# Mortgage Credit Risk Transfer (CRT) while emerging from a Pandemic

Michael C. Schmitz, FCAS, MAAA - Principal and Consulting Actuary, Milliman
Alan Tiernan, FIA, FCAS, FSAI - Chief Actuary, Global Mortgage Group Arch Capital Group Ltd.
Jonathan Berenbom, FCAS, MAAA - Managing Director, Guy Carpenter

2022 CAS Seminar on Reinsurance
June 6, 2023

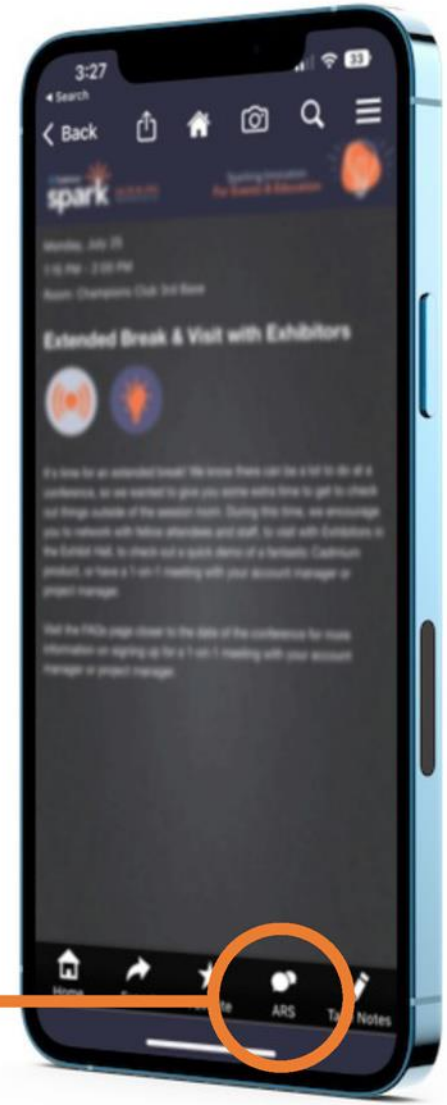
Milliman

# Milliman

- Private Mortgage Insurance (PMI) – the basics
- Tracking a changing economic environment
- GSE loan performance update
- Long-term view of mortgage credit risk
- Reinsurer PML in uncertain times

## Get your devices ready for a poll!

1. Locate the session in the mobile app.
2. Tap the “ 💬 ” button on the bottom menu bar of the session to open the poll.
3. The poll will launch when polling begins.



This slide will activate the polling question once the presentation is started.
Do not change or delete text on this slide.

**Poll Key= QSXQJ**

**Label = Mortgage/CRT Market**

# Basics of Private Mortgage Insurance (PMI)

- Front-end risk transfer
- Covers lender/investor for financial loss if borrower defaults
- Generally required if (loan > 80% x property value)
- What makes it different:
  - Long term contracts with pricing set up front
  - Reserves only cover delinquent loans – claims vs cures
  - But ultimate losses have substantial tail risk
  - Mismatch between revenue and expense
  - Therefore contingency reserves and capital requirements
  - Reserving: short-ish tail
  - Pricing/PDR/Capital Adequacy: long tail!
- Q/S and XOL but function similarly for PMIERs capital relief
- CRT shares these risk characteristics

