the cross-currency interest rate swap is really a two-step transaction. Loan and business maturity is matched with the financing need or plan. Currency exchanged is a continuous rolling transaction on a one-month or three-month timetable. The mismatch is between the time periods of the currency swaps and the time periods of the loan or project financing.



This mismatching of cross-currency interest rate swaps as a financing mechanism is the least costly approach and places risk on parties other than the users of the swaps. The notional counterparties of the short-term swaps are fully hedged with short-term currency futures. Those futures are priced on the market-based pricing of the central bank's policy, which is predictable. Thus, the short-term risks are really held by the policy makers, who operate in their interest rate policy-making role with predictability. Their predictability operates beneficially for the market agents who depend on the timetables of the policy makers.

We see that benefit as market agents use futures contracts to price in the probabilities of short-term interest rate changes instituted by policy makers. By rolling these swaps in the short-term market, agents avoid taking on the more expensive futures price hedging needed for longer-term currency-exchange-rate-adjustment risk. Only when a central bank surprises the markets does a shock change this pricing mechanism. In the series of charts in this pamphlet, we will find examples with Canada when the Bank of Canada surprised the markets. Another example is Switzerland when the Swiss central bank was taking incoming euro flows as it tried to defend the Swiss currency from strengthening against the euro. Note that both attempts failed, and the market realigned quickly. The series of graphics depicts these changes.

The result of this continuous and expanding usage of cross-currency interest rate swaps with unmatched maturity structures is that the market-based pricing tends to align all yield curves. And when any currency gets out of alignment at any maturity, market agents quickly take advantage of that opportunity and arbitrage it back into alignment. The currency-exchange-rate risk has been transferred to the market, and that risk adds to volatility in the foreign exchange market. But the yield curves do not adjust accordingly and remain in parallel mode.

We measure that alignment and the changes in the yield curves and offer those results in the two tables at the end of this pamphlet. The z-scores tell us the distribution of the term structures and how they gradually gravitate toward parallel alignment.



In this pamphlet we will use slides and tables and calculations to articulate some of the history of interest rate changes that have taken place since 2009. We wanted to follow the old adage “a picture is worth a thousand words” to tell this story. And our particular focus is on the introductions of the zero interest rate policy (ZIRP) and the negative interest rate policy (NIRP).

We are going to show the entire term structure of the interest rates in various currencies on certain identified dates. We are also going to make comparisons with two interest rate spreads, the 2-year–10-year, or intermediate interest rate spread, and the 3-month–30-year, or longer-term spread. Using these two measures, we can determine a slope of the entire term structure in each currency, and we can observe the parallel nature of them worldwide. We stress that it is important to view both measures of the term structure to obtain a fuller picture of the movement of interest rates.

In recent times and in current times, market agents have tended to focus on the 2-year–10-year spreads. We see that range as a continuing reference on financial TV and in many publications. We believe that this narrow focus on 2-year–10-year offers an incomplete picture.

We believe it is also necessary to respect the research work of Robert D. Laurent published at the Federal Reserve Bank of Chicago and titled “An interest rate-based indicator of monetary policy”.^[1] Laurent made the case strongly for observing the short-term and the long-term interest rate spread to evaluate a central bank’s monetary policy. Of course, Laurent was focused on the Federal Reserve and the U.S. dollar.

We are extending the scope of Laurent’s observations in this pamphlet. So we will view these yield curves with the dual lens of a 2-year–10-year and a 3-month–30-year spread and then use both spreads to derive a picture of the yield curves in question.

^[1] http://www.chicagofed.org/digital_assets/publications/economic_perspectives/1988/ep_jan_feb1988_part1_laurent.pdf.



This pamphlet uses both spread approaches and depicts them together to make it easier for readers to compare and evaluate. The slope of the term structures becomes immediately apparent when both spreads are used to depict it.

Pamphlets have a place in history. They are more flexible than academic books are. They offer great license to the author, and we are using that license in this pamphlet. We have chosen this method to discuss interest rates and observations that we have made about them and used in our professional work for more than a decade. We started this work internally when the zero interest rate policy first appeared during the Great Financial Crisis of 2007–2009.

In the graphic depiction portion of this pamphlet, we will start in 2009 because that is when the first central bank moved its policy interest rate below zero. That's right: The first official negative policy interest rate was in Sweden in that year. For readers' ease we will offer the rest of this narrative in sections, and each section will correspond with the two-page graphic portion identified by the title, page numbers and date on the slides.



CUMBERLAND
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Slides



Sweden Introduces NIRP (07/02/2009)

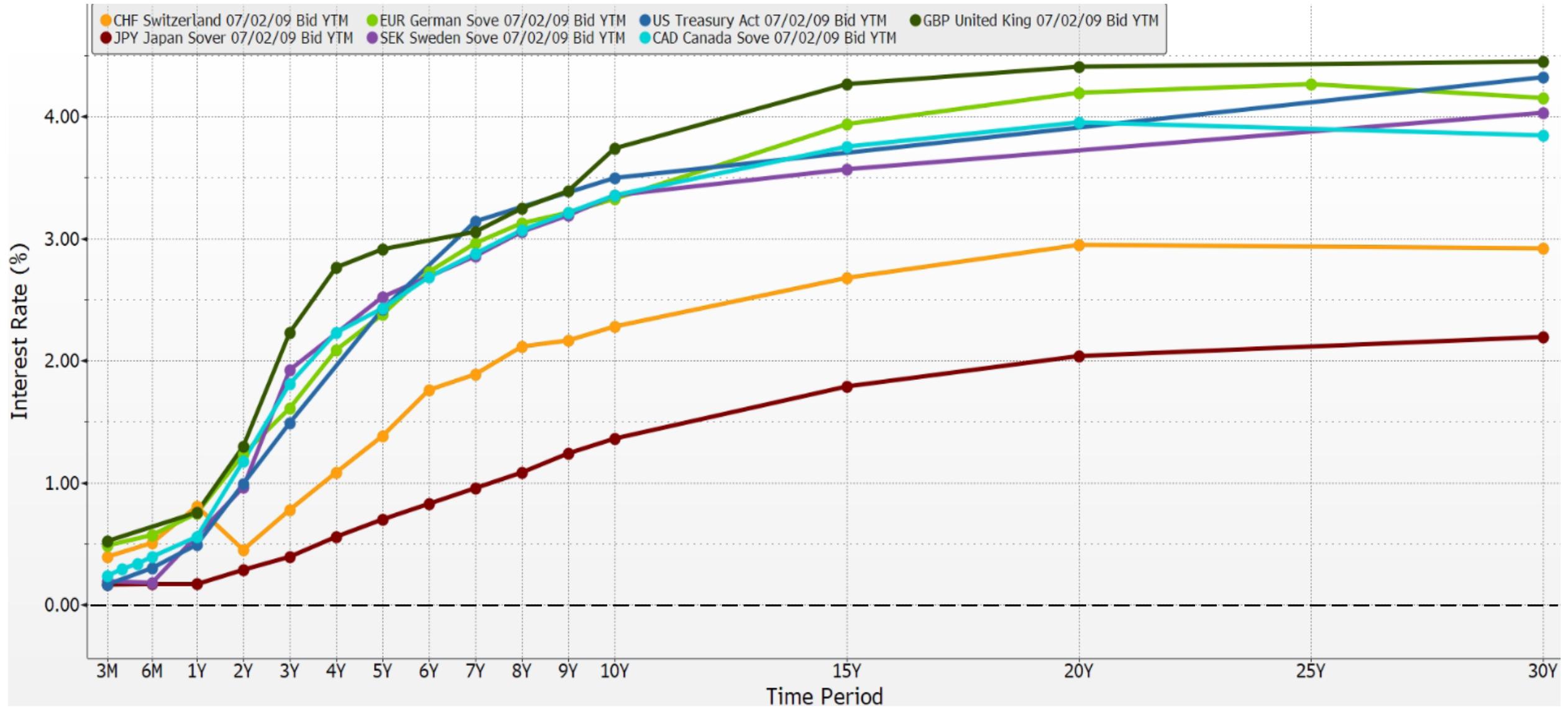
Sweden was first. At the time, the prevalent lower bound of interest rates had reached zero as the central banks of the world were responding to the Great Financial Crisis of 2007–08–09. The zero lower bound, or ZIRP, had already been spreading for over a year; and the question became “what next?” as central bankers tried to determine if they should add to monetary stimulus and, if so, how they should do it.

Sweden was using a “corridor system” for setting its policy interest rate. The corridor was 50 basis points wide. (A basis point is one one-hundredth of 1% or 0.0001). So the policy interest rate in Sweden was lowered to zero. But to maintain the corridor, the lower bound had to be a negative rate. Thus Sweden pioneered the use of the negative rate and set its corridor range from -0.25% to +0.25% with 0.0% as the policy target placed in the middle of the range. Thus NIRP was launched by Sweden as it tried to set the policy interest rate at zero and maintain the corridor at the same time.

At the moment that ZIRP was launched in Sweden, all interest rates were above zero. You can see that on the slide titled “Sweden introduces NIRP (07/02/2009). The slide shows the yield curves (technical word is term structures) of the interest rates on the highest-grade sovereign debt of seven major global currencies. The very shortest maturities are bunched in a one-quarter-point trading range between 0.25% and 0.50%. Note that on the same day the range of the longer-term interest rates (30-year bonds) was from over 2% in Japan to over 4% in four of the seven currencies, including the dollar in the United States Treasury market. The upward slope of the spread comparison is immediately visible.

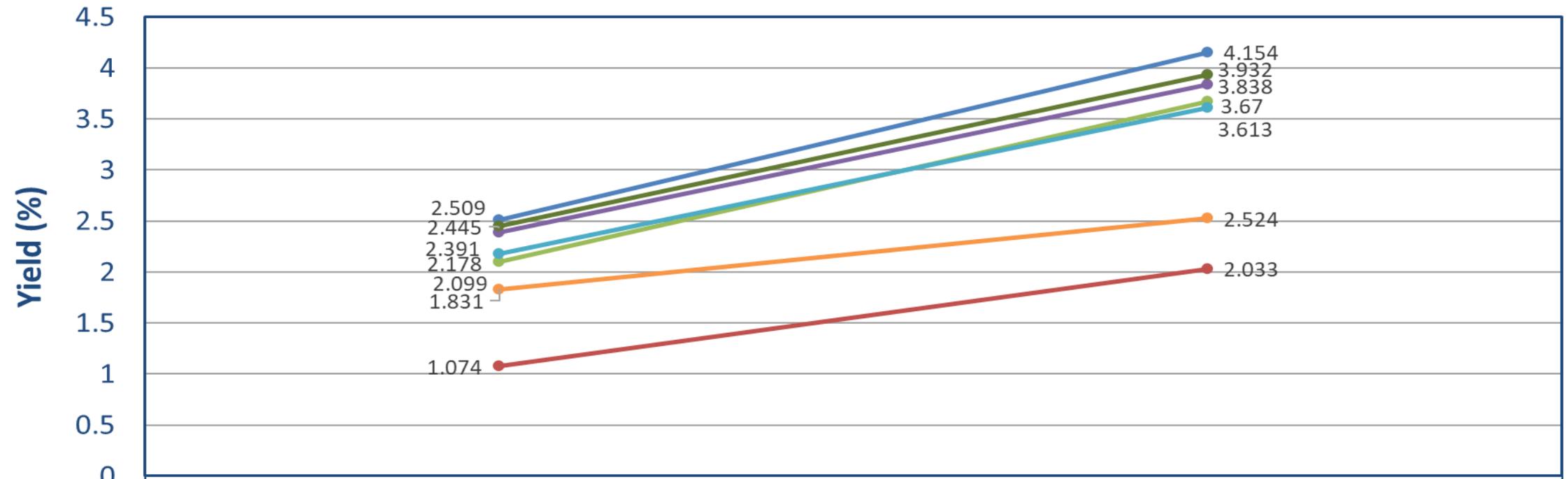


Sweden Introduces NIRP (07/02/2009)





Sweden Introduces NIRP (07/02/2009)



	Intermediate Spread (2 & 10YR)	Long Term Spread (3M & 30YR)
U.S. Treasury	2.509	4.154
JPY (Japan)	1.074	2.033
EUR (Germany)	2.099	3.67
SEK (Sweden)	2.391	3.838
CAD (Canada)	2.178	3.613
CHF (Switzerland)	1.831	2.524
GBP (Great Britain)	2.445	3.932

Spread Tenor



Draghi Gets Desperate, “Whatever it takes,” (07/26/2012)

This two-slide set is titled “Draghi Gets Desperate” for a reason. We are quoting his famous utterance which moved market prices worldwide at the time. Mario Draghi was the head of the European Central Bank when he offered this comment. The movement didn’t last long, and market forces quickly resumed the global adjustment processes using the mechanism we have described in this pamphlet.

Note how four of the shorter interest rates are bunched around zero. In the case of the euro-denominated benchmark German government notes, the interest rates out to three year’s maturity are below zero on this date.

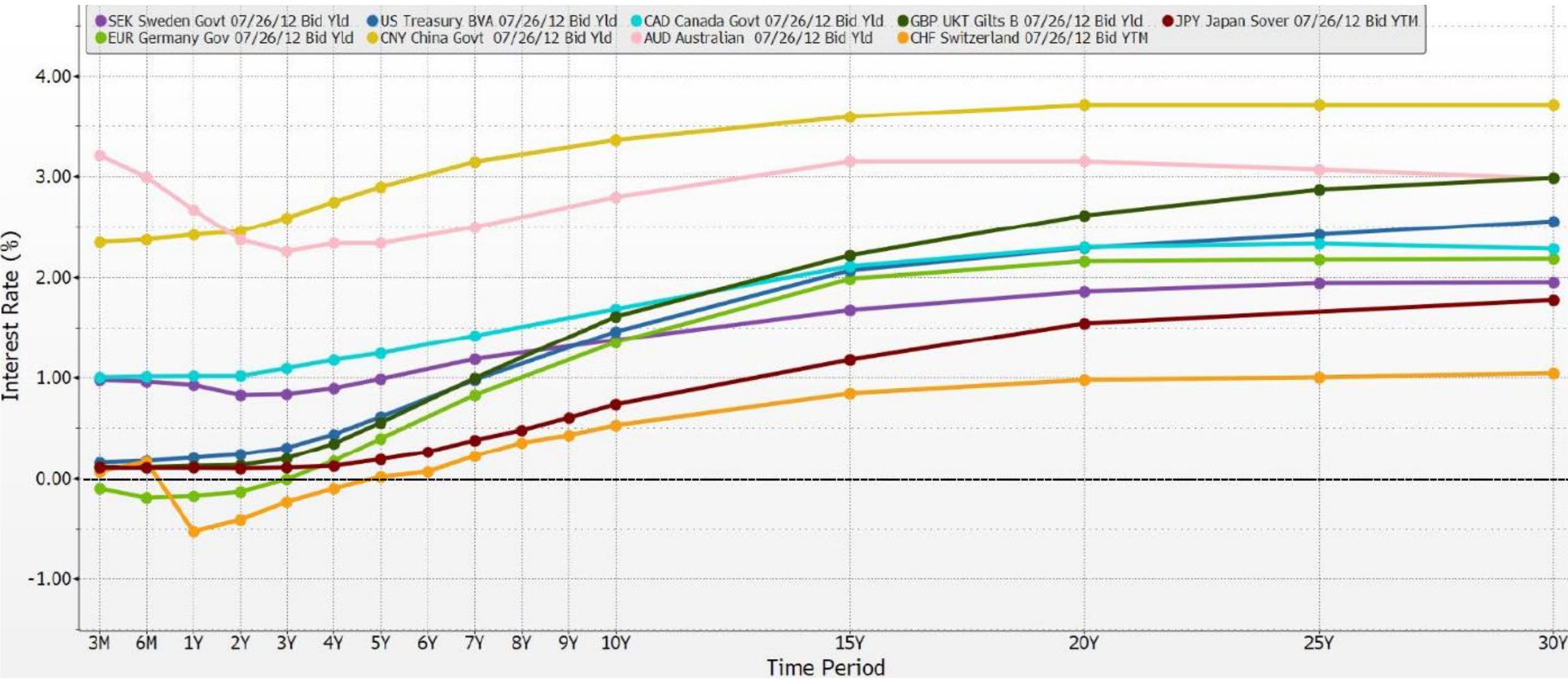
Also note how all the longer-term interest rates are below 4%. Excluding China’s, all of the longer-term rates shown are at 3% or lower. Comparing the package of data on the Draghi series with the Sweden series, we can easily see how dramatically lower all interest rates have become and how the term structures have changed over the three years. The development of alignment is visible, as is the parallelism of the term structures’ slopes.

Please note that the upward slopes of all the term structures on both dates are still intact, with one exception: Switzerland’s. The term structures are all flatter except for Switzerland’s.

Switzerland was now reacting to inflows of money into the Swiss franc and was changing its monetary policy by forcing negative interest rates lower and lower. Switzerland was trying to avoid floating the currency while the euro was changing price due to the ECB’s negative interest rate policy. Note how the Swiss rate is negative out to five years in the term structure. This policy created the remarkably inconsistent spread comparison that we see in the graphic. Market agents could and did seize this opportunity with a “one-way” trading bet that Switzerland would have to change policy. As we will see, they did.

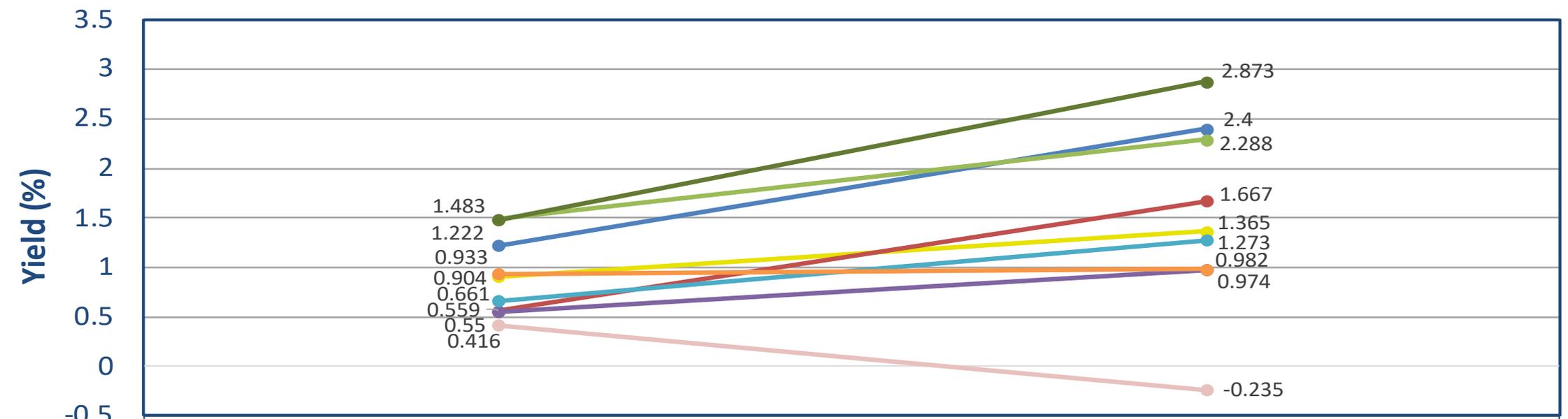


Draghi Gets Desperate, "Whatever it takes," (07/26/2012)





Draghi Gets Desperate (07/26/2012)



- U.S. Treasury
- CNY (China)
- JPY (Japan)
- EUR (Germany)
- SEK (Sweden)
- CAD (Canada)
- AUD (Australia)
- CHF (Switzerland)
- GBP (Great Britain)

	Intermediate Spread (2 & 10YR)	Long Term Spread (3M & 30YR)
U.S. Treasury	1.222	2.4
CNY (China)	0.904	1.365
JPY (Japan)	0.559	1.667
EUR (Germany)	1.483	2.288
SEK (Sweden)	0.55	0.974
CAD (Canada)	0.661	1.273
AUD (Australia)	0.416	-0.235
CHF (Switzerland)	0.933	0.982
GBP (Great Britain)	1.48	2.873

Spread Tenor



Day After Brexit Vote (06/24/2016)

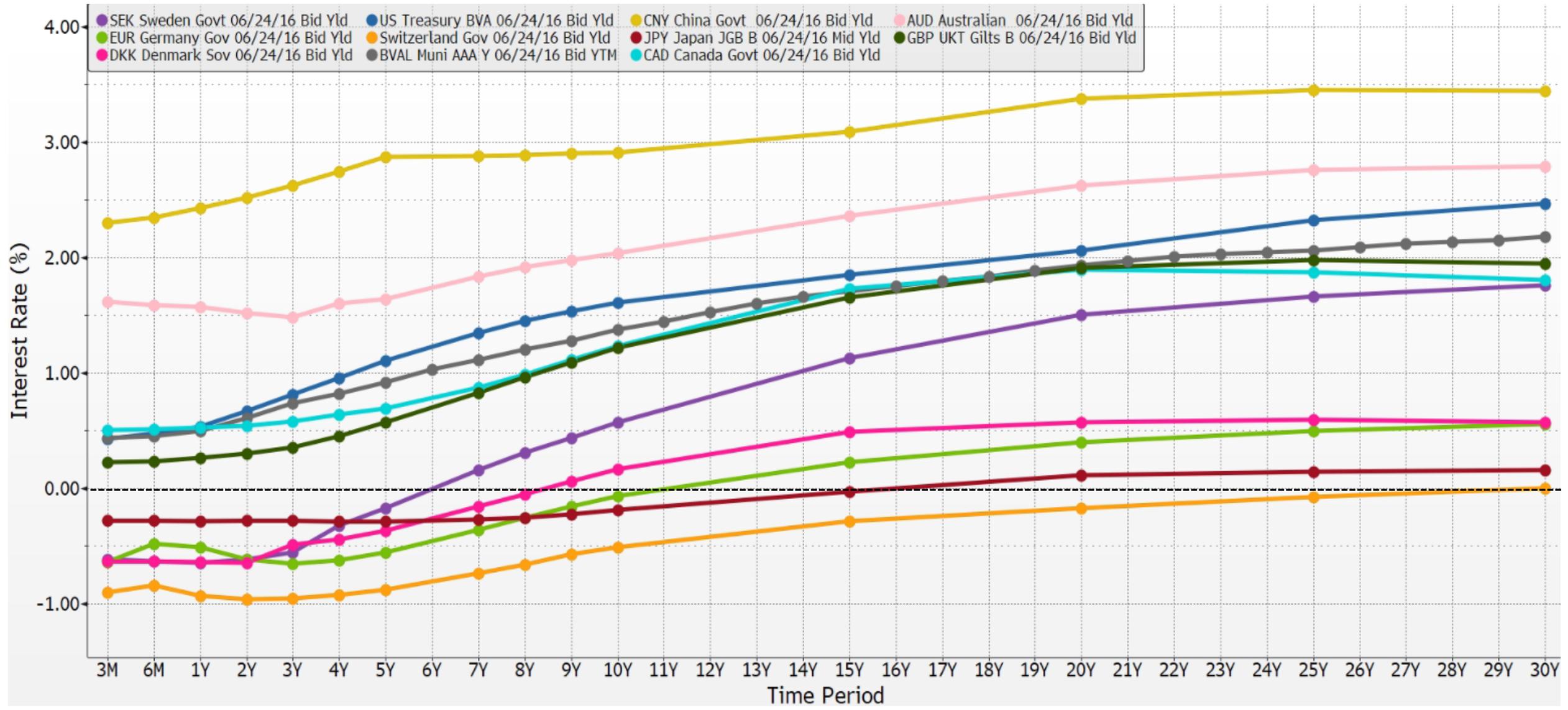
The history-making outcome of the Brexit referendum in the United Kingdom shocked the world. Markets reacted violently to Britain's withdrawal from the European Union. Notice that the yield curve parallel structures hold when we examine these curves using the method of two spreads.