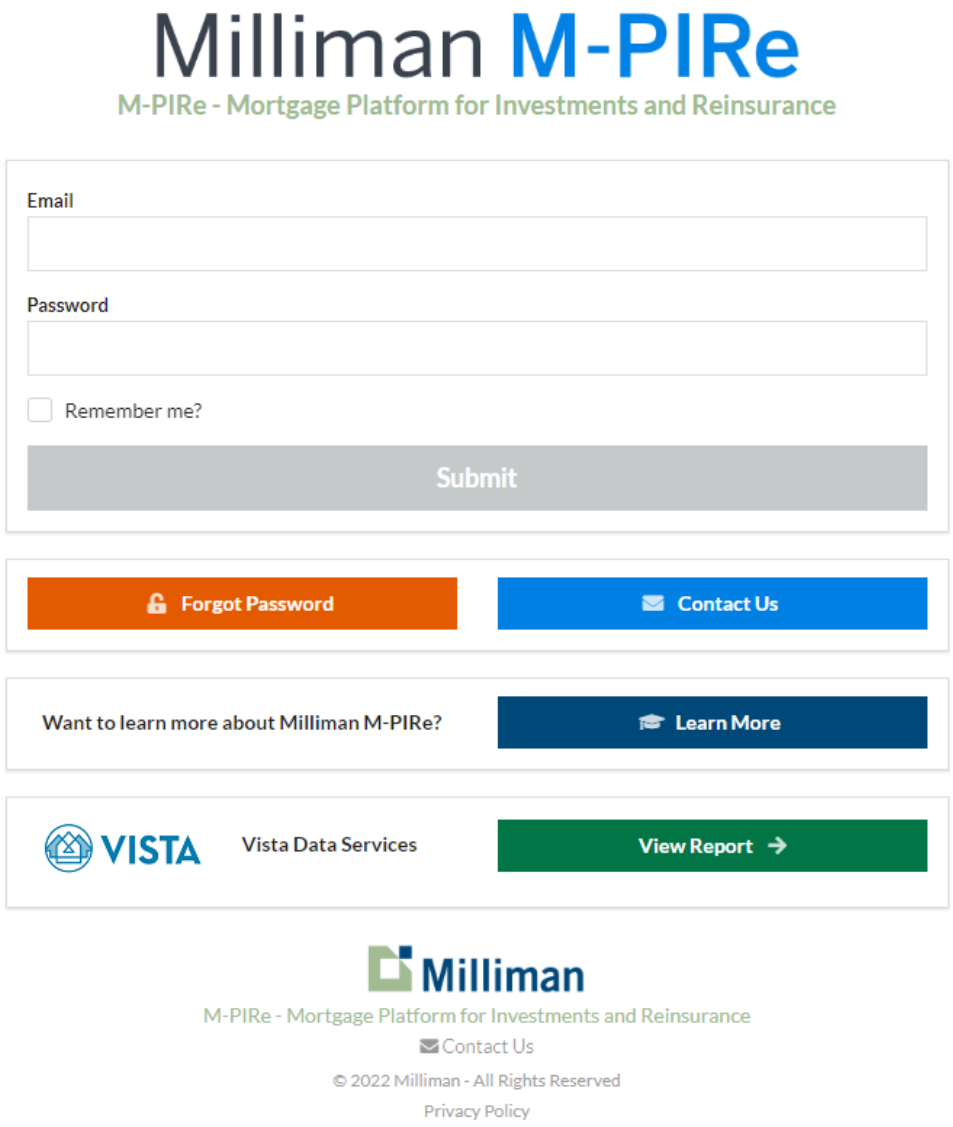
Milliman

# Milliman M-PIRe

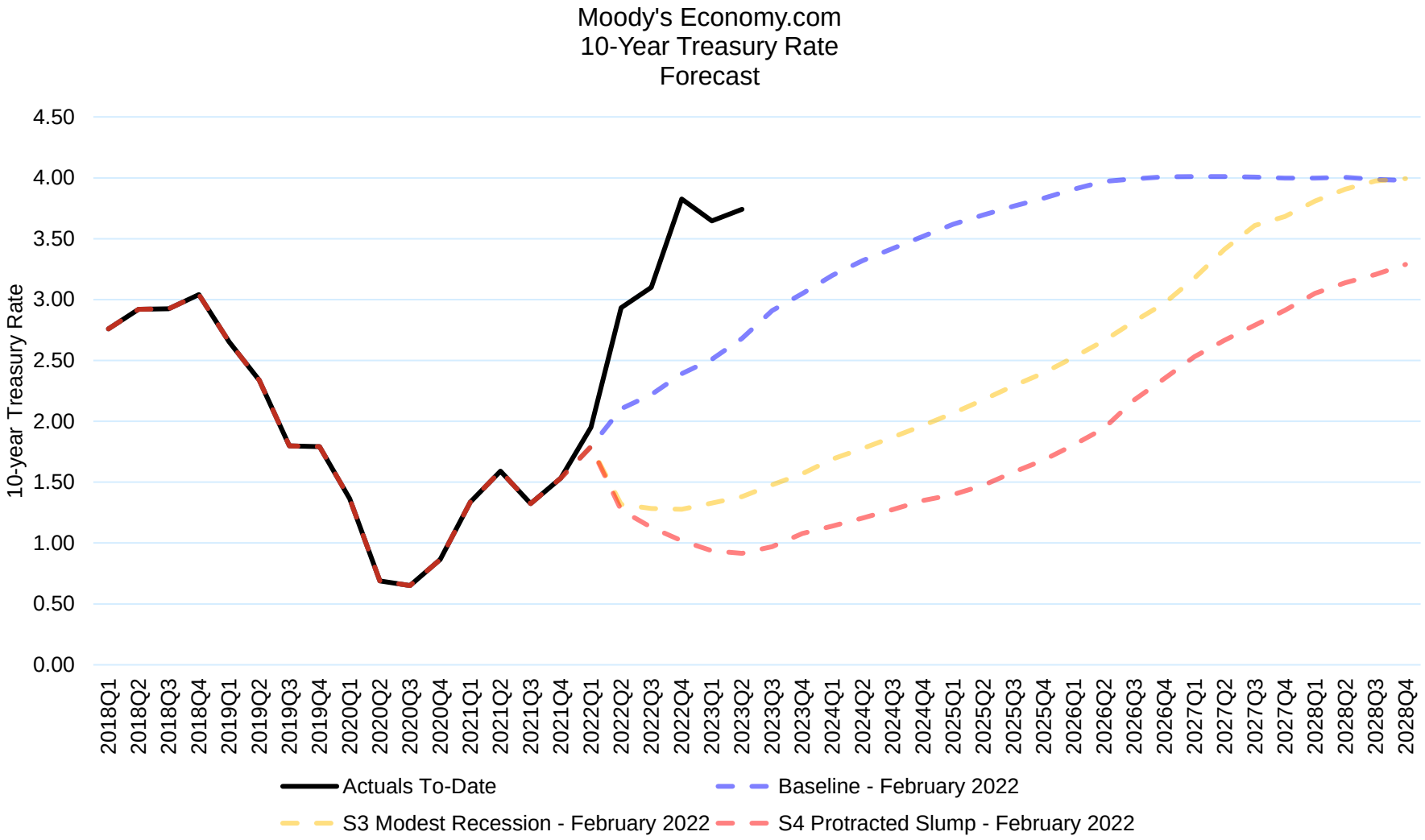
End-to-end CRT and mortgage reinsurance analytics software solution

# Key Product Features

1. Contains all required data for complete and thorough CRT analysis **including reinsurance and private transactions**: Eliminates the requirement for time-consuming data collection, processing, and report generation
2. 100% Cloud-based product with all required integrated modules for CRT analysis: No need to purchase multiple licenses from multiple providers and try to stich the pitches together
3. Real-time updates to platform for all users: All users received continuous updates to the platform; clients do not need to download or update software
4. Stochastic portfolio analysis can be performed within minutes for a new portfolio: M-PIRe was built by a development team with expertise in mortgage analysis and high-frequency trading.
5. Coverage for multiple exposure types: GSE CRT, MI Reinsurance, MI ILN, Multifamily, and non-US risk transfer deals



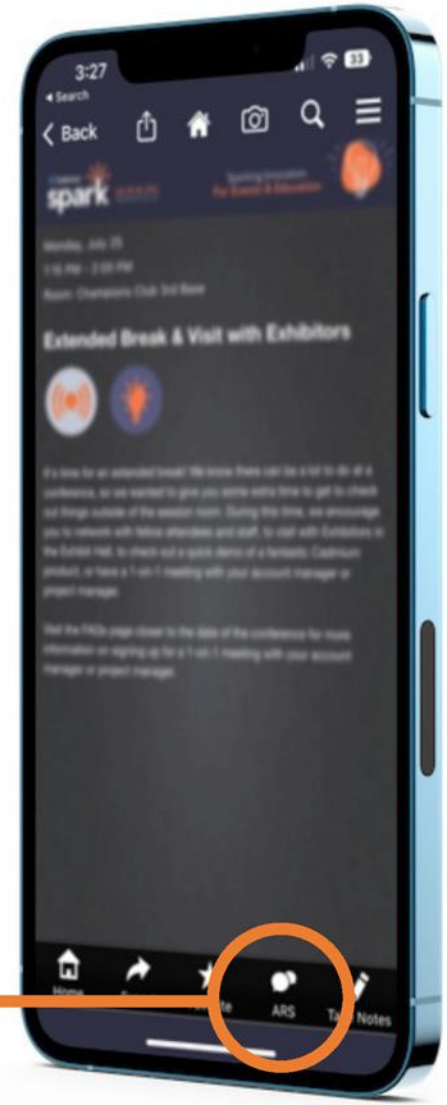
# Economics post-pandemic: 10-Year Treasury




Moody's Economy.com – Interest Rates: 10-Year Treasury Constant Maturities, (% p.a., NSA)

## Get your devices ready for a poll!

1. Locate the session in the mobile app.
2. Tap the “ 💬 ” button on the bottom menu bar of the session to open the poll.
3. The poll will launch when polling begins.