Further notice how Switzerland is back in alignment as market-based forces force a change in the Swiss central bank's policy. Four currencies have short-term policy rates below zero. The 30-year Swiss government bond is now at a zero interest rate. Even China's longest-term bond is now below 4%.

Brexit shocked the markets, and market agents were quick to seize this trading opportunity. Thus alignment was restored very quickly back into the form we have described. The two-spread comparison shows how tightly the intermediate spread is bunched. The longer spread is continuing to tighten into a bunch as market forces pressure these yield curves into parallel alignment.

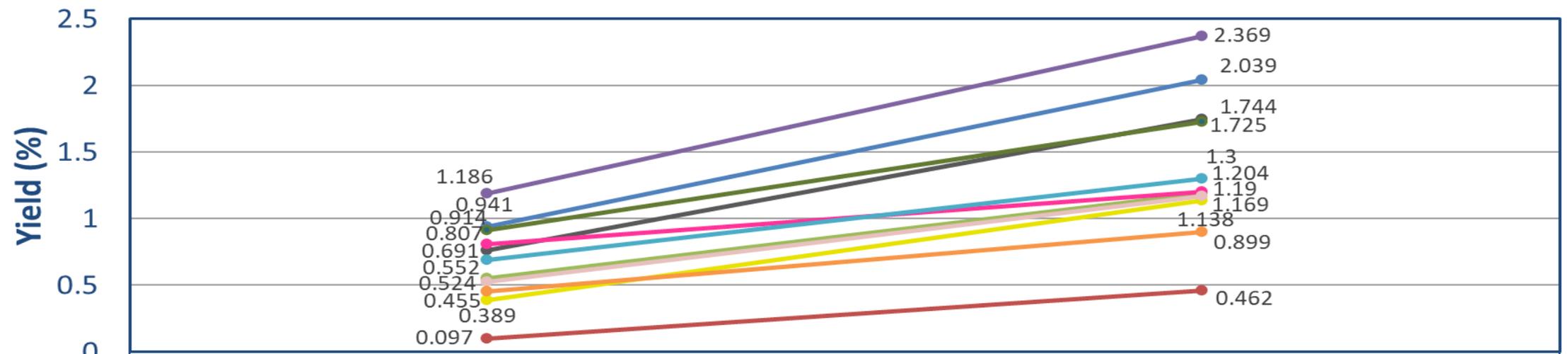


Day After Brexit Vote (06/24/2016)





Day After Brexit Vote (06/24/2016)



	Intermediate Spread (2 & 10YR)	Long Term Spread (3M & 30YR)
U.S. Treasury	0.941	2.039
U.S. AAA MUNI	0.762	1.744
CNY (China)	0.389	1.138
JPY (Japan)	0.097	0.462
EUR (Germany)	0.552	1.19
DKK (Denmark)	0.807	1.204
SEK (Sweden)	1.186	2.369
CAD (Canada)	0.691	1.3
AUD (Australia)	0.524	1.169
CHF (Switzerland)	0.455	0.899
GBP (Great Britain)	0.914	1.725

Spread Tenor



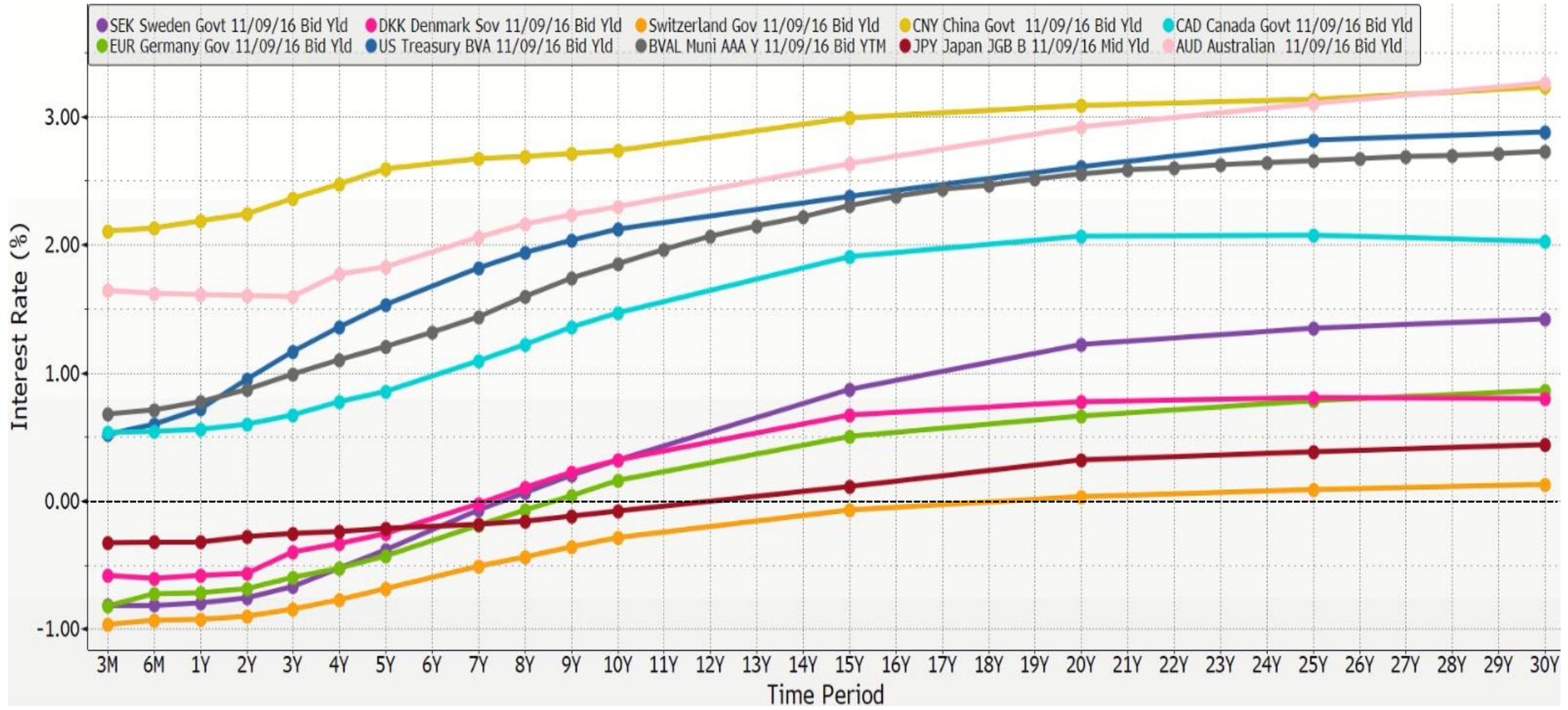
Day After Trump Elected (11/09/2016)

The 2016 election of Donald Trump was another surprise that shocked the global financial world. However, market agents' forces again quickly took advantage of trading opportunities and restored any misalignment.

At this point, five currencies are now trading below zero. Nearly all longer-term bonds are below 3%. The parallel term structure using the two-spread analysis is intact. The bunching continues.

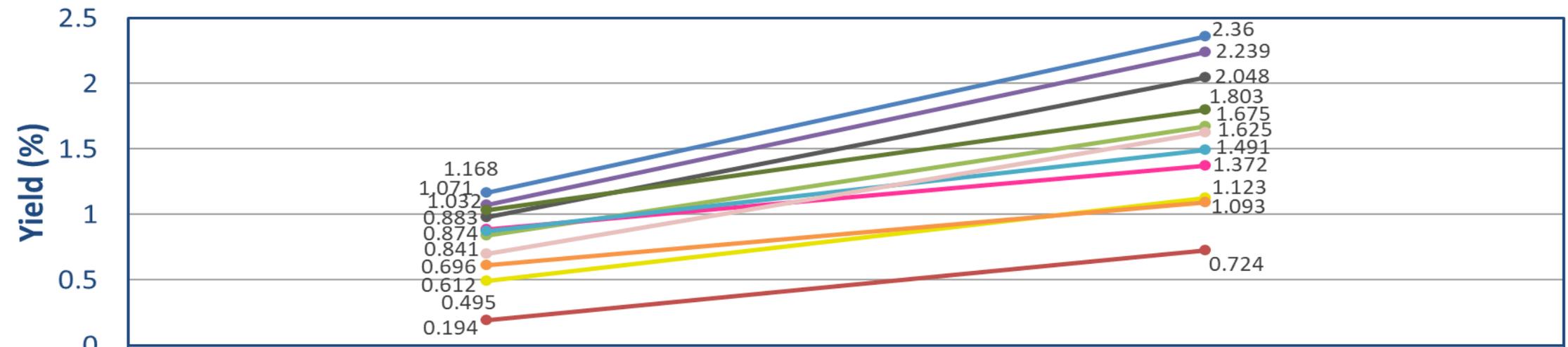


Day After Trump Elected (11/09/2016)





Day After Trump Elected (11/09/2016)



	Intermediate Spread (2 & 10YR)	Long Term Spread (3M & 30YR)
U.S. Treasury	1.168	2.36
U.S. AAA MUNI	0.981	2.048
CNY (China)	0.495	1.123
JPY (Japan)	0.194	0.724
EUR (Germany)	0.841	1.675
DKK (Denmark)	0.883	1.372
SEK (Sweden)	1.071	2.239
CAD (Canada)	0.874	1.491
AUD (Australia)	0.696	1.625
CHF (Switzerland)	0.612	1.093
GBP (Great Britain)	1.032	1.803

Spread Tenor



Sweden Lows (11/17/2017)

Here's the extreme in market-based pricing and policy responses to a central bank. The actual policy-driven interest rate in Sweden has fallen below a negative 1%. Yield curves worldwide are now very parallel in shape. Market agents have been using this swaps technique for years and are very good at it. The largest G-SIB banks are facilitators, and the fee income from accommodating these market agents is a considerable sum. We can examine the notes on the financial reporting statements of those banks to see the amounts of derivative notional exposures. With a time lag for data accumulation, we can see the growing outstanding balance of derivatives from the reporting of the Bank for International Settlements (BIS).

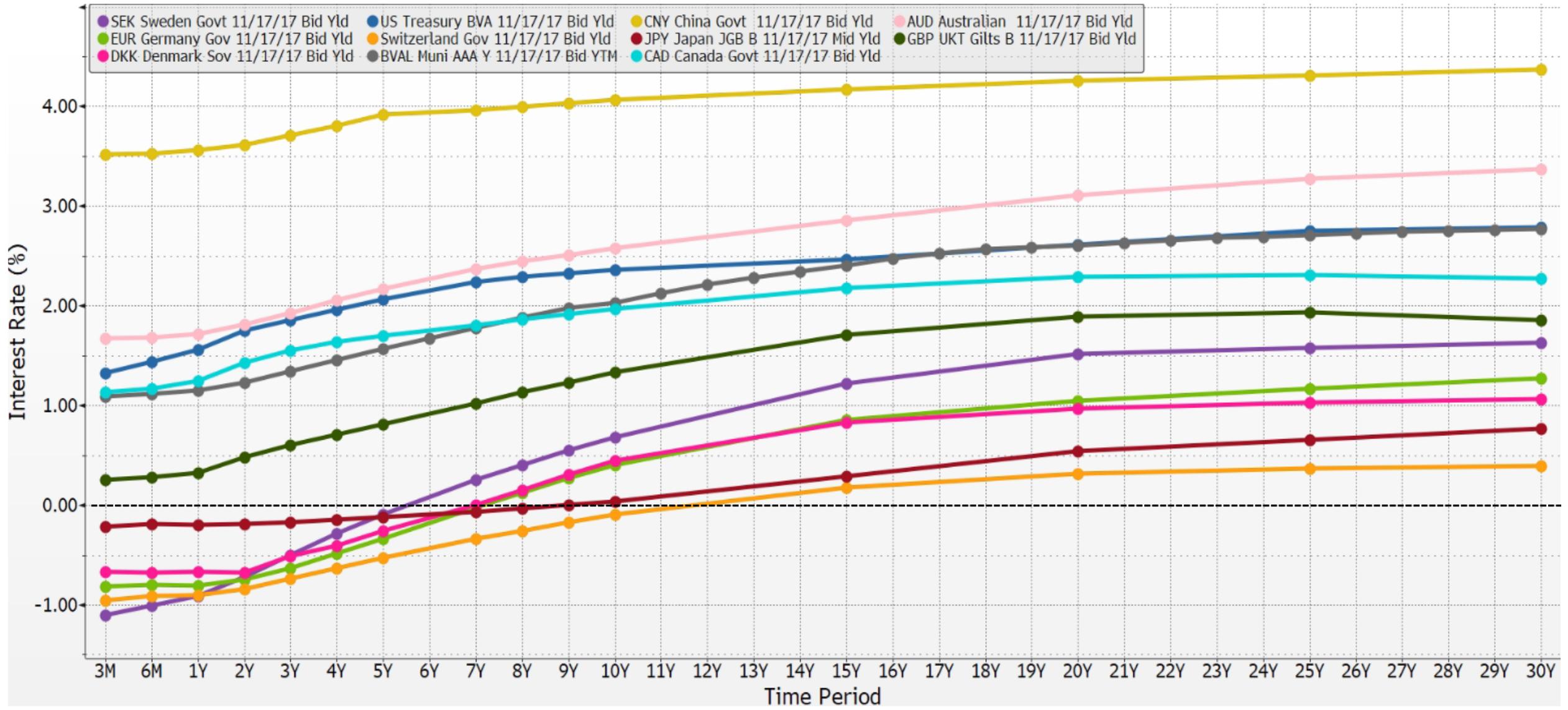
Readers can see that we have incorporated the AAA U.S. municipal bond curve into this slide set. At this point the muni bond curve is very much influenced by these forces that are driven by multinational jurisdictions. American investors tend to ignore foreign forces' influence on the setting of municipal bond prices in the United States. That's a mistake. A large component of global bond investors realize that sovereign debt of American states and some local governments offers nearly the same credit quality as some international sovereign debt. In a few cases the American state's credit rating is higher than the foreign country's rating.

Those foreign investors also watch the spread between taxable Treasury yields and tax-free yields of very-high-credit-quality munis. They know that when tax-free yields are higher than taxable yields are, it is only a matter of time before the market will adjust. Thus the "crossover buyer" is a serious player in the American municipal bond markets. We see that buyer become active when tax-free yields are higher than taxable yields are, as they are at time of the writing of this pamphlet.

The graphics depict this relationship, and that is why we have added munis to the series. It is very hard to find public evidence of the use of cross-currency interest rate swaps in transactions affecting municipal bonds. We know of anecdotes. We know they are used. The collection of data on this subject of the influence of the crossover bond buyer merits a future research project.

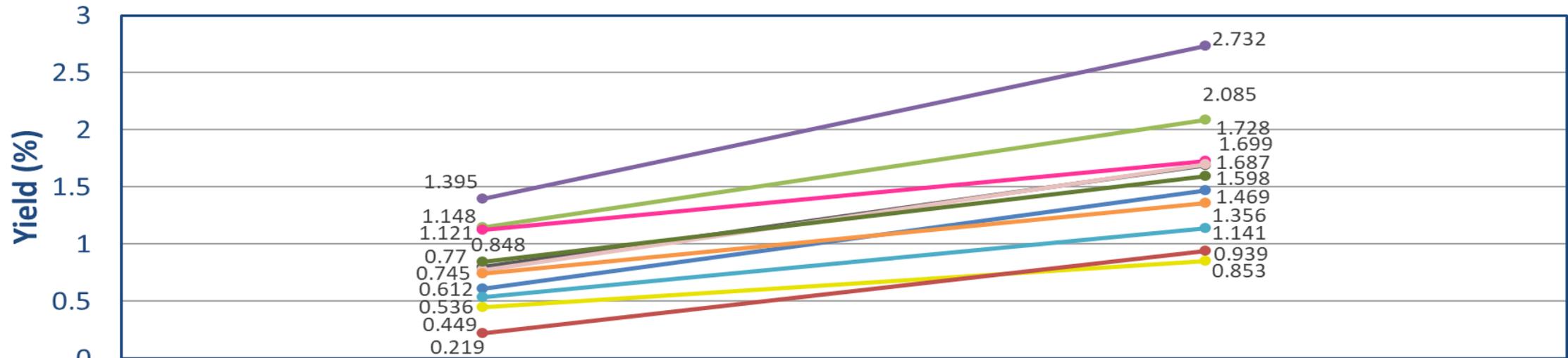


Sweden Lows (11/17/2017)





Sweden Lows (11/17/2017)



U.S. Treasury	0.612	1.469
U.S. AAA MUNI	0.803	1.687
CNY (China)	0.449	0.853
JPY (Japan)	0.219	0.939
EUR (Germany)	1.148	2.085
DKK (Denmark)	1.121	1.728
SEK (Sweden)	1.395	2.732
CAD (Canada)	0.536	1.141
AUD (Australia)	0.77	1.699
CHF (Switzerland)	0.745	1.356
GBP (Great Britain)	0.848	1.598

Intermediate Spread (2 & 10YR)

Long Term Spread (3M & 30YR)

Spread Tenor

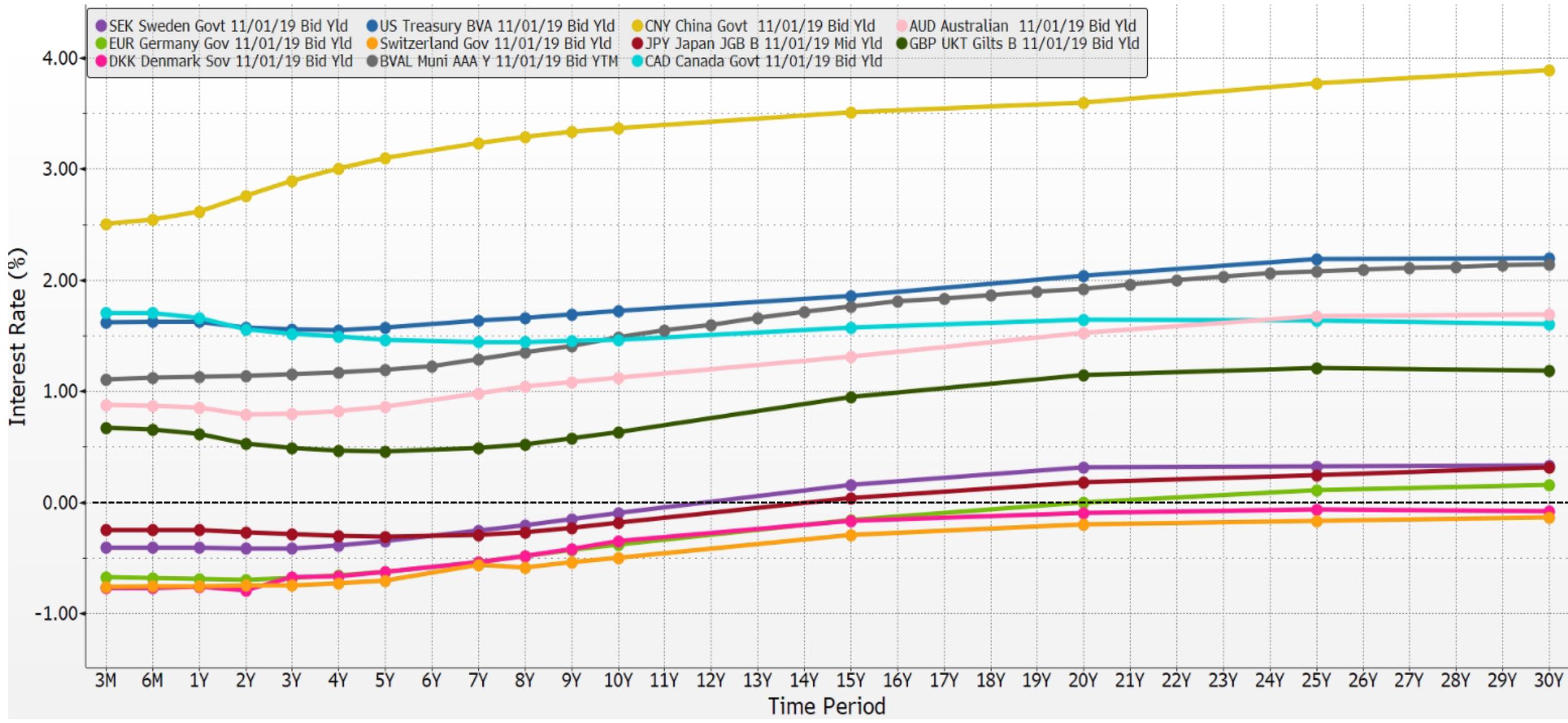


Draghi Retires (11/01/2019)

By this date, the negative interest rates in the short-term are no longer below minus 1%. Four currencies still support a negative interest rate policy. Switzerland is the lowest but is aligned very closely to the benchmark euro-denominated debt of Germany. All curves remain in the parallel configuration. The bunching is tighter, as we would expect. Worldwide use of the derivative-based techniques is quite widespread. The Bank for International Settlements (BIS) is reporting derivative notional amounts regularly, and the estimates are in the many hundreds of trillions of dollars.

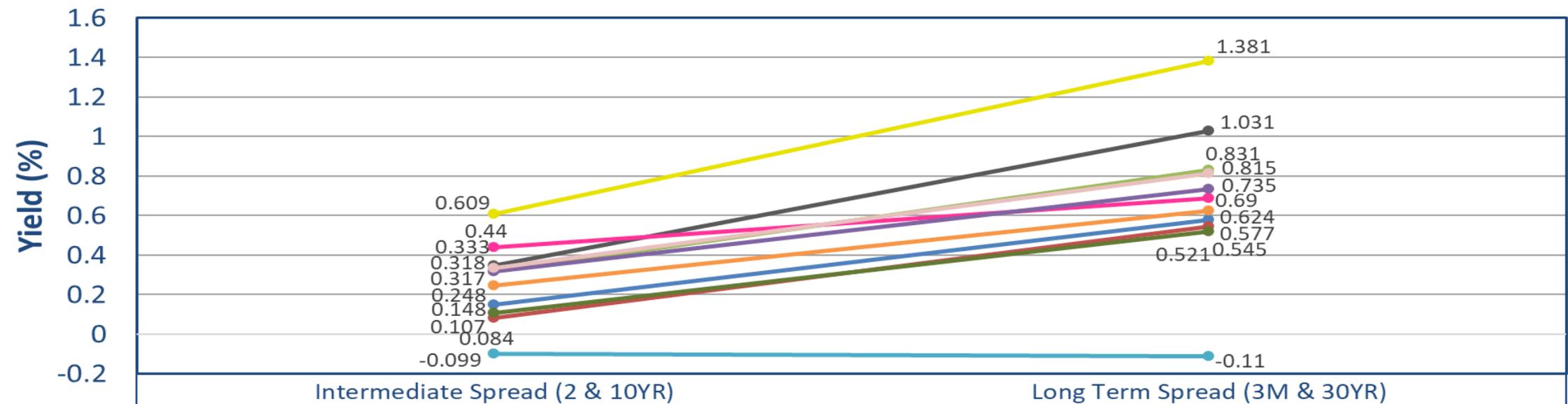


Draghi Retires (11/01/2019)





Draghi Retires (11/01/2019)



	Intermediate Spread (2 & 10YR)	Long Term Spread (3M & 30YR)
U.S. Treasury	0.148	0.577
U.S. AAA MUNI	0.346	1.031
CNY (China)	0.609	1.381
JPY (Japan)	0.084	0.545
EUR (Germany)	0.318	0.831
DKK (Denmark)	0.44	0.69
SEK (Sweden)	0.317	0.735
CAD (Canada)	-0.099	-0.11
AUD (Australia)	0.333	0.815
CHF (Switzerland)	0.248	0.624
GBP (Great Britain)	0.107	0.521

Spread Tenor



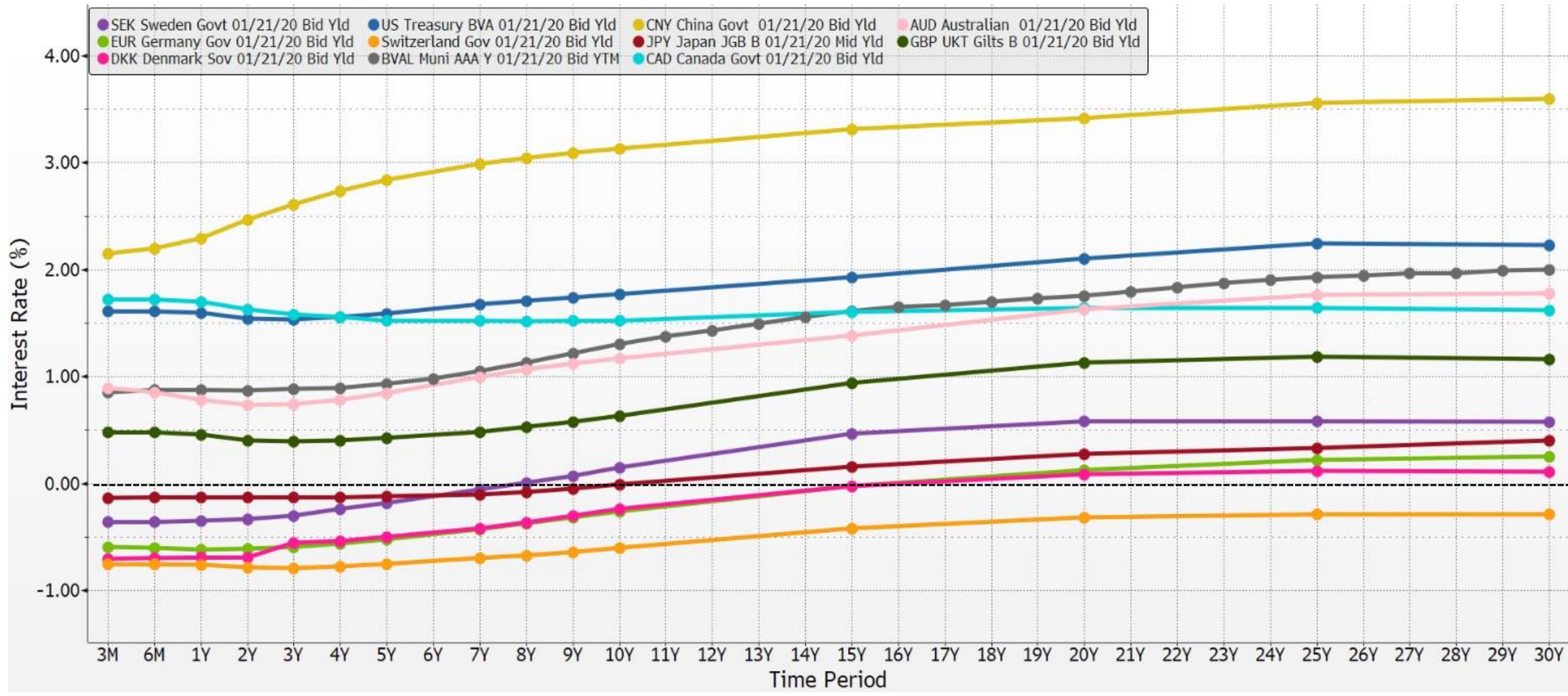
Two Days After First U.S. Case of COVID-19 in Snohomish County, Washington (01/21/2020)

The Covid shock was extraordinary in so many ways. It triggered a worldwide recession. Markets reacted violently. All financial markets faced turmoil.

In the global sovereign debt markets of the major countries, Covid caused the bunching to tighten. Market agents had many years of practicing using derivatives for the adjustment process. Note how all yield curves are very nearly parallel except for China's. Notice how tight the U.S. Treasury–muni spread is. Also notice how the Canadian spread comparison has become completely flat. As Switzerland was in the early part of the series, Canada is now the outlier. Market forces will quickly take advantage of this shock, as will be depicted in the next few slides.

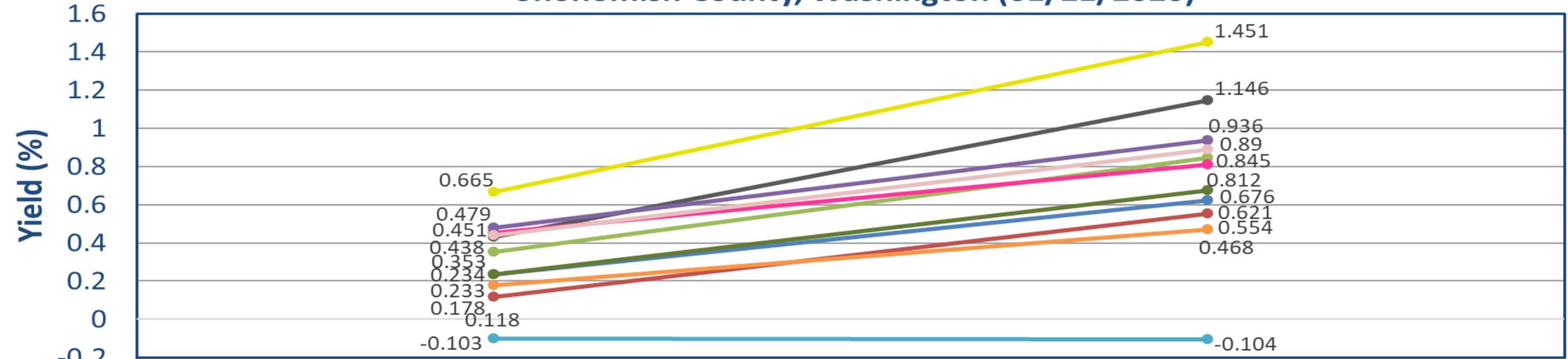


Two Days After First U.S. Case of COVID-19 in Snohomish County, Washington (01/21/2020)





Two Days After First U.S. Case of COVID-19 in Snohomish County, Washington (01/21/2020)



	Intermediate Spread (2 & 10YR)	Long Term Spread (3M & 30YR)
U.S. Treasury	0.233	0.621
U.S. AAA MUNI	0.43	1.146
CNY (China)	0.665	1.451
JPY (Japan)	0.118	0.554
EUR (Germany)	0.353	0.845
DKK (Denmark)	0.451	0.812
SEK (Sweden)	0.479	0.936
CAD (Canada)	-0.103	-0.104
AUD (Australia)	0.438	0.89
CHF (Switzerland)	0.178	0.468
GBP (Great Britain)	0.234	0.676

Spread Tenor

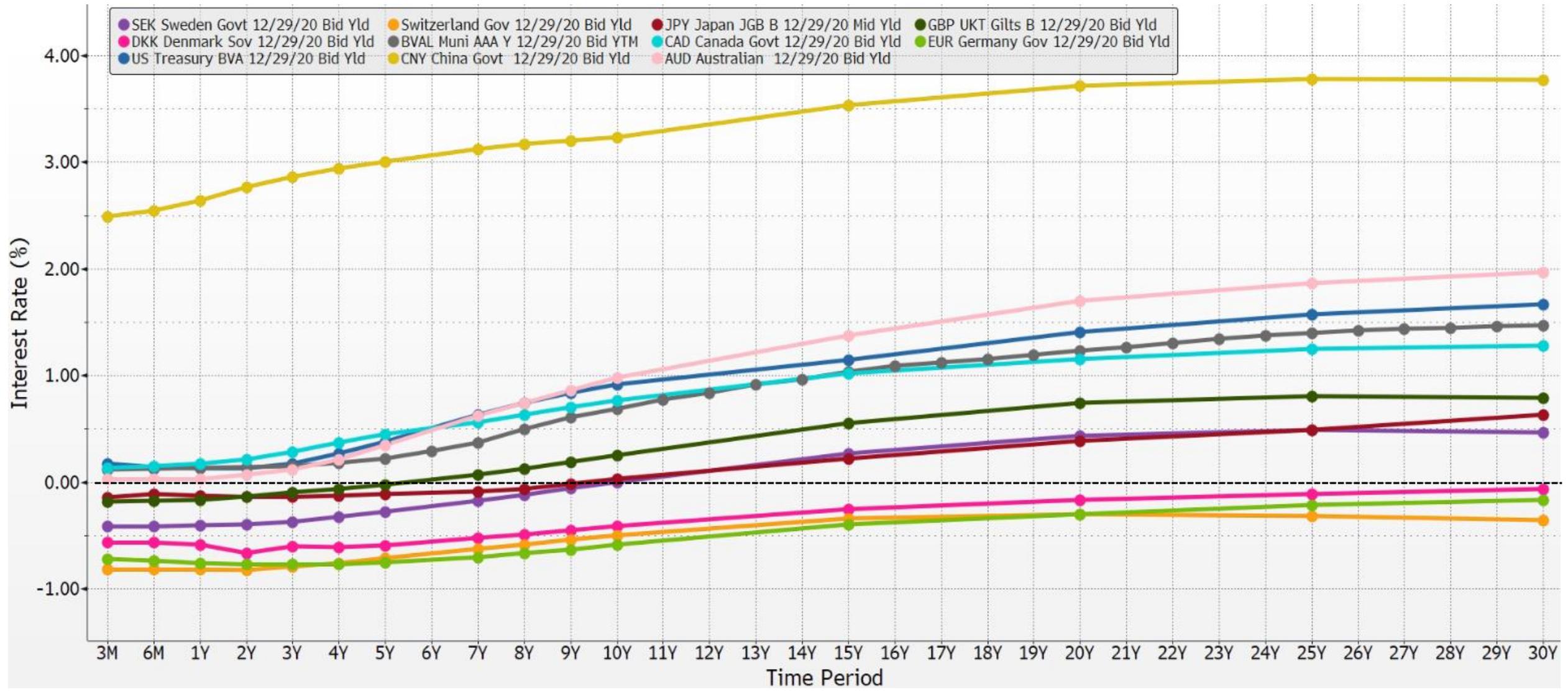


One Full Trading Day After Brexit Deal Announced (12/29/2020)

The news of the long-awaited Brexit deal was anticipated by markets, as the negotiations had been in the headlines preceding the official announcement. Yield curves had already adjusted. Note how the Canadian outlier in the previous slide pairing has been resolved. Also note that all yield curves remain parallel using the two-spread analysis. China remains apart from the rest of the currencies depicted. The bunching in the 2-year–10-year spread is so tight that the entire array is bunched under 100 basis points.

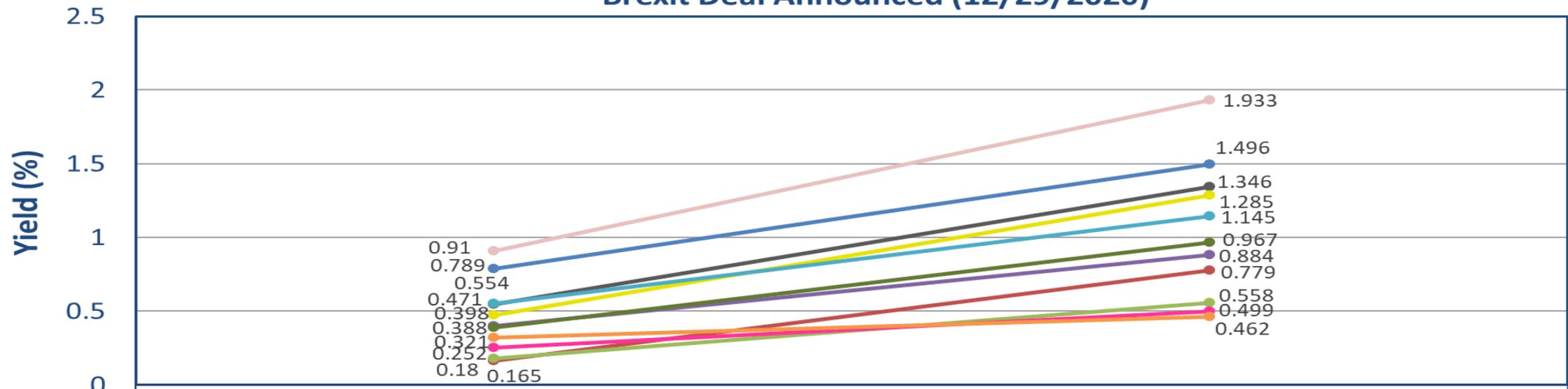


One Full Trading Day After Brexit Deal Announced (12/29/2020)





One Full Trading Day After Brexit Deal Announced (12/29/2020)



	Intermediate Spread (2 & 10YR)	Long Term Spread (3M & 30YR)
U.S. Treasury	0.789	1.496
U.S. AAA MUNI	0.548	1.346
CNY (China)	0.471	1.285
JPY (Japan)	0.165	0.779
EUR (Germany)	0.18	0.558
DKK (Denmark)	0.252	0.499
SEK (Sweden)	0.398	0.884
CAD (Canada)	0.554	1.145
AUD (Australia)	0.91	1.933
CHF (Switzerland)	0.321	0.462
GBP (Great Britain)	0.388	0.967

Spread Tenor

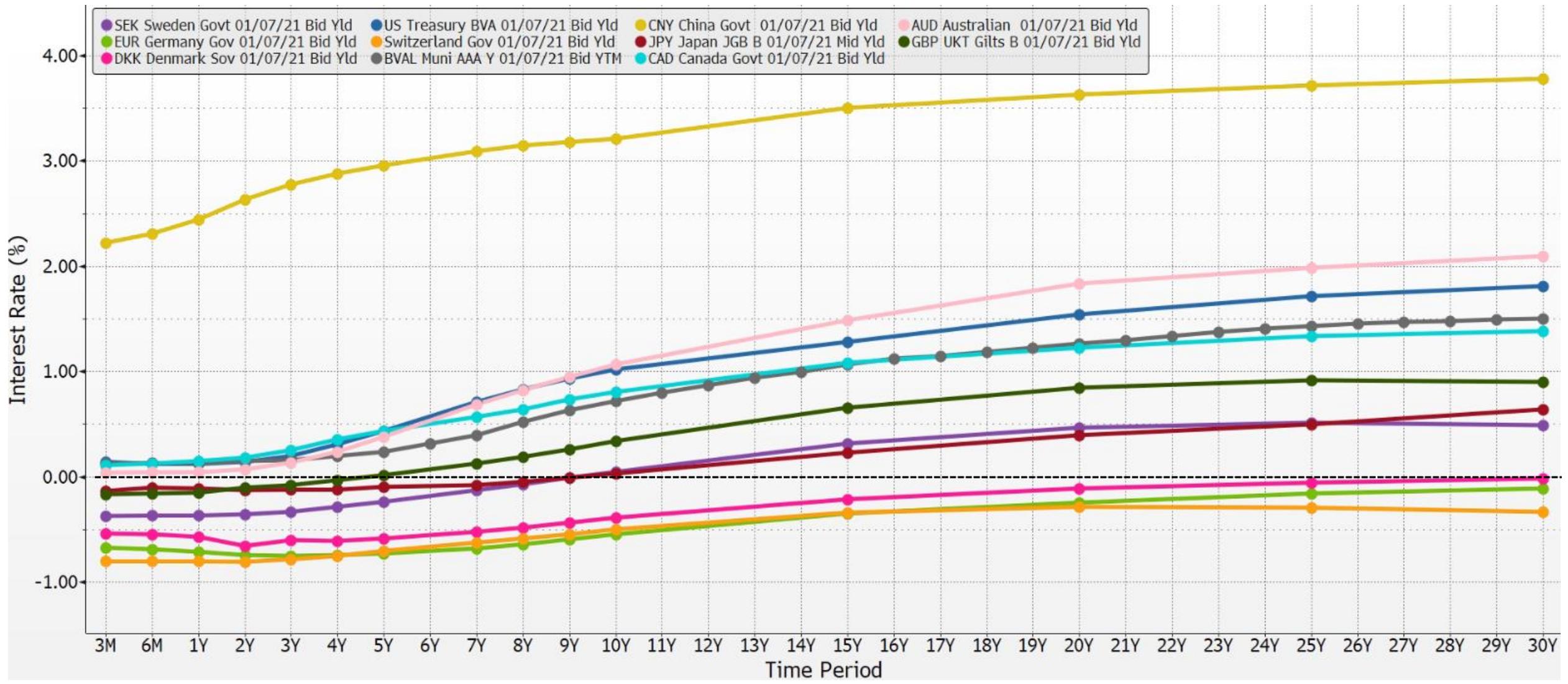


One Full Trading Day After Democrat Senate Majority Established by Georgia Run-off Elections (01/07/2021)

With the exception of China's yield curve, the parallel nature of the yield curves is nearly a perfect alignment. Bunching in the intermediate spread is about 80 basis points. Six currencies are in negative rate territory.