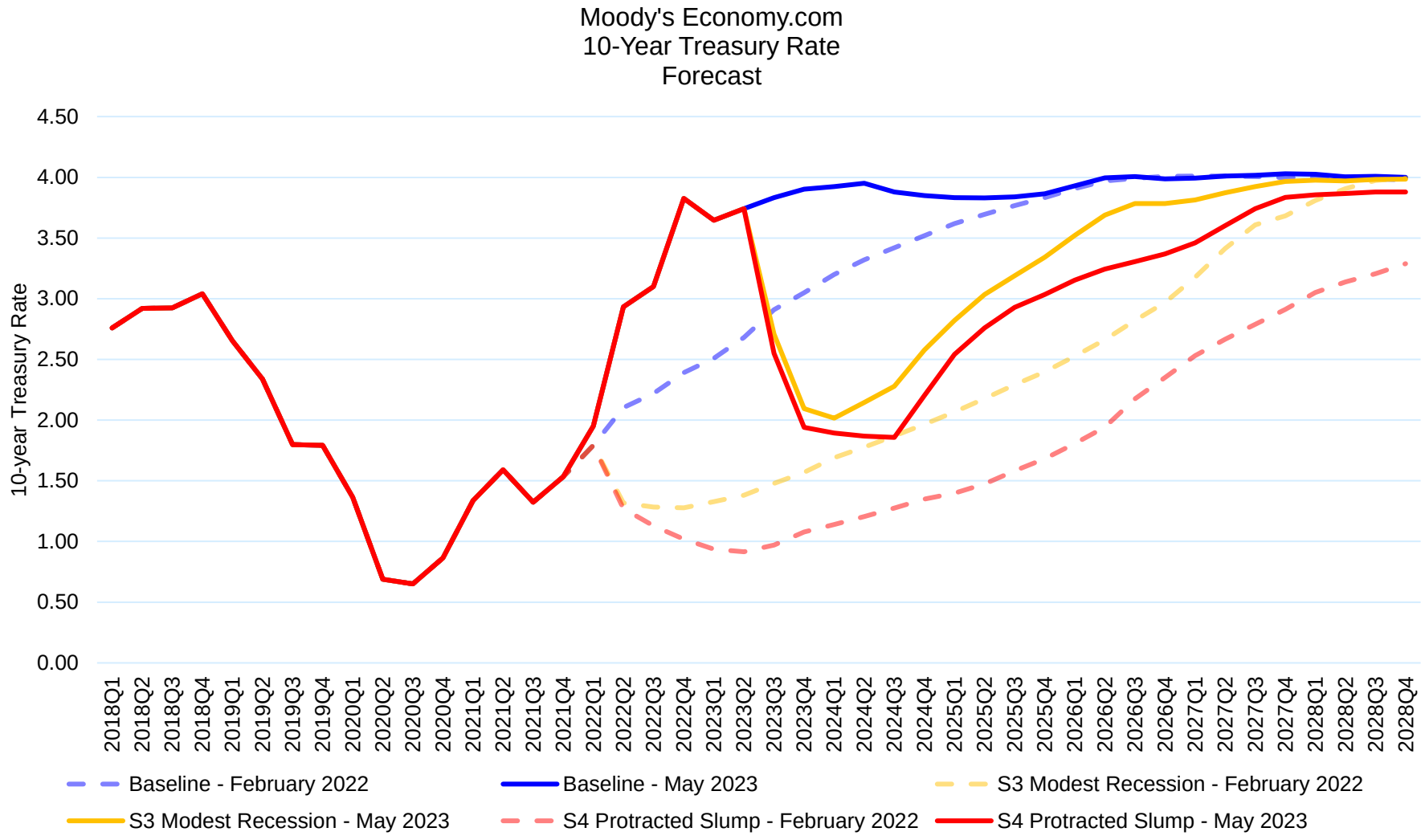


This slide will activate the polling question once the presentation is started.
Do not change or delete text on this slide.