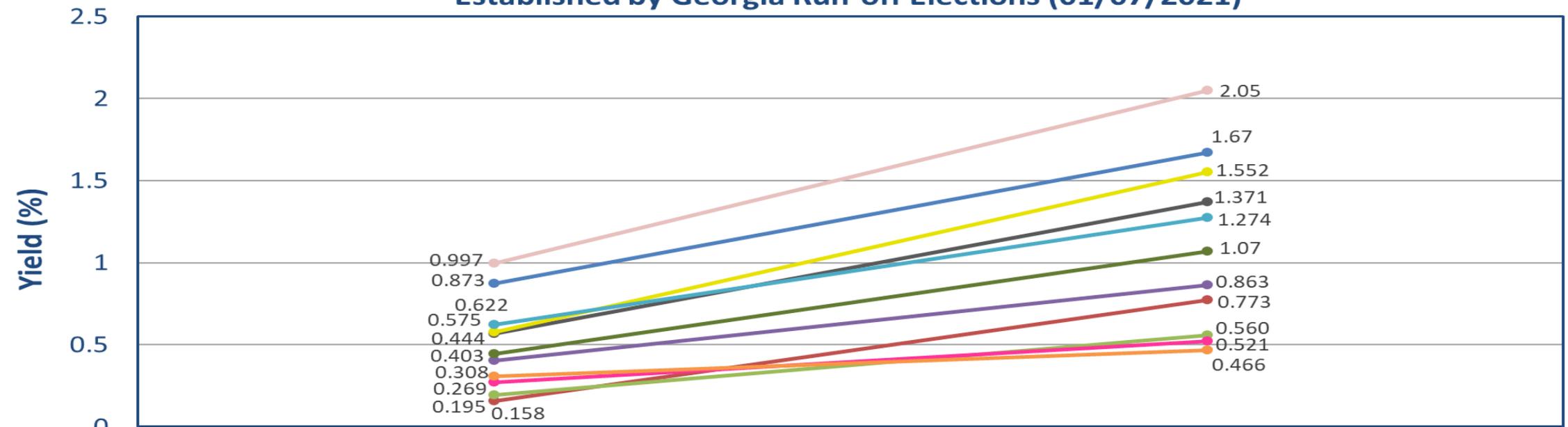


One Full Trading Day After Democrat Senate Majority Established by Georgia Run-off Elections (01/07/2021)





One Full Trading Day After Democrat Senate Majority Established by Georgia Run-off Elections (01/07/2021)



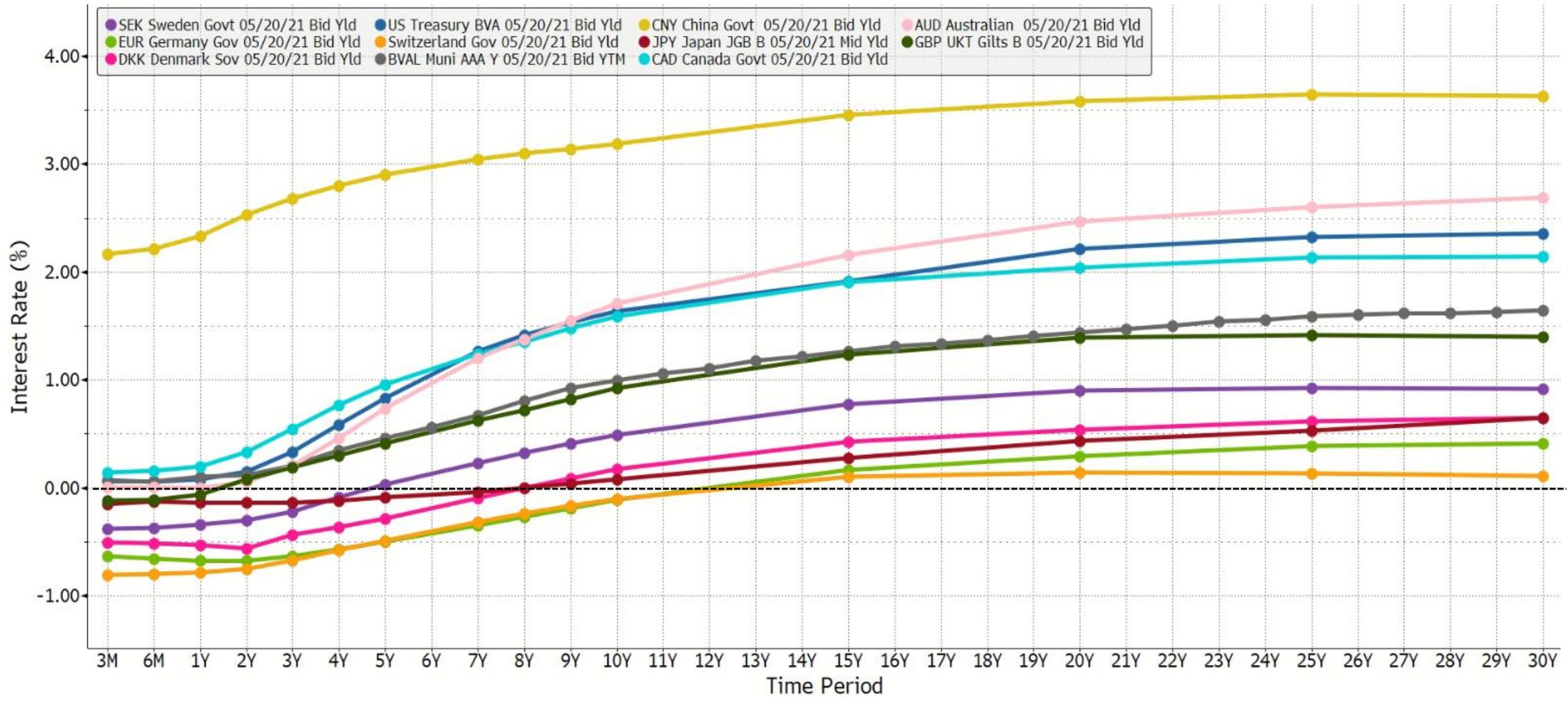
	Intermediate Spread (2 & 10YR)	Long Term Spread (3M & 30YR)
U.S. Treasury	0.873	1.67
U.S. AAA MUNI	0.566	1.371
CNY (China)	0.575	1.552
JPY (Japan)	0.158	0.773
EUR (Germany)	0.444	1.07
DKK (Denmark)	0.269	0.521
SEK (Sweden)	0.403	0.863
CAD (Canada)	0.622	1.274
AUD (Australia)	0.997	2.05
CHF (Switzerland)	0.308	0.466
GBP (Great Britain)	0.195	0.560

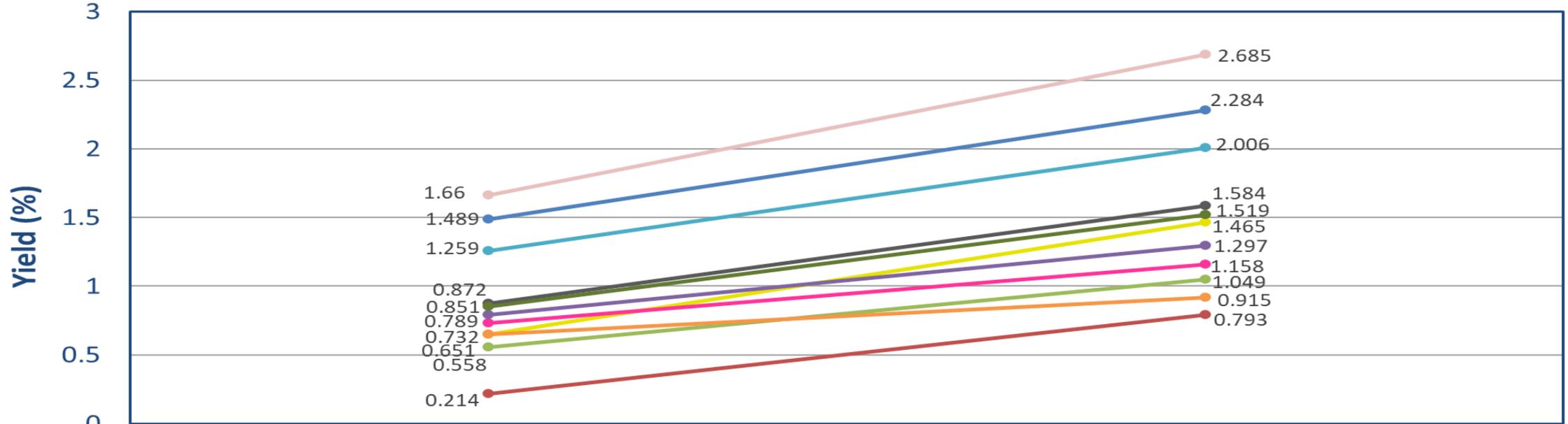
Spread Tenor



Interim Date (05/20/2021)

As of May 2020, markets are beginning the adjustment after the Covid shock. Central banks have responded with extraordinary Covid-related policies, and those policies are showing results of the extraordinary stimulus that has been applied. Fiscal policies have been hugely expanded in many jurisdictions. The financial world is accepting that Covid will be painful but will not be the cause of a worldwide depression. Note that inflation is not on the radar screens of many jurisdictions at this time, nor is it a headline subject. Russian preparations for a war on Ukraine haven't started yet or are not yet visible. Yield curves are still parallel. Bunching is just beginning to loosen.





- U.S. Treasury
- U.S. AAA MUNI
- CNY (China)
- JPY (Japan)
- EUR (Germany)
- DKK (Denmark)
- SEK (Sweden)
- CAD (Canada)
- AUD (Australia)
- CHF (Switzerland)
- GBP (Great Britain)

	Intermediate Spread (2 & 10YR)	Long Term Spread (3M & 30YR)
U.S. Treasury	1.489	2.284
U.S. AAA MUNI	0.872	1.584
CNY (China)	0.651	1.465
JPY (Japan)	0.214	0.793
EUR (Germany)	0.558	1.049
DKK (Denmark)	0.732	1.158
SEK (Sweden)	0.789	1.297
CAD (Canada)	1.259	2.006
AUD (Australia)	1.66	2.685
CHF (Switzerland)	0.649	0.915
GBP (Great Britain)	0.851	1.519

Spread Tenor

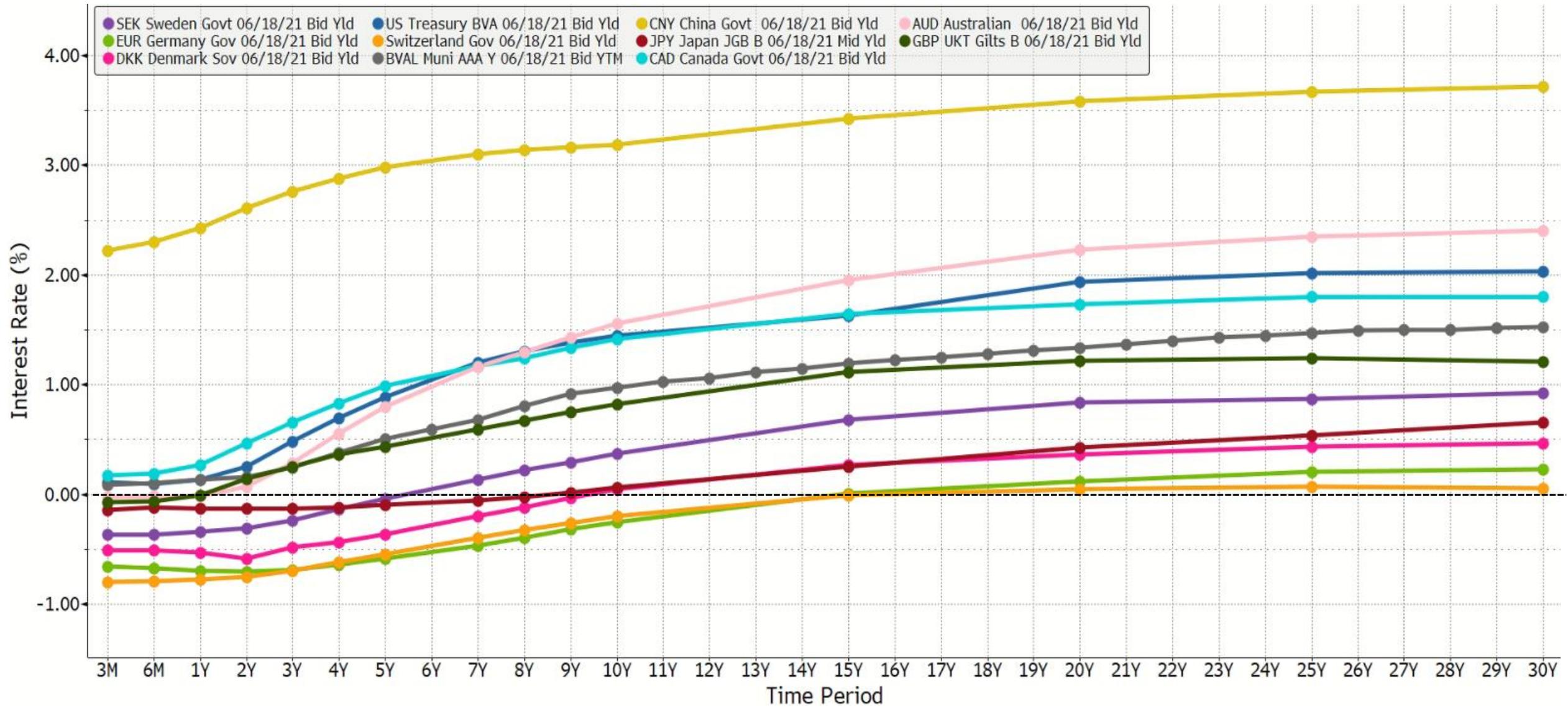


Before Delta Variant Surge (06/18/2021)

Covid adjustment in financial terms has continued through this date. In many jurisdictions Covid restrictions have been relaxed. Covid fatigue is spreading, and Covid infection mitigation efforts seem harder to achieve in many places. All yield curves remain parallel. Bunching in the very short end continues, and the intermediate spreads show it clearly. The coming Delta variant surge is not contemplated to be as deadly as it would subsequently become. That assumption doesn't last long.

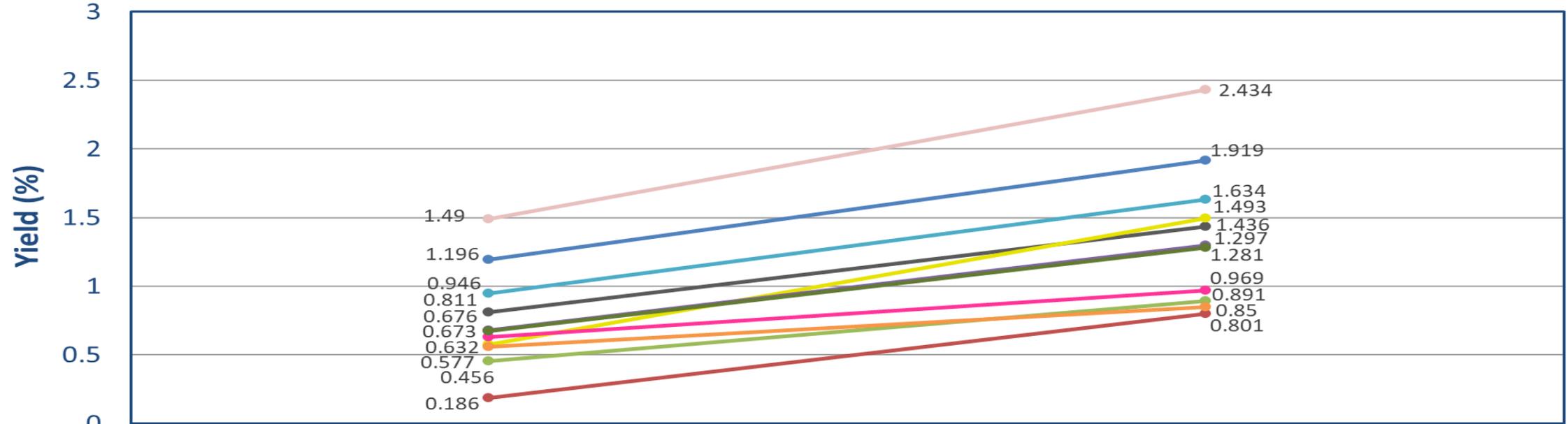


Before Delta Variant Surge (06/18/2021)





Before Delta Variant Surge (06/18/2021)



	Intermediate Spread (2 & 10YR)	Long Term Spread (3M & 30YR)
U.S. Treasury	1.196	1.919
U.S. AAA MUNI	0.811	1.436
CNY (China)	0.577	1.493
JPY (Japan)	0.186	0.801
EUR (Germany)	0.456	0.891
DKK (Denmark)	0.632	0.969
SEK (Sweden)	0.676	1.297
CAD (Canada)	0.946	1.634
AUD (Australia)	1.49	2.434
CHF (Switzerland)	0.556	0.85
GBP (Great Britain)	0.673	1.281

Spread Tenor

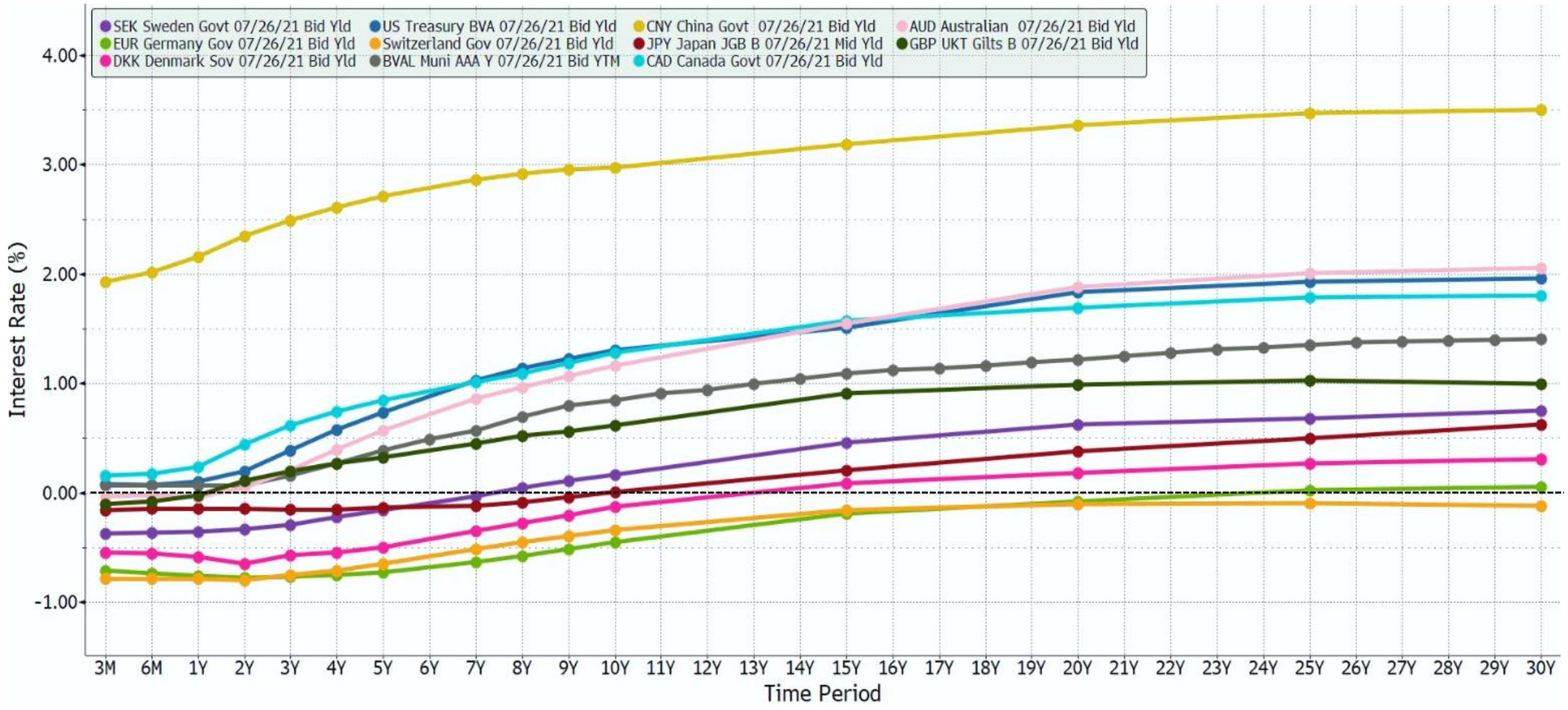


Delta Variant Surges (07/26/2021)

The Delta variant starts to rage worldwide and especially in the United States, where mitigation fatigue and various governmental failures have exposed much of the population. Delta is more often fatal and surprises market agents and the general populace. The rest of world is experiencing its version of this variant, with adverse impacts. Recession fears rise. All central banks' efforts and all fiscal initiatives have already reached nearly all their stimulative value. Central banks can do more, but the additional increment doesn't have much impact. Note how many currencies are in negative rate territory again. Note how parallel the yield curves are. Note that the peak in negative interest rate debt in the world is above \$18 trillion.

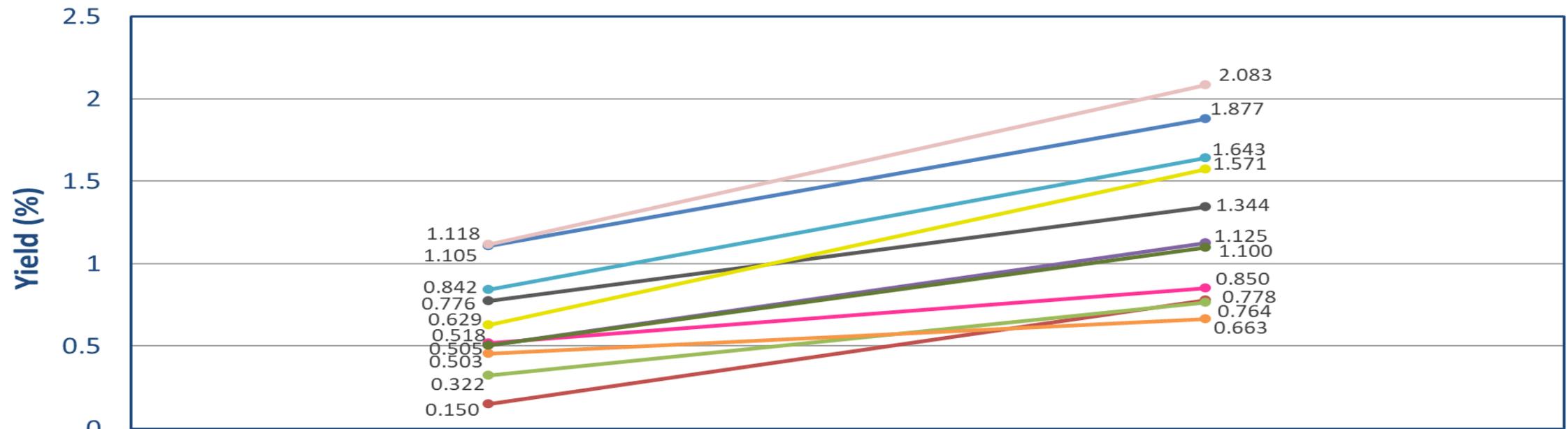


Delta Variant Surges (07/26/2021)





Delta Variant Surges (07/26/2021)



- U.S. Treasury
- U.S. AAA MUNI
- CNY (China)
- JPY (Japan)
- EUR (Germany)
- DKK (Denmark)
- SEK (Sweden)
- CAD (Canada)
- AUD (Australia)
- CHF (Switzerland)
- GBP (Great Britain)

	Intermediate Spread (2 & 10YR)	Long Term Spread (3M & 30YR)
U.S. Treasury	1.105	1.877
U.S. AAA MUNI	0.776	1.344
CNY (China)	0.629	1.571
JPY (Japan)	0.150	0.778
EUR (Germany)	0.322	0.764
DKK (Denmark)	0.518	0.850
SEK (Sweden)	0.503	1.125
CAD (Canada)	0.842	1.643
AUD (Australia)	1.118	2.083
CHF (Switzerland)	0.456	0.663
GBP (Great Britain)	0.505	1.100

Spread Tenor

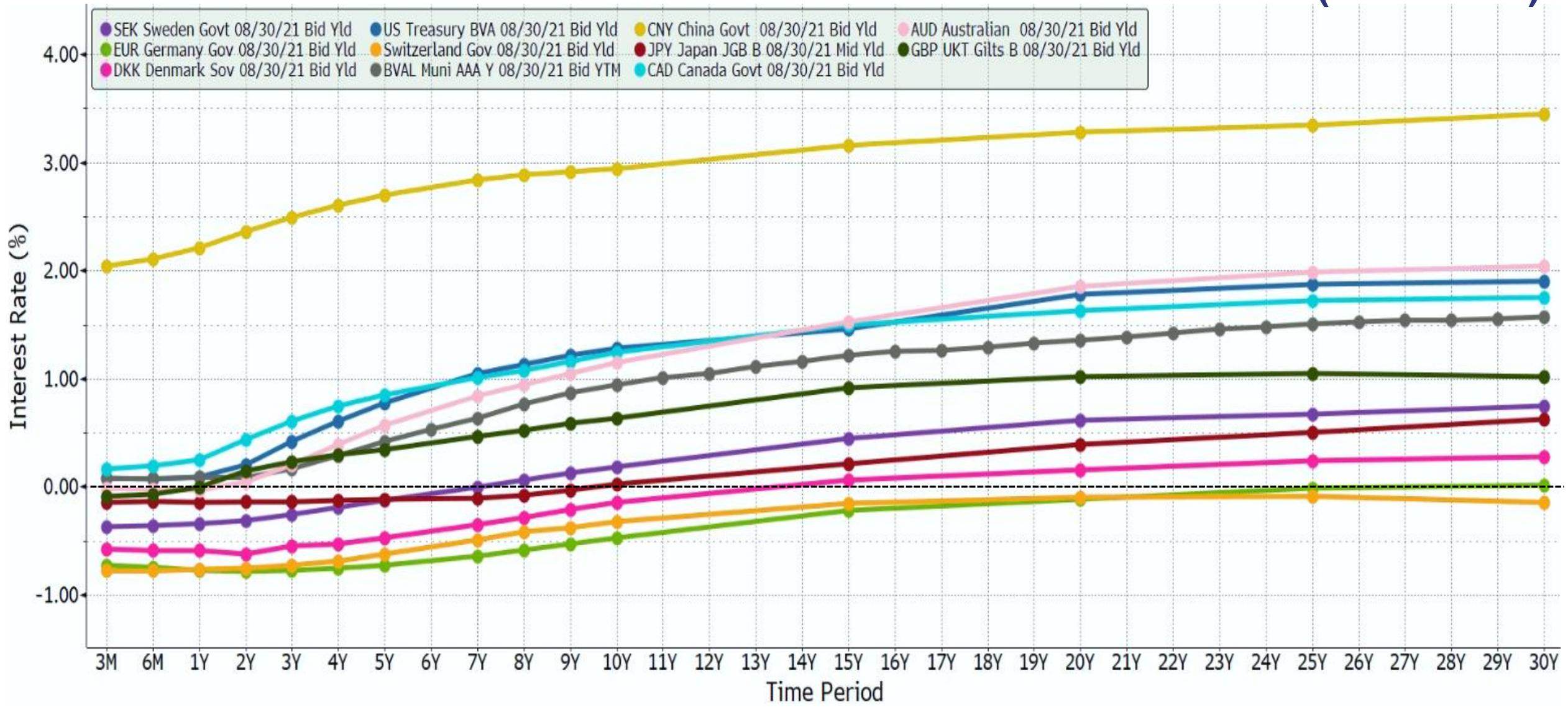


After ECB Minutes & Fed Jackson Hole Meeting (08/30/2021)

Markets are speculating about any forthcoming policy changes. Inflation statistics are still calm, but warnings about forthcoming rising inflation are percolating in the financial markets and among commentators. Meanwhile, the ECB and Fed offer no alarming signals, and the parallel structure of the yield curves remains in operational mode. Notice that curves are still parallel and bunching is still in place.