**Poll Key= WMXFB**

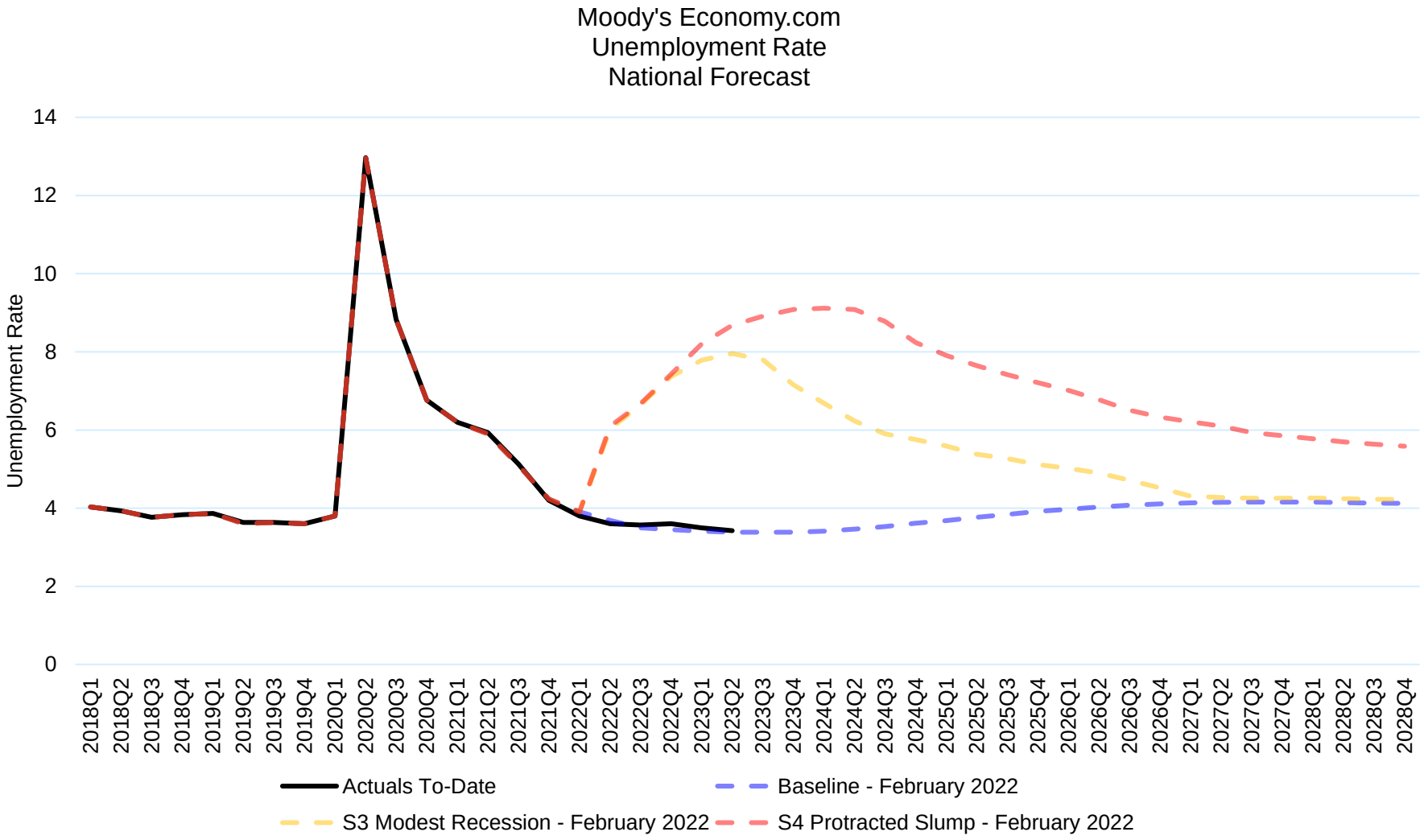
**Label = 10 year Treasury**

# Economics post-pandemic: 10-Year Treasury