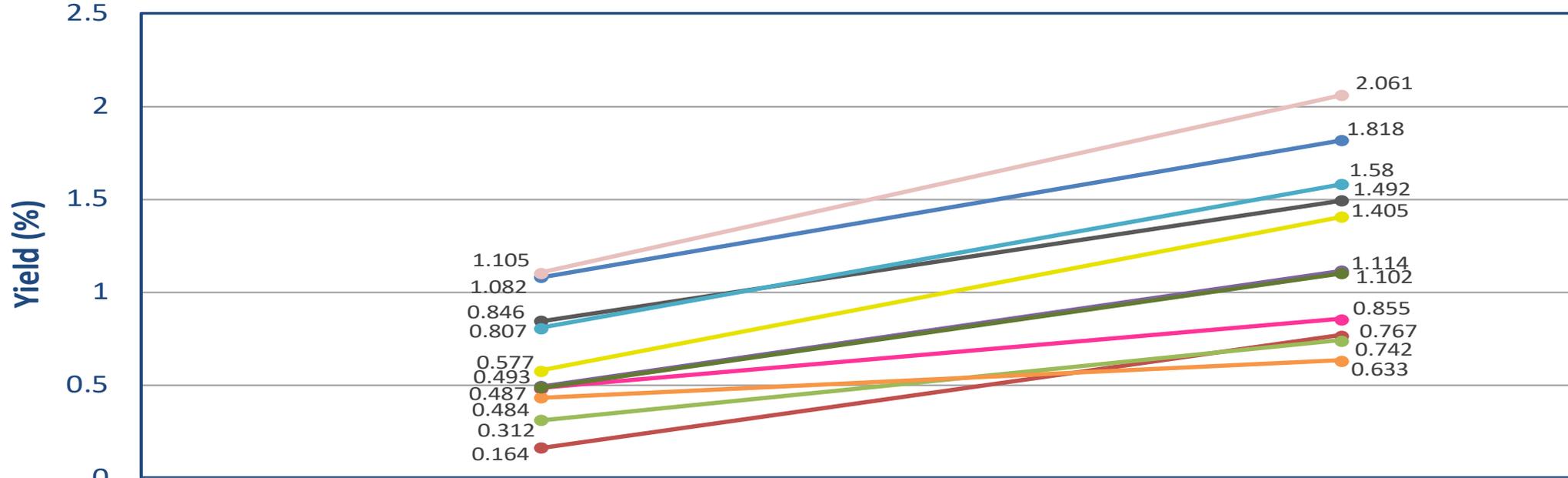


After ECB Minutes & Fed Jackson Hole Meeting (08/30/2021)





After ECB Minutes & Fed Jackson Hole Meeting (08/30/2021)



U.S. Treasury
U.S. AAA MUNI
CNY (China)
JPY (Japan)
EUR (Germany)
DKK (Denmark)
SEK (Sweden)
CAD (Canada)
AUD (Australia)
CHF (Switzerland)
GBP (Great Britain)

	Intermediate Spread (2 & 10YR)	Long Term Spread (3M & 30YR)
1.082	1.818	
0.846	1.492	
0.577	1.405	
0.164	0.767	
0.312	0.742	
0.484	0.855	
0.493	1.114	
0.807	1.58	
1.105	2.061	
0.435	0.633	
0.487	1.102	

Spread Tenor



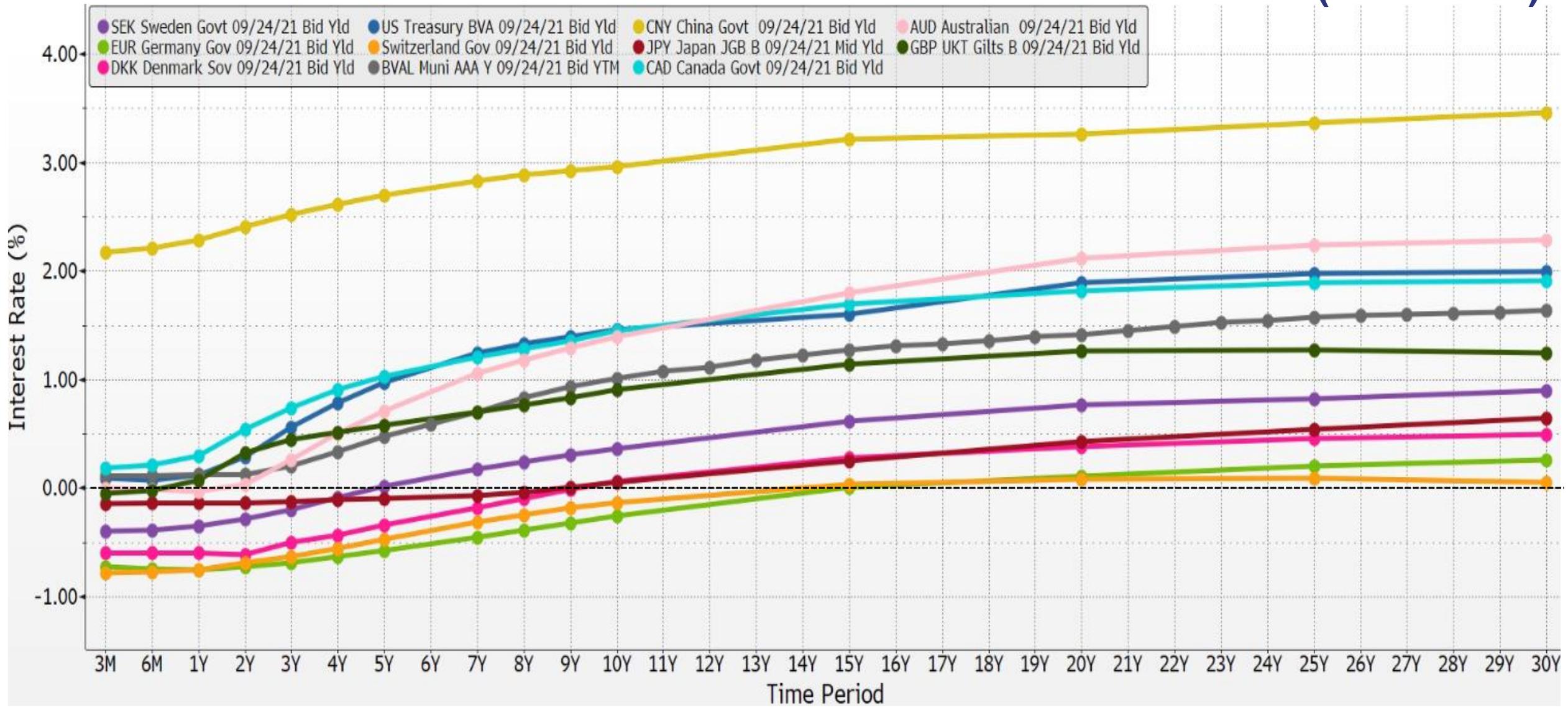
After September Fed Meeting and Evergrande Headlines (09/24/2021)

As of September 2021, markets are worried about contagion risk spreading from the development of default risk in Chinese real estate companies. Evergrande is the first company to raise concern. Speculation about how there is “never just one cockroach” prevails in discussions. No one knows yet how the Chinese policymakers will respond to this growing default risk. Interest rates at the longer end of the Chinese yield curve start to rise. Other yield curves that are sensitive to China’s economics also start to shift. The Australian yield curve is a good example. The shorter-term curves remain bunched.

Examination of the intermediate-term spread versus the longer-term spread shows this beginning of steepening in the yield curves. Swaps are still keeping the curves parallel. The short-term end of the swaps continues in the rolling mode, and that anchors the shorter-term end of the spread.

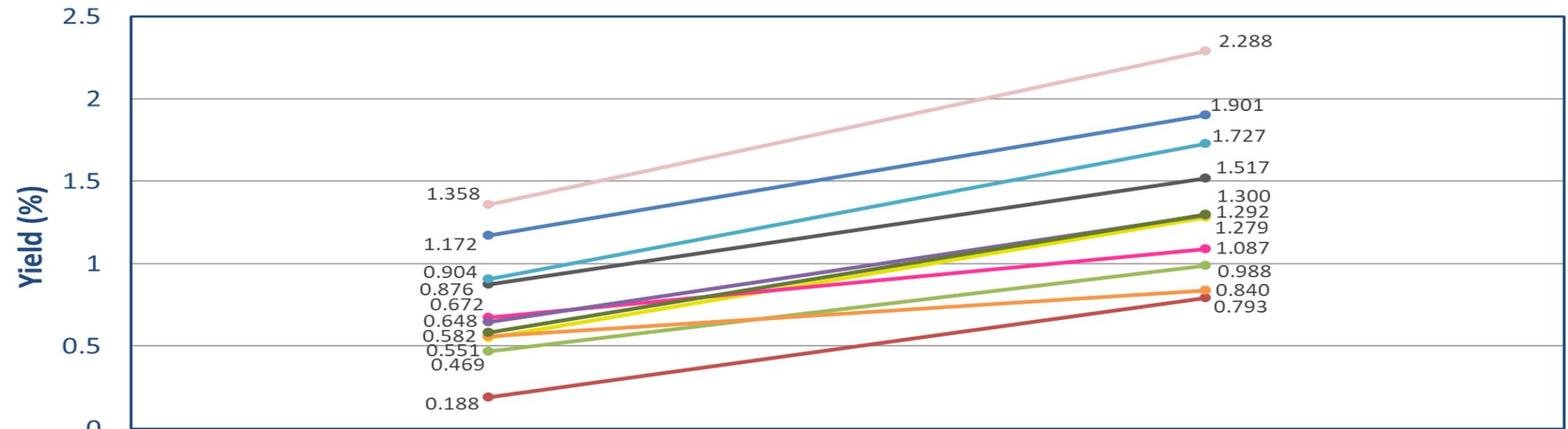


After September Fed Meeting and Evergrande Headlines (09/24/2021)





After September Fed Meeting and Evergrande Headlines (09/24/2021)



	Intermediate Spread (2 & 10YR)	Long Term Spread (3M & 30YR)
U.S. Treasury	1.172	1.901
U.S. AAA MUNI	0.876	1.517
CNY (China)	0.551	1.279
JPY (Japan)	0.188	0.793
EUR (Germany)	0.469	0.988
DKK (Denmark)	0.672	1.087
SEK (Sweden)	0.648	1.292
CAD (Canada)	0.904	1.727
AUD (Australia)	1.358	2.288
CHF (Switzerland)	0.558	0.840
GBP (Great Britain)	0.582	1.300

Spread Tenor

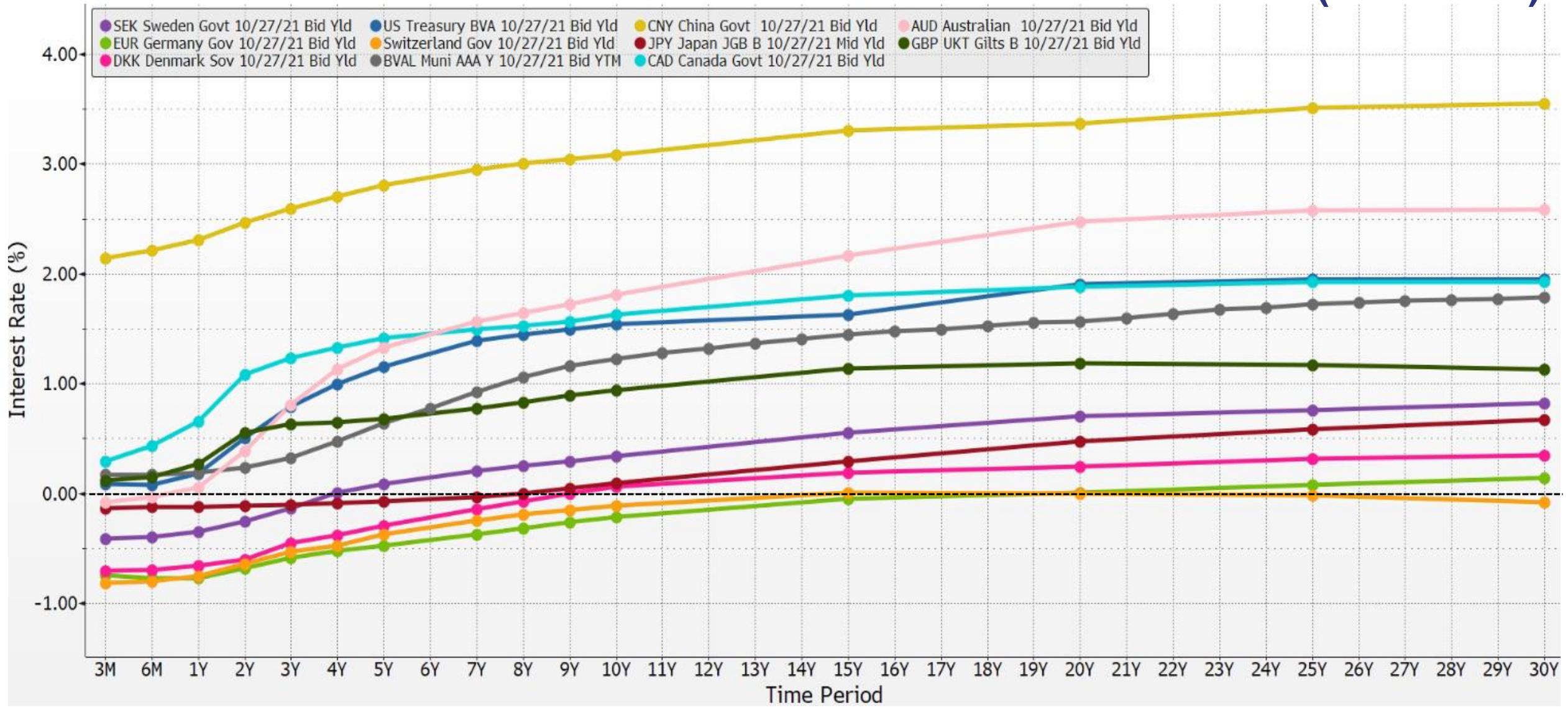


Bank of Canada Surprise End of QE (10/27/2021)

In late October 2021, Canada surprises the markets by moving to end QE, and all the yield curves commence shifting. Australia is steepening, with the longer end above 2.5%. The shorter-term end is still bunched, but the intermediate and longer-term maturity structures are adjusting as inflation worries grow and as central banks begin their respective processes of changing policy interest rates. Bunching is still intact, but the early signs of unbunching are beginning.

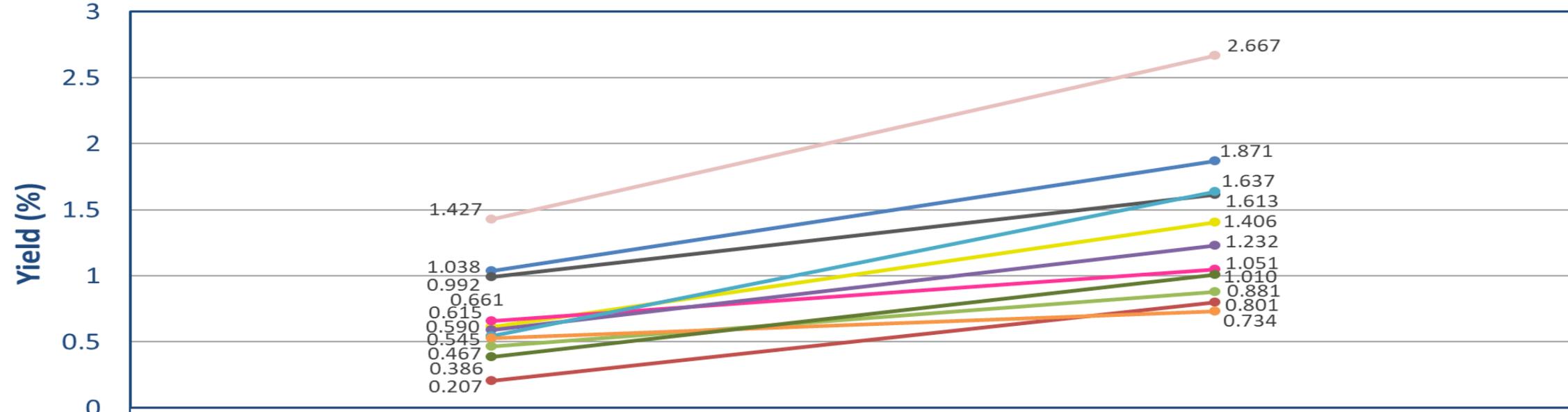


Bank of Canada Surprise End of QE (10/27/2021)





Bank of Canada Surprise End of QE (10/27/2021)



- U.S. Treasury
- U.S. AAA MUNI
- CNY (China)
- JPY (Japan)
- EUR (Germany)
- DKK (Denmark)
- SEK (Sweden)
- CAD (Canada)
- AUD (Australia)
- CHF (Switzerland)
- GBP (Great Britain)

	Intermediate Spread (2 & 10YR)	Long Term Spread (3M & 30YR)
U.S. Treasury	1.038	1.871
U.S. AAA MUNI	0.992	1.613
CNY (China)	0.615	1.406
JPY (Japan)	0.207	0.801
EUR (Germany)	0.467	0.881
DKK (Denmark)	0.661	1.051
SEK (Sweden)	0.590	1.232
CAD (Canada)	0.545	1.637
AUD (Australia)	1.427	2.667
CHF (Switzerland)	0.530	0.734
GBP (Great Britain)	0.386	1.010

Spread Tenor

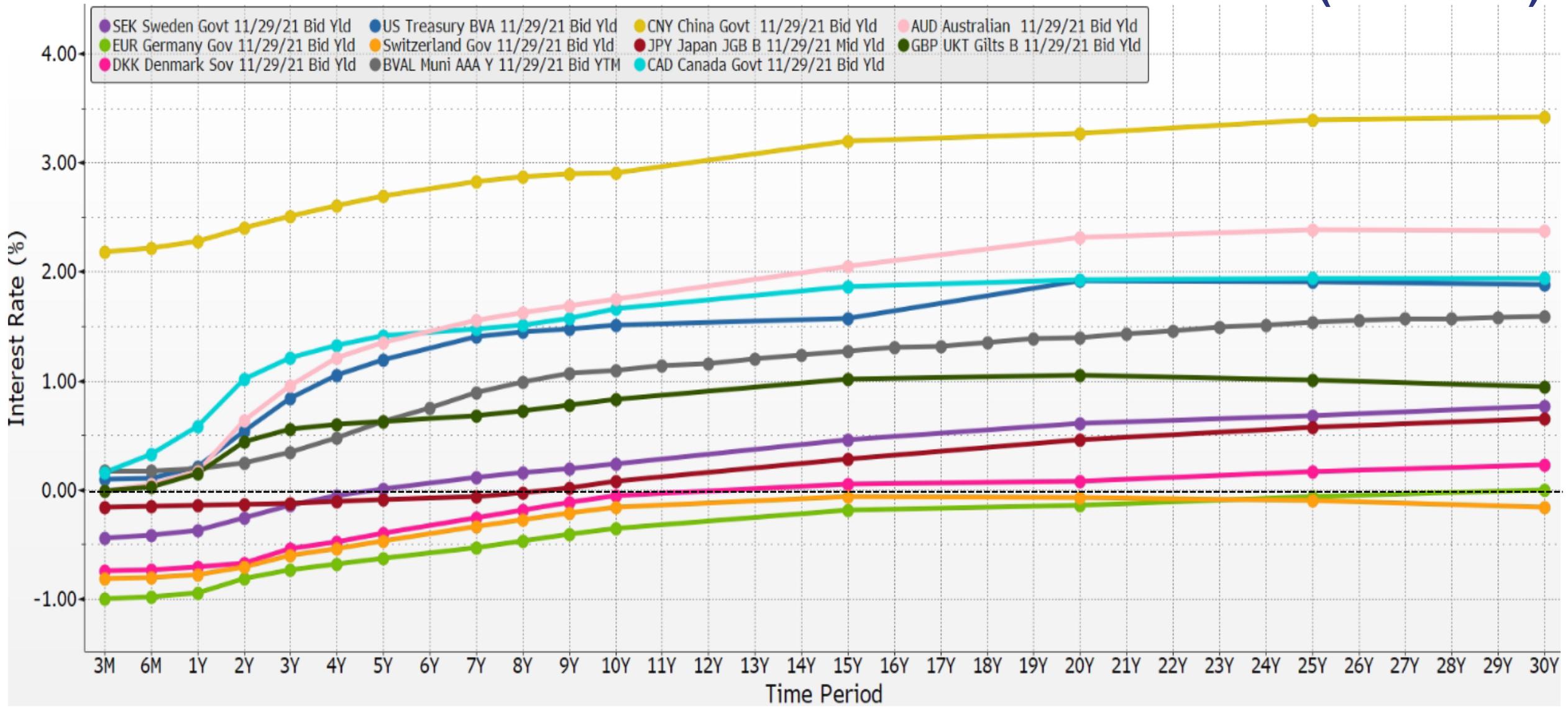


First Week After Powell Reappointment (11/29/2021)

By the end of November, markets have absorbed the Canada news and gained relief after speculation has ceased about who will be the chair of the world's most important central bank. Fed appointments disappear as an issue. Powell's reappointment and the other appointments give market agents comfort about continuing policymaking. Powell had to get through confirmation in the U.S. Senate, as did the others; and a political issue arose about one of the appointees. Markets are still sanguine about inflation as November draws to a close, although the signs are pointing toward intensification. Covid seems to be drifting into the "fatigue zone," and market agents are looking elsewhere for sources of calm or risk.