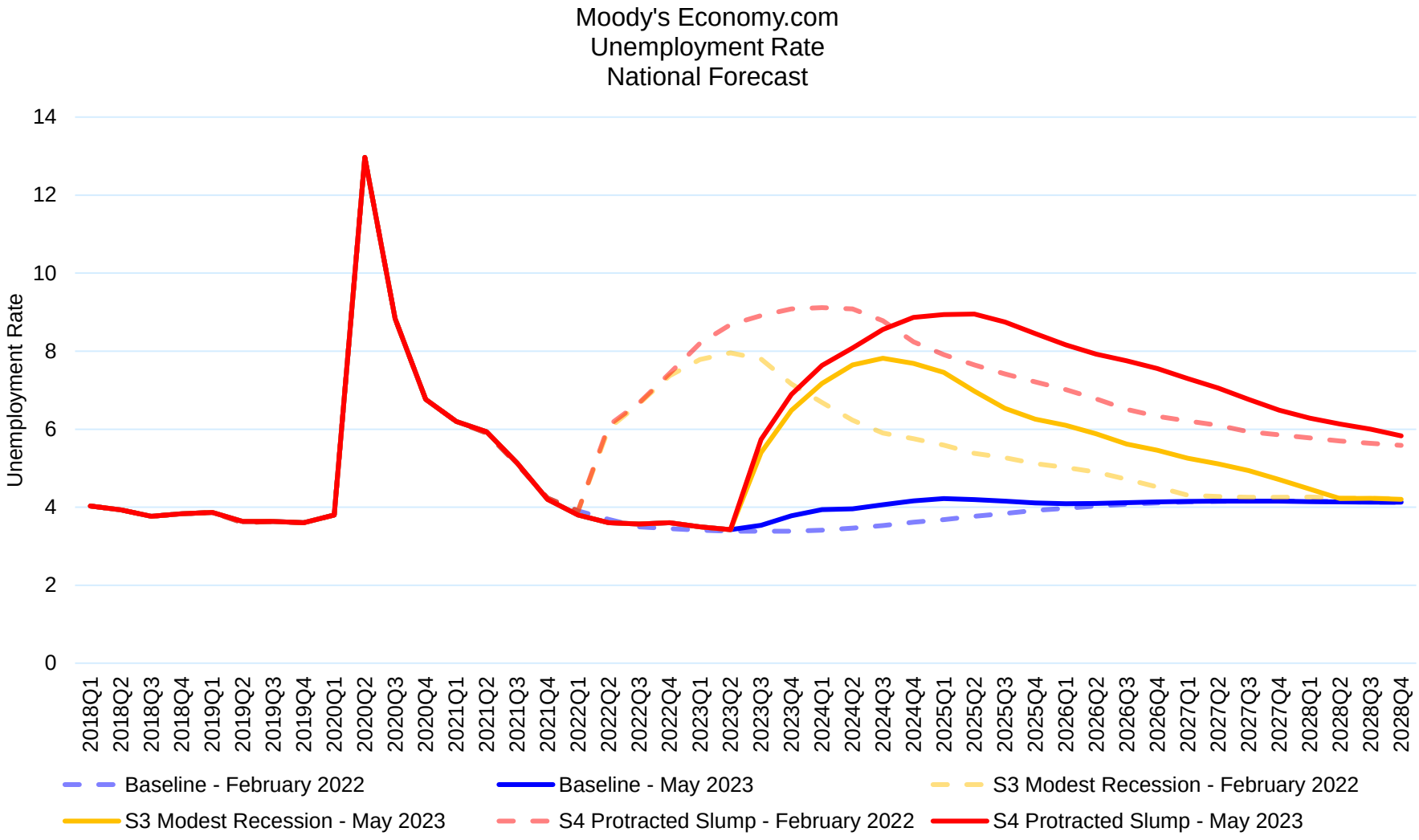

Moody's Economy.com – Interest Rates: 10-Year Treasury Constant Maturities, (% p.a., NSA)