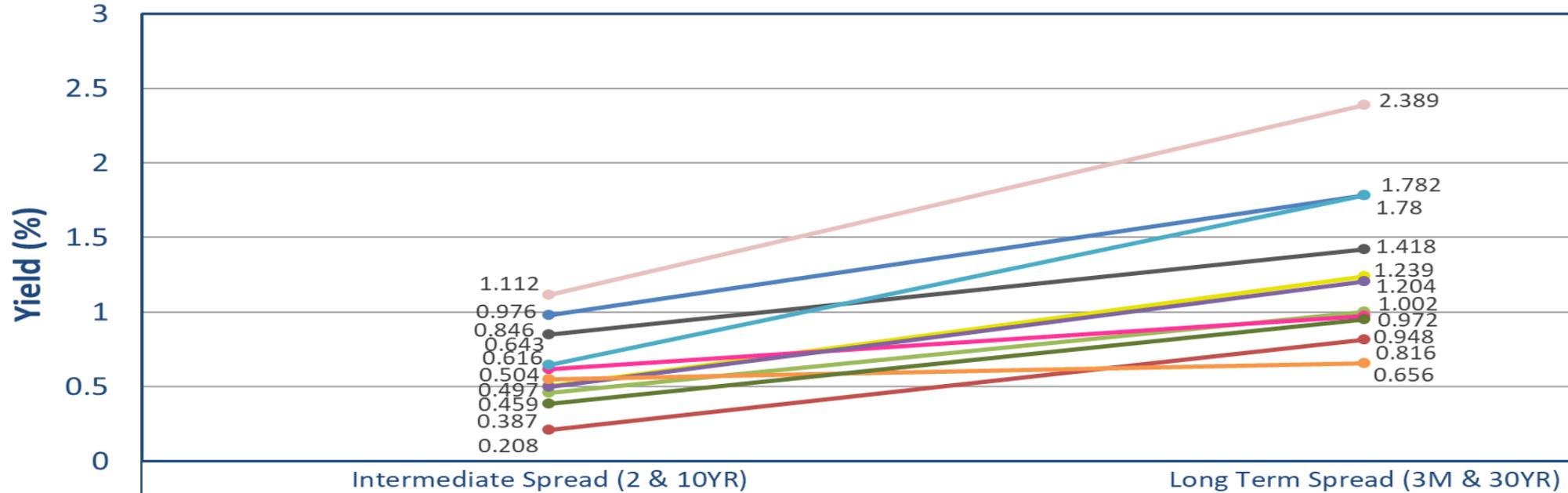


First Week After Powell Reappointment (11/29/2021)





First Week After Powell Reappointment (11/29/2021)



U.S. Treasury	0.976	1.78
U.S. AAA MUNI	0.846	1.418
CNY (China)	0.504	1.239
JPY (Japan)	0.208	0.816
EUR (Germany)	0.459	1.002
DKK (Denmark)	0.616	0.972
SEK (Sweden)	0.497	1.204
CAD (Canada)	0.643	1.782
AUD (Australia)	1.112	2.389
CHF (Switzerland)	0.548	0.656
GBP (Great Britain)	0.387	0.948

Spread Tenor



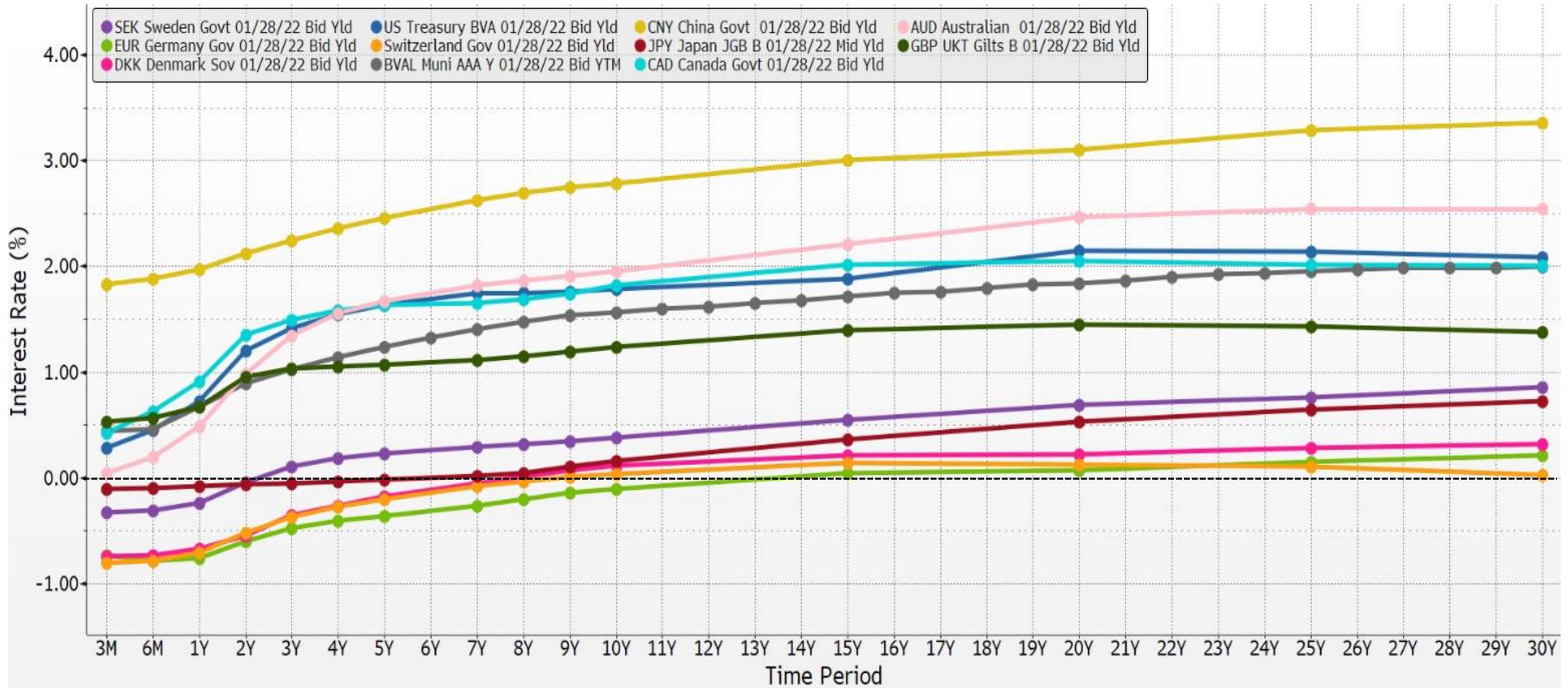
After Omicron, Biden Budget's Failure, and Fed January Shock (01/28/2022)

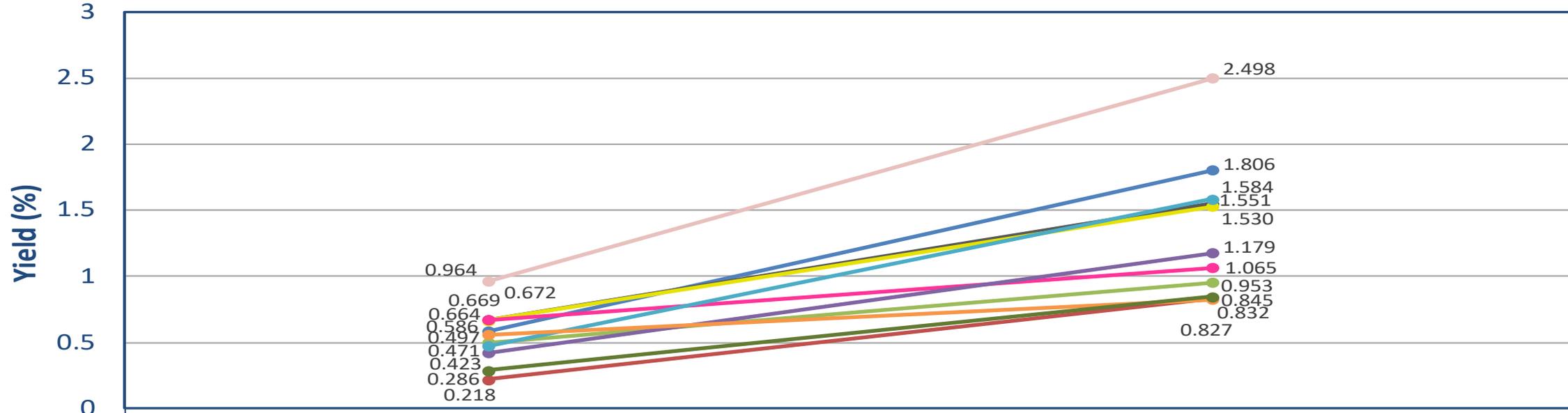
Yield curves are steepening in January 2022, and the spread measures show how dramatically things are changing. The currency markets reflect the volatility. Meanwhile, the use of swaps continues and has a dampening effect. Estimates of total notional derivatives in this mode are now in the \$700 trillion range.

Notice that bunching in the short term continues unabated. Why? The rolling one-month and three-month currency side of the swaps mechanism keeps these anchors in place. At the same time, the longer side of the spread comparisons is steepening. Curve structures remain nearly parallel. No one knows that the Russian invasion of Ukraine lies only a month in the future. There is no evidence of anticipatory pricing in these currency markets.



After Omicron, Biden Budget's Failure, and Fed January Shock (01/28/2022)





U.S. Treasury	0.586	1.806
U.S. AAA MUNI	0.672	1.551
CNY (China)	0.664	1.530
JPY (Japan)	0.218	0.832
EUR (Germany)	0.497	0.953
DKK (Denmark)	0.669	1.065
SEK (Sweden)	0.423	1.179
CAD (Canada)	0.471	1.584
AUD (Australia)	0.964	2.498
CHF (Switzerland)	0.559	0.827
GBP (Great Britain)	0.286	0.845

Intermediate Spread (2 & 10YR)

Long Term Spread (3M & 30YR)

Spread Tenor



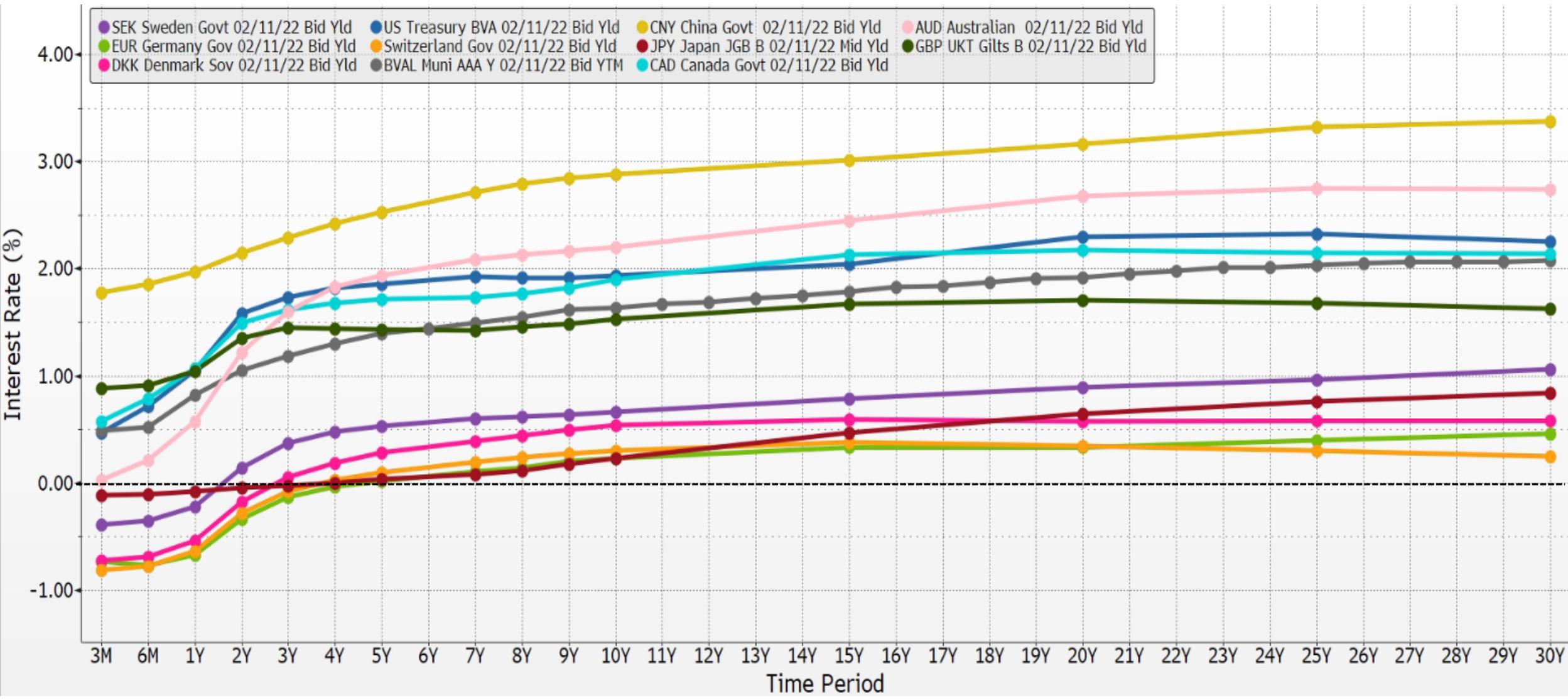
After Lagarde, German Yield Spike & U.S. CPI Spike (02/11/2022)

Things have clearly changed by February. The European Central Bank is trying to be in two places at once: raising interest rates sometime in the future to fight developing inflation risk and not raising interest rates now because of worries about financial stability. Early warning signs about Putin's invasion of Ukraine are still being ignored by market agents but are worrisome to military planners and geopolitical risk analysts. Market agents simply don't believe Putin is engaged in anything more than a fearmongering military exercise.

Meanwhile, Covid fatigue seems to have returned to many countries but is fully reversed in others. China and others in Asia, such as South Korea, now face rising Covid cases and the spread of the newer variants. Fewer short-term interest rates are below zero. Yield curves remain parallel, but the shape to a more upward slope is developing in most of them. The very short period of one month to two years is steepening rapidly, and market agents are discounting a rise in policymakers' shorter-term interest rate targets. The longer and intermediate ends of yield curves are also steepening, but less dramatically. Note how the spread measures capture the differentials. Using these various spreads, arbitrage possibilities continue for market agents. The process of continuous rolling of the currency side is ongoing.

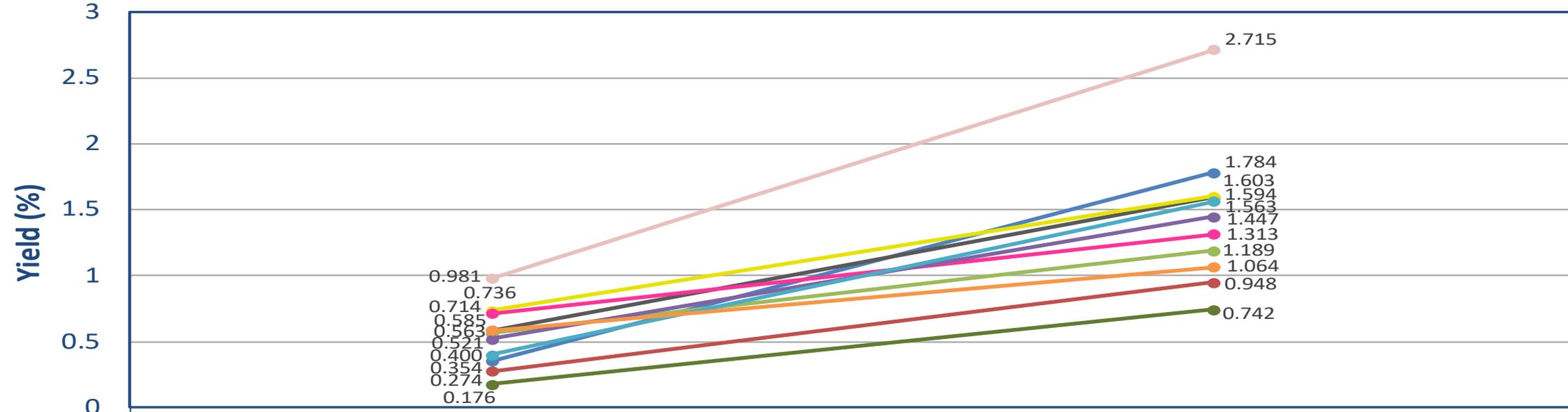


After Lagarde, German Yield Spike & U.S. CPI Spike (02/11/2022)





After Lagarde, German Yield Spike & U.S. CPI Spike (02/11/2022)



U.S. Treasury	0.354	1.784
U.S. AAA MUNI	0.585	1.594
CNY (China)	0.736	1.603
JPY (Japan)	0.274	0.948
EUR (Germany)	0.563	1.189
DKK (Denmark)	0.714	1.313
SEK (Sweden)	0.521	1.447
CAD (Canada)	0.400	1.563
AUD (Australia)	0.981	2.715
CHF (Switzerland)	0.584	1.064
GBP (Great Britain)	0.176	0.742

Intermediate Spread (2 & 10YR)

Long Term Spread (3M & 30YR)

Spread Tenor

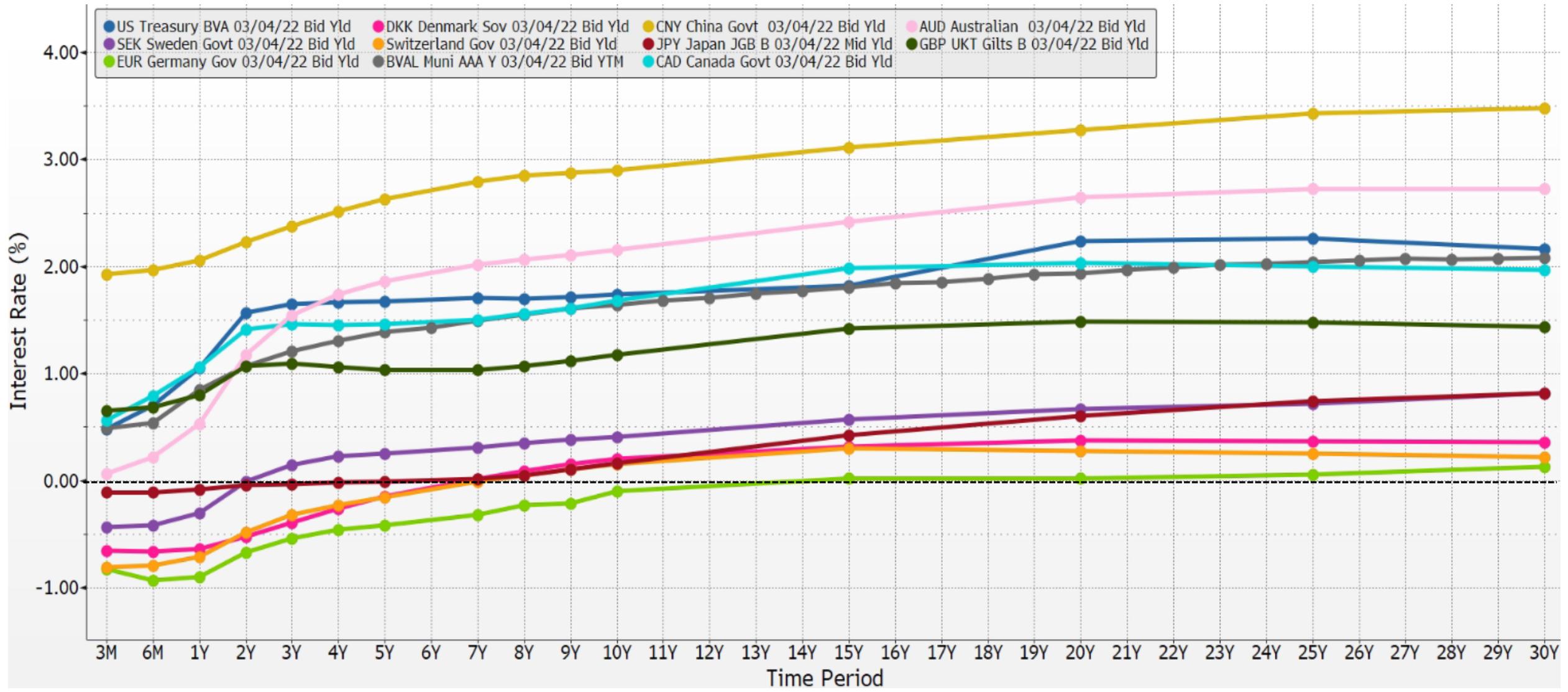


After Russian Invasion of Ukraine (03/04/2022)

The short-term side is steepening rapidly. The Russian war against Ukraine is now a geopolitical risk event of major proportions. Unbunching continues as each central bank and each currency adjusts to higher volatility. Parallel shapes in yield curves continue. Swaps enable the parallel structure to survive shocks. Most markets are starting to price in a rise in the shorter-term policy rate of between a 100 and 200 basis points within a year or two years. Notice how the 2-year–10-year spread measure is still tightly bunched, while the 3-month–30-year measure is starting to widen.

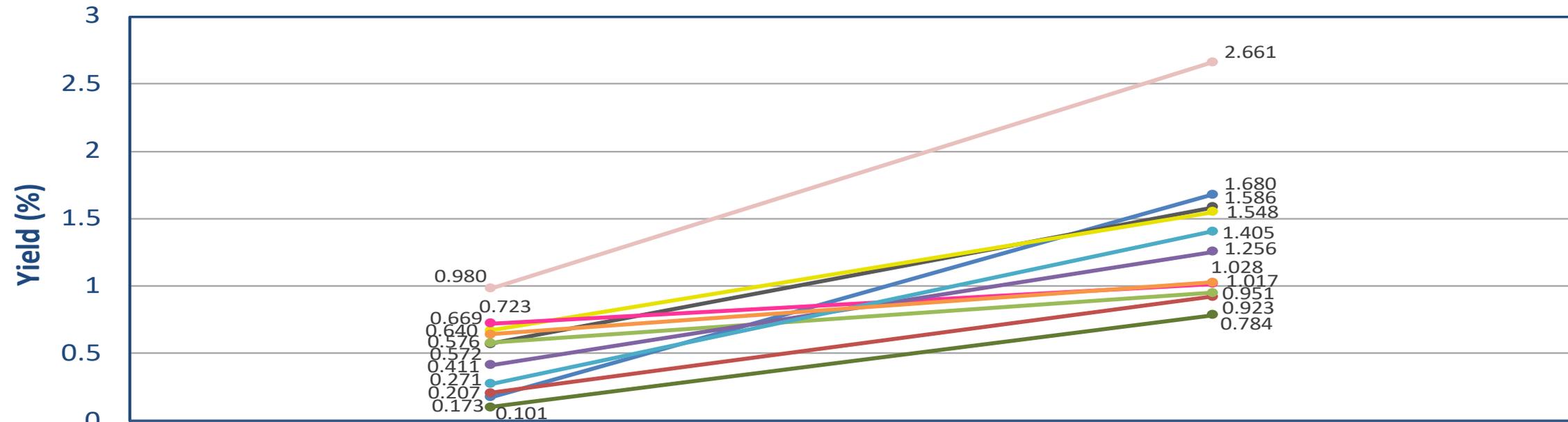


After Russian Invasion of Ukraine (03/04/2022)





After Russian Invasion of Ukraine (03/04/2022)



U.S. Treasury	0.173	1.680
U.S. AAA MUNI	0.572	1.586
CNY (China)	0.669	1.548
JPY (Japan)	0.207	0.923
EUR (Germany)	0.576	0.951
DKK (Denmark)	0.723	1.017
SEK (Sweden)	0.411	1.256
CAD (Canada)	0.271	1.405
AUD (Australia)	0.980	2.661
CHF (Switzerland)	0.640	1.028
GBP (Great Britain)	0.101	0.784

	Intermediate Spread (2 & 10YR)	Long Term Spread (3M & 30YR)
U.S. Treasury	0.173	1.680
U.S. AAA MUNI	0.572	1.586
CNY (China)	0.669	1.548
JPY (Japan)	0.207	0.923
EUR (Germany)	0.576	0.951
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AUD (Australia)	0.980	2.661
CHF (Switzerland)	0.640	1.028
GBP (Great Britain)	0.101	0.784

Spread Tenor



After Powell NABE Speech Mentions 50bps Hike (03/25/2022)

Fed Chair Jay Powell uses his speech to the National Association for Business Economics (NABE) in Washington, DC, to message markets that a 50-bps hike in the short-term policymaking interest rate is coming soon. Markets are already adjusting to the future path of several 50-bps hikes during the year. Some are pricing in four or five successive interest rate hikes in one year.

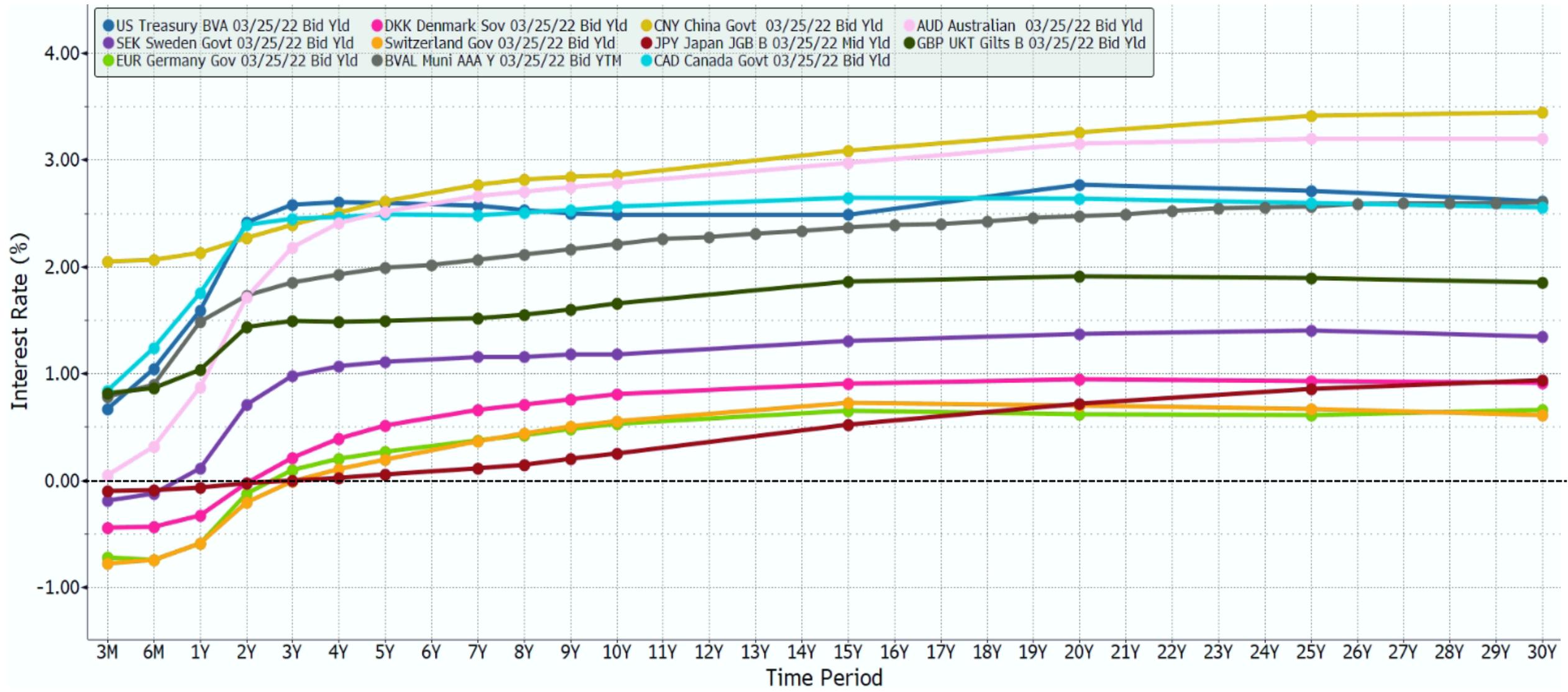
Notice how the curves remain parallel from about 2-years to 30-years maturity. The reason? The swaps mechanism still works and dampens volatility and causes alignment. Market agents adjust quickly, and the rolling feature of the currency one-month and three-month currency swaps continues to work for the currency adjustment portion of the swap. In the use of derivatives and swaps, the world's expertise is well developed, and there is an immediate response to any news item or change.

When we step back from the day-to-day and look at these yield curves and their parallel nature occurring in the midst of a pandemic shock and, now, a shooting-war shock, we can see how the swaps structure has worked in global finance. The currency exchange rates take the volatility. When central banks do not align with others in policymaking, the market does the aligning for them. Outlier central banks are quickly punished by market forces, as we saw with Switzerland and Canada. The process is very fast.

We are coming up on the end of the chart sequence and the cutoff date for this pamphlet. In the spring of 2022, all eyes are on Japan, which is still managing yield curve control and still trying to anchor both ends of its yield curve. Markets are positioning against this outlier just as they did against Switzerland and Canada. We see that in the dramatic change in the market value of the yen against other currencies.

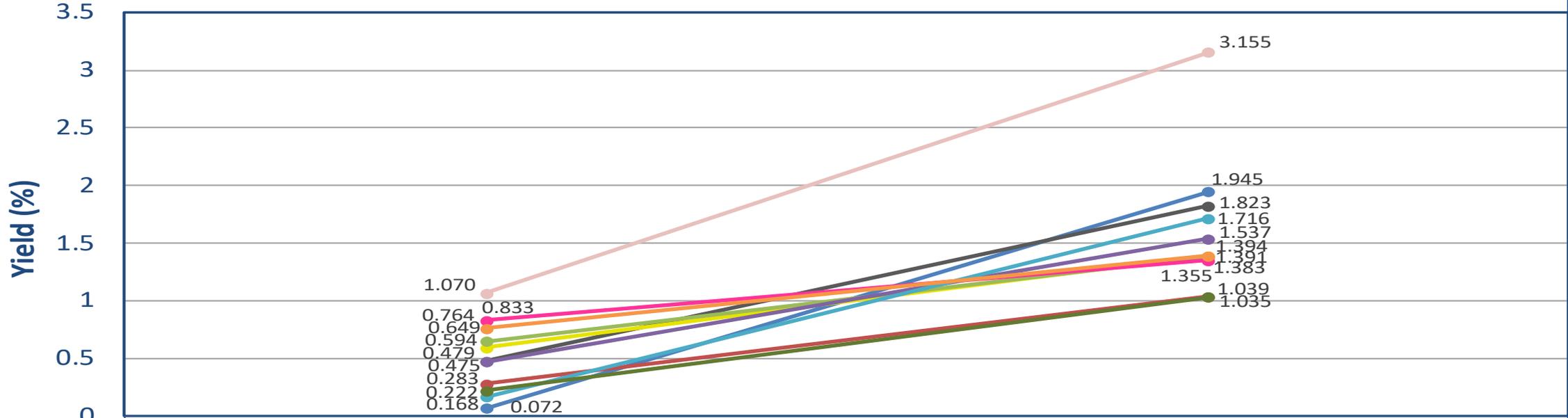


After Powell NABE Speech Mentions 50bps Hike (03/25/2022)





After Powell NABE Speech Mentions 50bps Hike (03/25/2022)



Intermediate Spread (2 & 10YR)

Long Term Spread (3M & 30YR)

U.S. Treasury	0.072	1.945
U.S. AAA MUNI	0.479	1.823
CNY (China)	0.594	1.394
JPY (Japan)	0.283	1.039
EUR (Germany)	0.649	1.383
DKK (Denmark)	0.833	1.355
SEK (Sweden)	0.475	1.537
CAD (Canada)	0.168	1.716
AUD (Australia)	1.070	3.155
CHF (Switzerland)	0.764	1.391
GBP (Great Britain)	0.222	1.035

0.072

1.945

0.479

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0.594

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1.537

0.168

1.716

1.070

3.155

0.764

1.391

0.222

1.035

Spread Tenor



After April 1st Employment Report & Brainard Comments (04/08/2022)

In April 2022, yield curve parallels persist. Bunching in the short-term is very tight. Bunching in the longer term is unwinding slowly as the longer-term spread is widening. Inflation is now at the top of every political and central banking agenda. The Russian invasion of Ukraine looks like a longer-term event. War risks are consequently rising. The Covid surge in China is having an enormous shock effect on world supply chains. Geopolitics has triggered worldwide commodity price shocks. Aggregate demand curves and supply curves have both shifted.

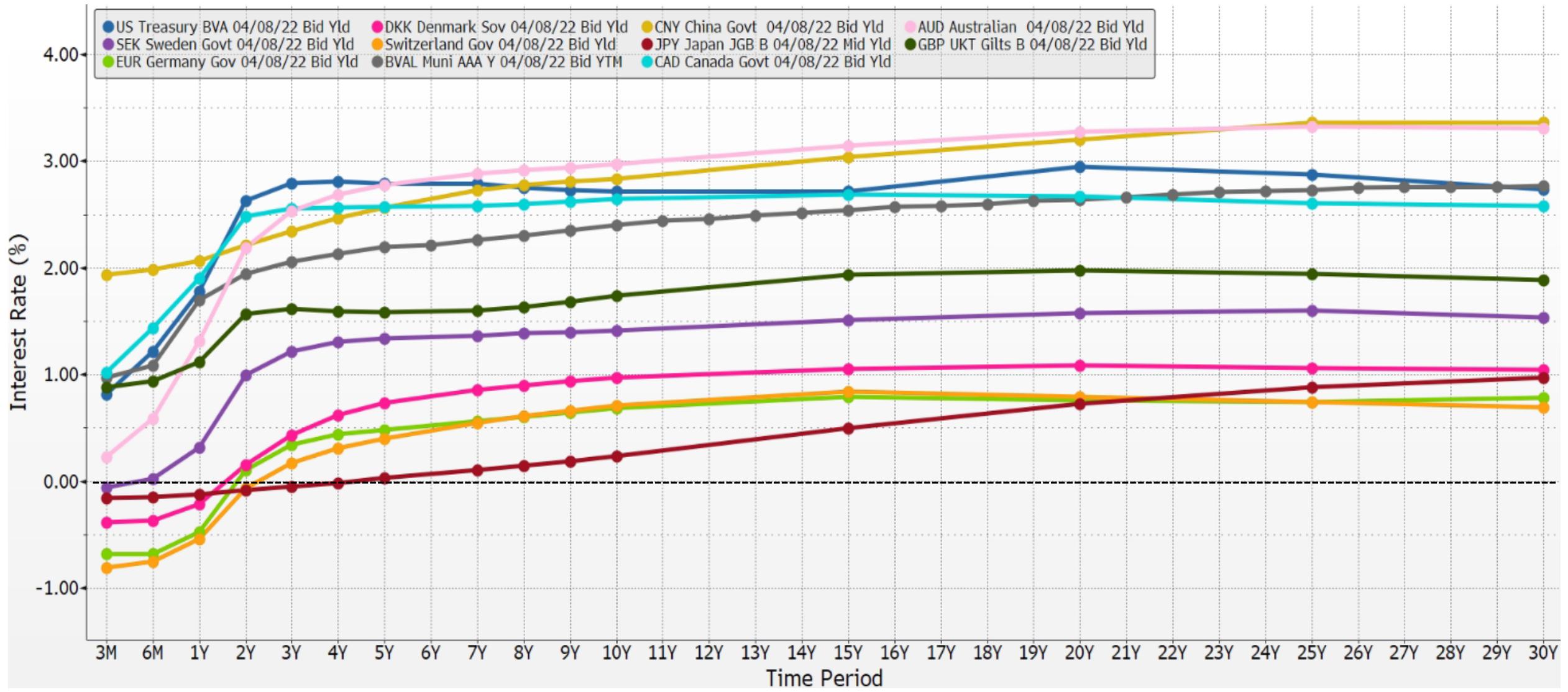
Given these headlines without understanding the nature of the yield curves, their slopes, and their parallel term structures, would we expect the curves to be so aligned and parallel? Would we ever expect them to show the bunching that we see in the graphics? We suspect that the answer is no.

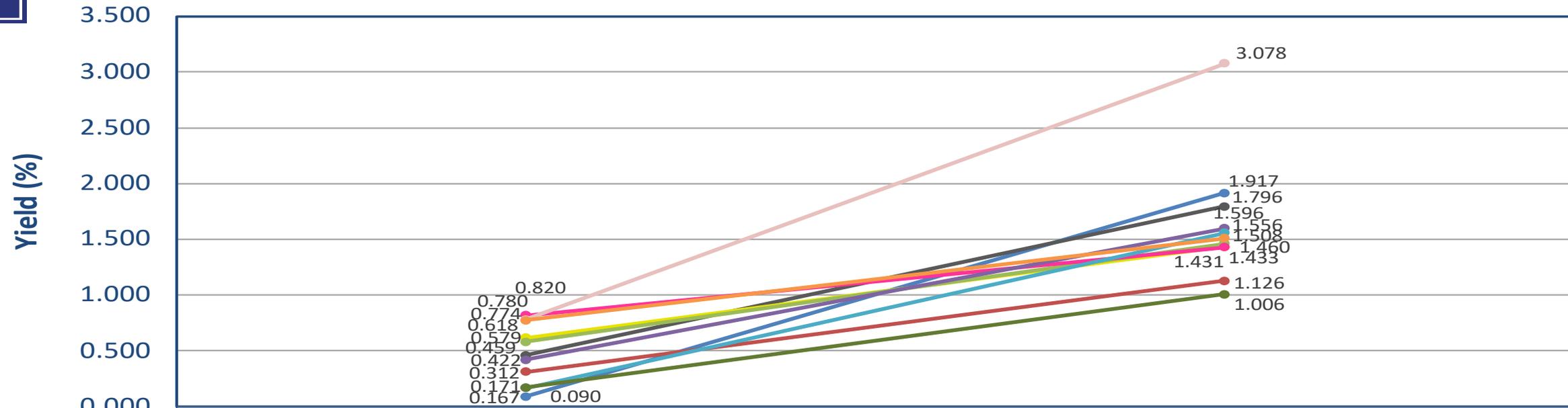
The only major central bank that is not in motion for change is Japan. And it's Japanese currency volatility that is revealed, as one would expect. Remember, the short end of the swaps technique anchors the currency in the rolling one-month and three-month currency exchange trading arena. The longer-maturity side of the swaps is matched in terms of maturity of loan and project. That hasn't changed.

We will now look at the last set of slides and then the tables, which will capture the statistical measures used for assessing trading opportunities and risks.



After April 1st Employment Report & Brainard Comments (04/08/2022)





U.S. Treasury	0.090	1.917
U.S. AAA MUNI	0.459	1.796
CNY (China)	0.618	1.433
JPY (Japan)	0.312	1.126
EUR (Germany)	0.579	1.460
DKK (Denmark)	0.820	1.431
SEK (Sweden)	0.422	1.596
CAD (Canada)	0.167	1.556
AUD (Australia)	0.780	3.078
CHF (Switzerland)	0.774	1.508
GBP (Great Britain)	0.171	1.006

Intermediate Spread (2 & 10YR) Long Term Spread (3M & 30YR)

Spread Tenor



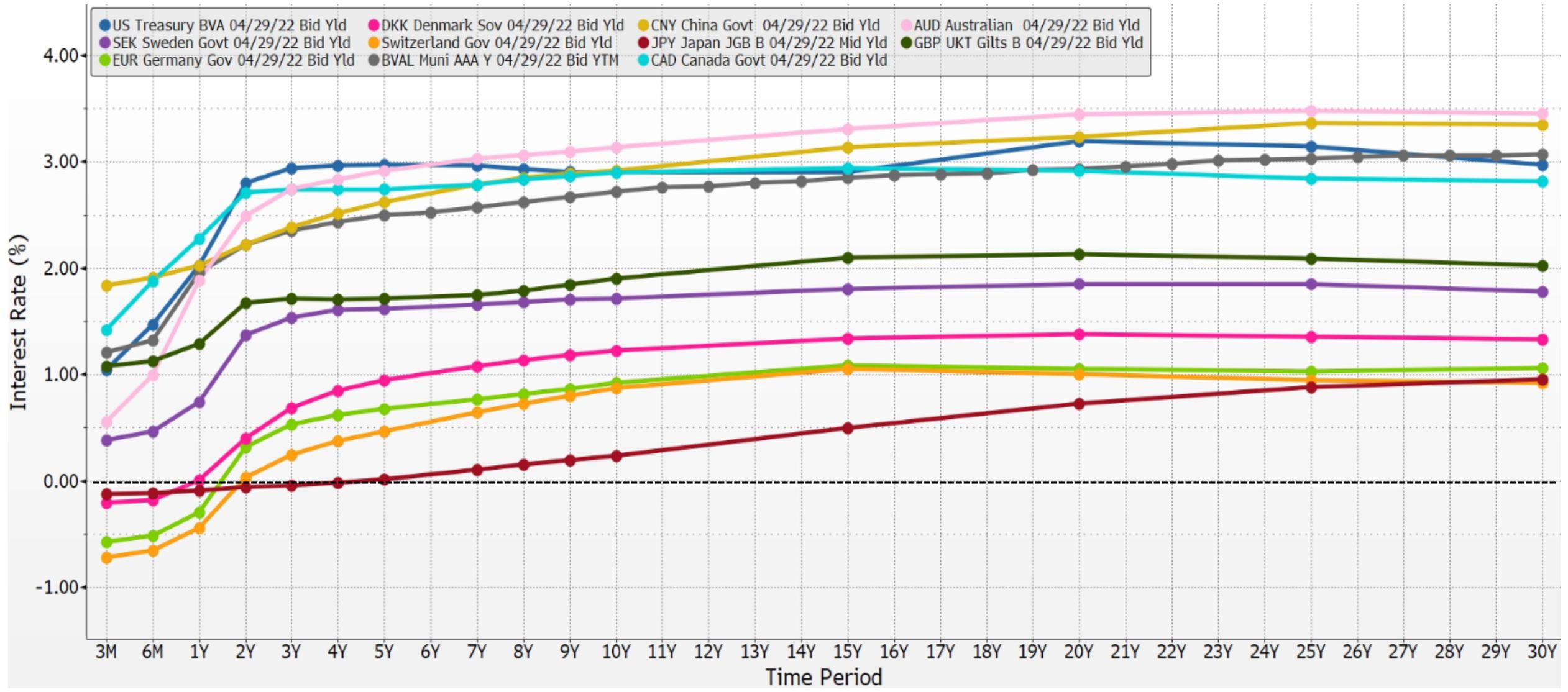
After Japanese Yen Weakness, BOJ Policy in Doubt (04/29/2022)

We're at the end of the yield curve chart pack for this pamphlet. Bunching in the intermediate spread measure is very tight, nearly down to 60 basis points. In the longer-term spread, things are widening, and the unbunching mechanism is at work. Australia is now an apparent outlier, as a comparison of the intermediate-term with the longer-term demonstrates. We do not know when and how Japan will change its policy course. We watch the news of the Russia-Ukraine war and observe the continuing Covid lockdown in China. Note how the muni term structure in the U.S. continues to reveal that munis appear to be very cheap for an American bond buyer. And this is also true for a crossover buyer. The Fed has achieved market influence through "jawboning," and the market is pricing in several rises in policy short-term interest rates. Note that yield curves are still mostly parallel.

So far, the cumulative evidence points to successful use of swaps by market agents as they apply the cross-currency interest rate swap techniques. As for tomorrow, more will be revealed.