# Economics post-pandemic: Unemployment Rate



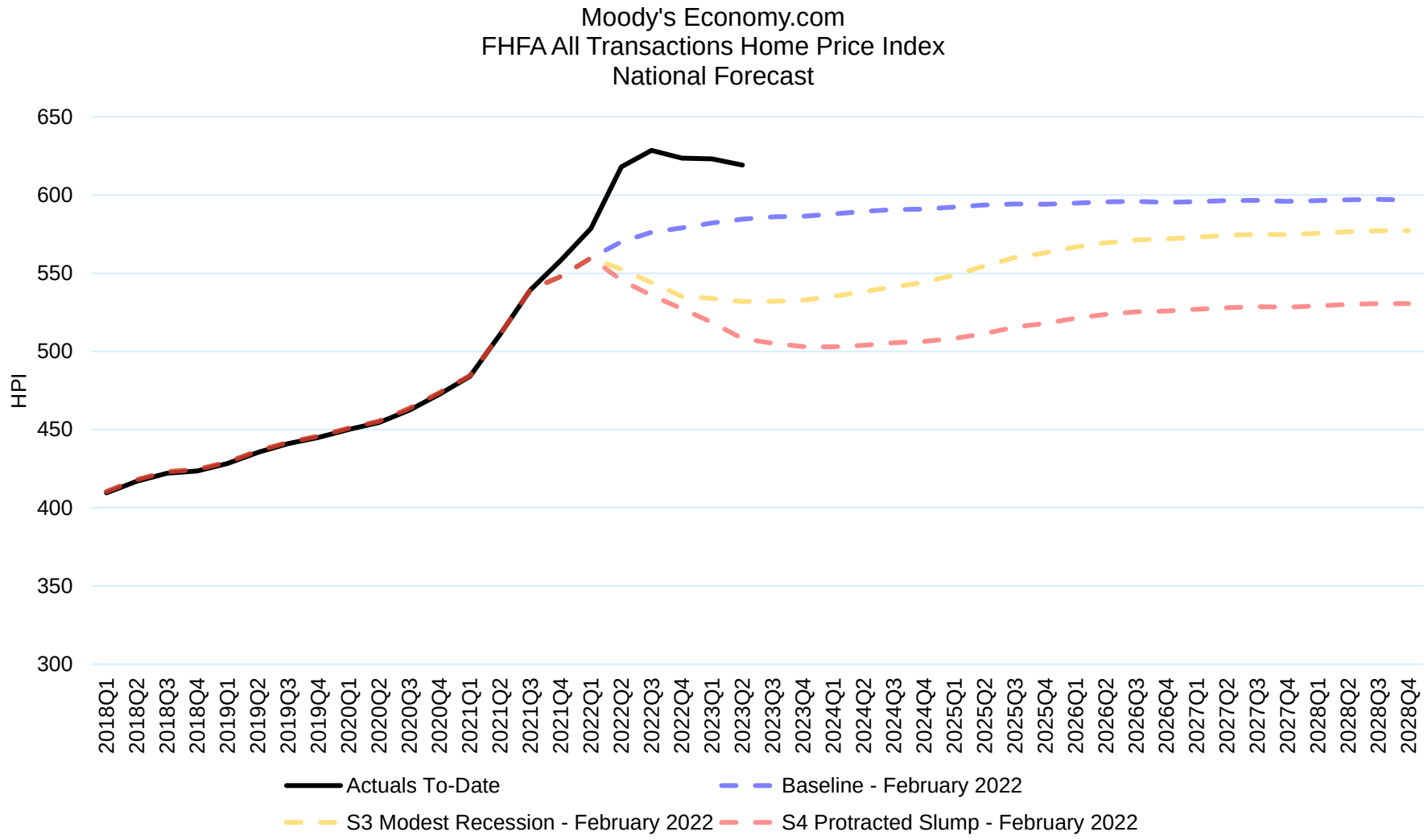

Moody's Economy.com – Household Survey: Unemployment Rate, (%, SA)

# Economics post-pandemic: Unemployment Rate




Moody's Economy.com – Household Survey: Unemployment Rate, (%, SA)

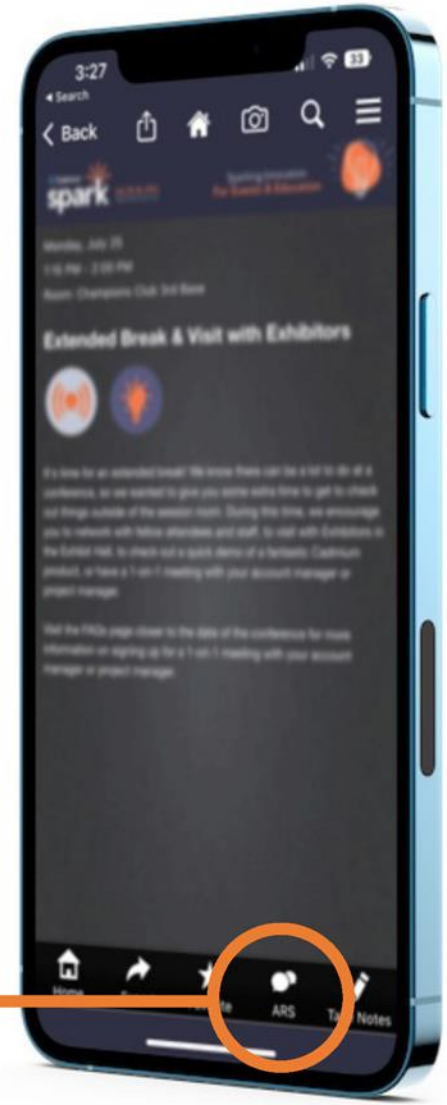
# Economics post-pandemic: Home Prices (FHFA)




Moody's Economy.com – FHFA All Transactions Home Price Index, (Index 1980Q1=100, NSA)

## Get your devices ready for a poll!

1. Locate the session in the mobile app.
2. Tap the “ 💬 ” button on the bottom menu bar of the session to open the poll.
3. The poll will launch when polling begins.