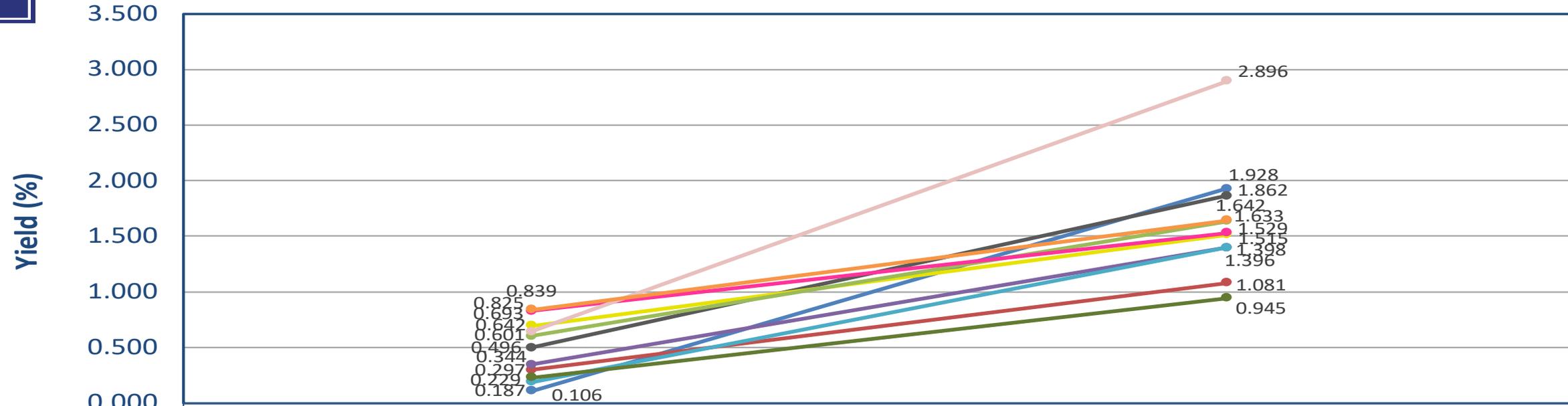


After Japanese Yen Weakness, BOJ Policy in Doubt (04/29/2022)





After Japanese Yen Weakness, BOJ Policy in Doubt (04/29/2022)



U.S. Treasury	0.106	1.928
U.S. AAA MUNI	0.496	1.862
CNY (China)	0.693	1.515
JPY (Japan)	0.297	1.081
EUR (Germany)	0.601	1.633
DKK (Denmark)	0.825	1.529
SEK (Sweden)	0.344	1.398
CAD (Canada)	0.187	1.396
AUD (Australia)	0.642	2.896
CHF (Switzerland)	0.839	1.642
GBP (Great Britain)	0.229	0.945

Intermediate Spread (2 & 10YR)

Long Term Spread (3M & 30YR)

Spread Tenor



Table A: Every Curve on a Specific Date

This slide summarizes the data from the time series. We have divided the intermediate 2-year–10-year spread and the longer-term 3-month–30-year spread into two sections. Notice the same dates and the different currencies. Also notice the z-scores and how they depict the gravitation over time. We are showing both the positive and negative z-scores and the absolute z-scores. That is where we see the power of the use of the cross-currency interest rate swap mechanism that we have described in this pamphlet.



Table A: Every Curve on a Specific Date

Intermediate Spread (2 & 10YR)	7/2/2009	7/26/2012	6/24/2016	11/9/2016	11/17/2017	11/1/2019	1/21/2020	12/29/2020	1/7/2021	5/20/2021	6/18/2021	7/26/2021	8/30/2021	9/24/2021	10/27/2021	11/29/2021	1/28/2022	2/11/2022	3/4/2022	3/25/2022	4/8/2022	4/29/2022
Range	1.435	1.067	1.089	0.974	1.176	0.708	0.768	0.745	0.839	1.446	1.304	0.968	0.941	1.170	1.220	0.904	0.746	0.707	0.807	0.998	0.690	0.733
Mean	2.049	0.955	0.665	0.804	0.786	0.259	0.316	0.452	0.492	0.884	0.745	0.629	0.617	0.725	0.678	0.618	0.546	0.535	0.484	0.510	0.472	0.478
Std. Dev.	0.404	0.384	0.288	0.272	0.323	0.183	0.201	0.226	0.256	0.405	0.342	0.291	0.290	0.316	0.329	0.253	0.195	0.219	0.261	0.295	0.252	0.248
U.S. TREASURY Z-Score	1.137	0.697	0.956	1.336	-0.539	-0.607	-0.413	1.487	1.487	1.493	1.318	1.636	1.601	1.415	1.093	1.416	0.203	-0.830	-1.192	-1.487	-1.517	-1.502
U.S. MUNI AAA Z-Score	0.487	0.997	0.335	0.649	0.053	0.474	0.568	0.422	0.289	-0.030	0.192	0.504	0.788	0.477	0.954	0.902	0.644	0.228	0.338	-0.105	-0.052	0.072
CNY (China) Z-Score	-0.053	-0.132	-0.958	-1.136	-1.043	1.909	1.739	0.082	0.324	-0.575	-0.492	-0.002	-0.139	-0.552	-0.191	-0.450	0.603	0.919	0.709	0.285	0.580	0.868
JPY (Japan) Z-Score	-2.414	-1.031	-1.970	-2.241	-1.755	-0.956	-0.986	-1.269	-1.302	-1.653	-1.636	-1.649	-1.563	-1.702	-1.431	-1.620	-1.680	-1.196	-1.061	-0.770	-0.635	-0.731
EUR (Germany) Z-Score	0.123	1.377	-0.393	0.135	1.121	0.321	0.184	-1.203	-1.158	-0.804	-0.846	-1.057	-1.053	-0.812	-0.641	-0.628	-0.252	0.127	0.353	0.472	0.425	0.496
DKK (Denmark) Z-Score	0.323	N/A	0.491	0.289	1.037	0.987	0.673	-0.885	-0.869	-0.375	-0.332	-0.383	-0.460	-0.169	-0.052	-0.007	0.628	0.818	0.916	1.097	1.382	1.400
SEK (Sweden) Z-Score	0.845	-1.054	1.805	0.979	1.885	0.315	0.812	-0.240	-0.346	-0.234	-0.203	-0.435	-0.429	-0.245	-0.267	-0.478	-0.631	-0.065	-0.279	-0.119	-0.199	-0.541
CAD (Canada) Z-Score	0.318	-0.765	0.089	0.256	-0.774	-1.954	-2.087	0.449	0.508	0.925	0.587	0.731	0.653	0.566	-0.404	0.100	-0.385	-0.619	-0.816	-1.161	-1.211	-1.175
AUD (Australia) Z-Score	-1.206	-1.403	-0.490	-0.398	-0.050	0.403	0.608	2.021	1.970	1.915	2.178	1.680	1.681	2.004	2.275	1.953	2.138	2.040	1.901	1.902	1.223	0.662
CHF (Switzerland) Z-Score	-0.540	-0.056	-0.729	-0.706	-0.127	-0.061	-0.687	-0.580	-0.717	-0.580	-0.554	-0.597	-0.629	-0.530	-0.450	-0.276	0.065	0.223	0.598	0.863	1.199	1.457
GBP (Great Britain) Z-Score	0.979	1.369	0.862	0.836	0.192	-0.830	-0.408	-0.284	-0.187	-0.081	-0.212	-0.428	-0.450	-0.454	-0.887	-0.912	-1.332	-1.644	-1.468	-0.977	-1.195	-1.005
Absolute Average Z-Score (ALL)	0.766	0.888	0.825	0.815	0.779	0.801	0.833	0.811	0.833	0.788	0.777	0.827	0.859	0.811	0.786	0.795	0.778	0.792	0.876	0.840	0.874	0.901
Absolute Average Z-Score (Positives)	0.602	1.110	0.756	0.640	0.857	0.735	0.764	0.892	0.916	1.444	1.069	1.138	1.181	1.116	1.441	1.093	0.714	0.726	0.803	0.924	0.962	0.826
Absolute Average Z-Score (Negatives)	1.053	0.740	0.908	1.120	0.715	0.882	0.917	0.744	0.763	0.542	0.611	0.650	0.675	0.637	0.540	0.624	0.856	0.871	0.963	0.770	0.801	0.991
Long-Term Spread (3M & 30YR)	7/2/2009	7/26/2012	6/24/2016	11/9/2016	11/17/2017	11/1/2019	1/21/2020	12/29/2020	1/7/2021	5/20/2021	6/18/2021	7/26/2021	8/30/2021	9/24/2021	10/27/2021	11/29/2021	1/28/2022	2/11/2022	3/4/2022	3/25/2022	4/8/2022	4/29/2022
Range	2.121	3.108	1.907	1.636	1.879	1.491	1.555	1.471	1.584	1.892	1.633	1.420	1.428	1.495	1.933	1.733	1.671	1.973	1.877	2.120	2.072	1.951
Mean	3.395	1.510	1.385	1.596	1.572	0.695	0.754	1.032	1.106	1.523	1.364	1.254	1.234	1.365	1.355	1.291	1.334	1.451	1.349	1.616	1.628	1.620
Std. Dev.	0.737	0.880	0.515	0.481	0.507	0.349	0.380	0.440	0.498	0.563	0.479	0.463	0.451	0.440	0.546	0.490	0.497	0.501	0.505	0.558	0.520	0.491
U.S. TREASURY Z-Score	1.031	1.012	1.270	1.587	-0.202	-0.337	-0.351	1.055	1.132	1.352	1.159	1.346	1.296	1.218	0.945	0.996	0.951	0.665	0.655	0.590	0.556	0.627
U.S. MUNI AAA Z-Score	N/A	N/A	0.697	0.939	0.228	0.965	1.033	0.714	0.531	0.108	0.150	0.194	0.573	0.346	0.473	0.258	0.437	0.285	0.469	0.371	0.323	0.492
CNY (China) Z-Score	N/A	-0.164	-0.481	-0.982	-1.418	1.968	1.836	0.575	0.895	-0.103	0.269	0.684	0.380	-0.195	0.094	-0.107	0.395	0.303	0.394	-0.397	-0.375	-0.215
JPY (Japan) Z-Score	-1.849	0.179	-1.794	-1.811	-1.248	-0.429	-0.527	-0.576	-0.669	-1.298	-1.176	-1.030	-1.034	-1.298	-1.014	-0.970	-1.010	-1.005	-0.843	-1.033	-0.964	-1.100
EUR (Germany) Z-Score	0.374	0.885	-0.380	0.165	1.013	0.391	0.240	-1.079	-1.097	-0.843	-0.988	-1.060	-1.090	-0.856	-0.868	-0.590	-0.766	-0.523	-0.787	-0.417	-0.323	0.026
DKK (Denmark) Z-Score	N/A	N/A	-0.352	-0.465	0.309	-0.013	0.153	-1.213	-1.175	-0.649	-0.825	-0.874	-0.839	-0.631	-0.556	-0.652	-0.541	-0.276	-0.657	-0.467	-0.378	-0.186
SEK (Sweden) Z-Score	0.602	-0.609	1.911	1.336	2.290	0.116	0.479	-0.337	-0.489	-0.402	-0.140	-0.280	-0.265	-0.165	-0.225	-0.178	-0.311	-0.008	-0.184	-0.141	-0.061	-0.453
CAD (Canada) Z-Score	0.296	-0.269	-0.166	-0.218	-0.850	-2.307	-2.261	0.257	0.337	0.858	0.564	0.840	0.768	0.823	0.517	1.001	0.504	0.223	0.111	0.180	-0.138	-0.458
AUD (Australia) Z-Score	N/A	-1.983	-0.420	0.061	0.252	0.345	0.358	2.049	1.895	2.065	2.235	1.791	1.835	2.097	2.403	2.239	2.344	2.524	2.595	2.757	2.787	2.600
CHF (Switzerland) Z-Score	-1.182	-0.600	-0.945	-1.044	-0.425	-0.202	-0.754	-1.297	-1.286	-1.081	-1.074	-1.278	-1.332	-1.192	-1.137	-1.296	-1.020	-0.773	-0.635	-0.403	-0.230	0.044
GBP (Great Britain) Z-Score	0.729	1.549	0.660	0.431	0.052	-0.498	-0.206	-0.148	-0.073	-0.007	-0.174	-0.334	-0.292	-0.147	-0.631	-0.701	-0.983	-1.416	-1.118	-1.040	-1.195	-1.377
Absolute Average Z-Score (ALL)	0.866	0.805	0.825	0.822	0.753	0.688	0.745	0.845	0.871	0.797	0.796	0.883	0.882	0.815	0.806	0.817	0.842	0.728	0.768	0.709	0.666	0.689
Absolute Average Z-Score (Positives)	0.606	0.906	1.134	0.753	0.691	0.757	0.683	0.930	0.958	1.096	0.876	0.971	0.970	1.121	0.886	1.123	0.926	0.800	0.845	0.974	1.222	0.758
Absolute Average Z-Score (Negatives)	1.516	0.725	0.648	0.904	0.829	0.631	0.820	0.775	0.798	0.626	0.730	0.809	0.809	0.640	0.739	0.642	0.772	0.667	0.704	0.557	0.458	0.631



Table B: Every Date for a Specific Curve

This final slide is a summary of all the data, shown in a different format. The currencies are on the left axis, and dates are the horizontal array at the top of the slides. The z-scores are found in the far-right columns. Again, the gravitation to bunching is shown. We can also see the outliers in the z-scores.

These slides are all derived from market-based prices that were listed and obtained via a Bloomberg terminal data system. Analysts can guess at the forces that changed these prices. We do that as well. We can draw conclusions about how the market dampens the activity and transfers volatility to the currencies. How the mechanism will evolve remains to be seen.



Table B: Every date for a specific curve

Country	Spread Tenor	Range	Mean	Std. Dev.	7/2/2009 Z-Score	7/26/2012 Z-Score	6/24/2016 Z-Score	11/9/2016 Z-Score	11/17/2017 Z-Score	11/1/2019 Z-Score	1/21/2020 Z-Score	12/29/2020 Z-Score	01/07/2021 Z-Score	05/20/2021 Z-Score	06/18/2021 Z-Score	07/26/2021 Z-Score	08/30/2021 Z-Score	09/24/2021 Z-Score	10/27/2021 Z-Score	11/29/2021 Z-Score	1/28/2022 Z-Score	2/11/2022 Z-Score	3/4/2022 Z-Score	3/25/2022 Z-Score	4/8/2022 Z-Score	4/29/2022 Z-Score	Absolute Average Z-Score (ALL)	Absolute Average Z-Score (Positives)	Absolute Average Z-Score (Negatives)
U.S. TREASURY	Intermediate Spread (2 & 10YR)	2.437	0.815	0.573	2.957	0.710	0.220	0.616	-0.355	-1.165	-1.016	-0.046	0.101	1.176	0.665	0.506	0.466	0.623	0.389	0.281	-0.400	-0.805	-1.121	-1.297	-1.266	-1.238	0.792	0.726	0.871
	Long-Term Spread (3M & 30YR)	3.577	1.877	0.660	3.450	0.792	0.245	0.732	-0.618	-1.970	-1.903	-0.577	-0.314	0.617	0.064	0.000	-0.090	0.036	-0.009	-0.147	-0.108	-0.141	-0.299	0.103	0.060	0.077	0.561	0.561	0.561
U.S. AAA MUNI	Intermediate Spread (2 & 10YR)	1.900	0.786	0.390	3.741	1.411	-0.063	0.499	0.043	-1.129	-0.913	-0.611	-0.565	0.219	0.063	-0.027	0.153	0.230	0.527	0.153	-0.293	-0.516	-0.549	-0.788	-0.839	-0.744	0.640	0.704	0.586
	Long Term Spread (3M & 30YR)	1.017	1.549	0.238	N/A	N/A	0.819	2.099	0.579	-2.182	-1.698	-0.856	-0.751	0.145	-0.478	-0.865	-0.242	-0.137	0.268	-0.553	0.007	0.188	0.154	1.151	1.038	1.316	0.776	0.706	0.862
CNY (China)	Intermediate Spread (2 & 10YR)	1.639	0.667	0.315	4.318	0.753	-0.880	-0.544	-0.690	-0.182	-0.005	-0.620	-0.290	-0.049	-0.284	-0.119	-0.284	-0.366	-0.163	-0.515	-0.008	0.220	0.008	-0.230	-0.154	0.084	0.489	1.077	0.317
	Long Term Spread (3M & 30YR)	0.750	1.382	0.177	N/A	-0.098	-1.383	-1.468	-2.996	-0.008	0.389	-0.551	0.960	0.468	0.626	1.068	0.128	-0.585	0.134	-0.811	0.836	1.249	0.938	0.066	0.287	0.751	0.752	0.608	0.987
JPY (Japan)	Intermediate Spread (2 & 10YR)	0.990	0.253	0.203	4.050	1.508	-0.772	-0.293	-0.170	-0.836	-0.669	-0.437	-0.471	-0.195	-0.333	-0.511	-0.441	-0.323	-0.229	-0.224	-0.175	0.101	-0.229	0.146	0.289	0.215	0.574	1.051	0.394
	Long Term Spread (3M & 30YR)	1.571	0.908	0.341	3.296	2.223	-1.306	-0.539	0.091	-1.063	-1.037	-0.378	-0.395	-0.337	-0.313	-0.381	-0.413	-0.337	-0.313	-0.269	-0.222	0.117	0.044	0.384	0.639	0.507	0.664	0.913	0.522
EUR (Germany)	Intermediate Spread (2 & 10YR)	1.919	0.622	0.432	3.418	1.993	-0.161	0.507	1.218	-0.703	-0.622	-1.022	-0.987	-0.147	-0.383	-0.693	-0.716	-0.353	-0.358	-0.376	-0.288	-0.136	-0.106	0.063	-0.099	-0.048	0.654	1.440	0.423
	Long Term Spread (3M & 30YR)	3.112	1.254	0.689	3.509	1.502	-0.093	0.611	1.207	-0.614	-0.594	-1.011	-1.008	-0.298	-0.527	-0.712	-0.744	-0.386	-0.542	-0.366	-0.437	-0.094	-0.440	0.187	0.299	0.550	0.715	1.124	0.524
DKK (Denmark)	Intermediate Spread (2 & 10YR)	1.928	0.729	0.381	3.805	N/A	0.205	0.405	1.029	-0.757	-0.728	-1.250	-1.205	0.009	-0.253	-0.552	-0.641	-0.149	-0.177	-0.295	-0.156	-0.038	-0.015	0.274	0.239	0.253	0.592	0.777	0.478
	Long Term Spread (3M & 30YR)	1.229	1.074	0.315	N/A	N/A	0.413	0.946	2.075	-1.218	-0.831	-1.824	-1.754	0.267	-0.333	-0.710	-0.694	0.042	-0.073	-0.323	-0.028	0.759	-0.181	0.892	1.133	1.444	0.797	0.885	0.724
SEK (Sweden)	Intermediate Spread (2 & 10YR)	2.074	0.681	0.462	3.700	-0.283	1.093	0.844	1.545	-0.788	-0.437	-0.612	-0.602	0.234	-0.011	-0.385	-0.407	-0.071	-0.197	-0.398	-0.558	-0.346	-0.584	-0.446	-0.560	-0.729	0.674	1.483	0.436
	Long Term Spread (3M & 30YR)	3.103	1.479	0.707	3.335	-0.714	1.258	1.074	1.771	-1.052	-0.768	-0.842	-0.871	-0.258	-0.258	-0.501	-0.517	-0.265	-0.350	-0.389	-0.425	-0.046	-0.316	0.082	0.165	-0.115	0.699	1.281	0.480
CAD (Canada)	Intermediate Spread (2 & 10YR)	2.281	0.615	0.478	3.271	0.097	0.160	0.543	-0.165	-1.494	-1.502	-0.127	0.015	1.348	0.693	0.476	0.402	0.605	-0.146	0.059	-0.301	-0.449	-0.719	-0.935	-0.937	-0.895	0.697	0.697	0.640
	Long Term Spread (3M & 30YR)	3.723	1.466	0.692	3.103	-0.279	-0.240	0.036	-0.470	-2.278	-2.269	-0.464	-0.277	0.780	0.243	0.256	0.165	0.377	0.247	0.457	0.171	0.140	-0.088	0.361	0.130	-0.101	0.588	0.497	0.718
AUD (Australia)	Intermediate Spread (2 & 10YR)	1.327	0.970	0.368	1.608	-1.503	-1.210	-0.743	-0.542	-1.729	-1.444	-0.162	0.074	1.874	1.413	0.403	0.367	1.054	1.242	0.386	-0.015	0.031	0.028	0.272	-0.515	-0.890	0.796	0.729	0.875
	Long Term Spread (3M & 30YR)	3.390	2.074	0.825	N/A	-2.799	-1.097	-0.544	-0.455	-1.526	-1.436	-0.171	-0.029	0.741	0.436	0.011	-0.016	0.259	0.719	0.382	0.514	0.777	0.712	1.310	1.217	0.996	0.769	0.673	0.897
CHF (Switzerland)	Intermediate Spread (2 & 10YR)	1.653	0.615	0.324	3.755	0.983	-0.493	-0.008	0.402	-1.132	-1.348	-0.907	-0.947	0.106	-0.181	-0.490	-0.555	-0.175	-0.261	-0.206	-0.172	-0.095	0.078	0.461	0.492	0.693	0.634	0.871	0.498
	Long Term Spread (3M & 30YR)	2.062	0.983	0.468	3.295	-0.002	-0.180	0.235	0.798	-0.768	-1.101	-1.114	-1.105	-0.145	-0.284	-0.684	-0.748	-0.306	-0.532	-0.699	-0.333	0.173	0.096	0.873	1.123	1.409	0.727	1.000	0.572
GBP (Great Britain)	Intermediate Spread (2 & 10YR)	2.344	0.589	0.528	3.513	1.687	0.616	0.839	0.491	-0.911	-0.671	-0.380	-0.274	0.497	0.160	-0.158	-0.192	-0.012	-0.383	-0.381	-0.573	-0.781	-0.923	-0.694	-0.790	-0.680	0.709	1.115	0.520
	Long Term Spread (3M & 30YR)	3.411	1.308	0.753	3.483	2.077	0.553	0.657	0.385	-1.045	-0.839	-0.453	-0.316	0.280	-0.036	-0.276	-0.274	-0.011	-0.396	-0.478	-0.615	-0.752	-0.696	-0.363	-0.401	-0.482	0.676	1.239	0.465



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