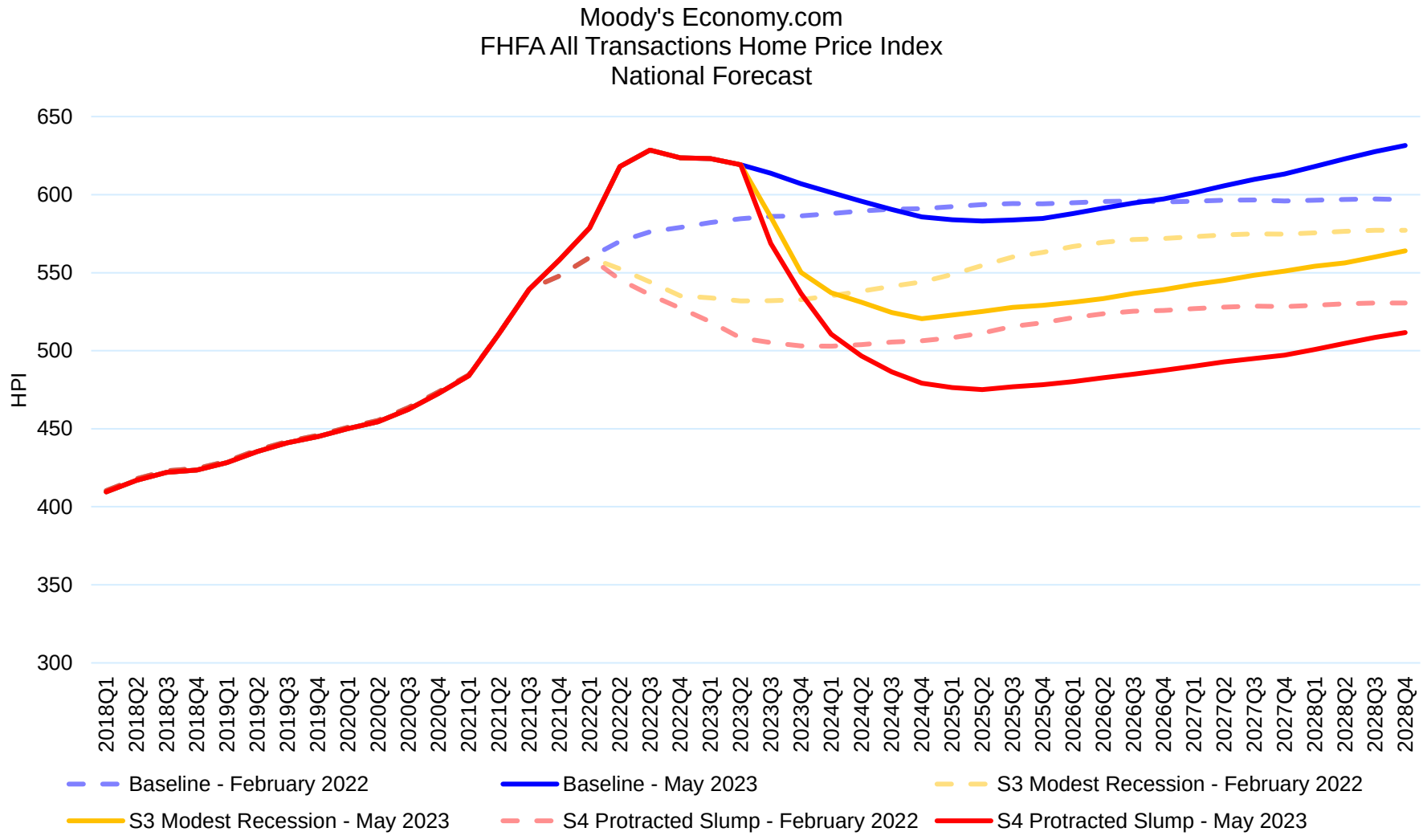


This slide will activate the polling question once the presentation is started.
Do not change or delete text on this slide.

**Poll Key= PHYZK**

**Label = Cumulative home price change**

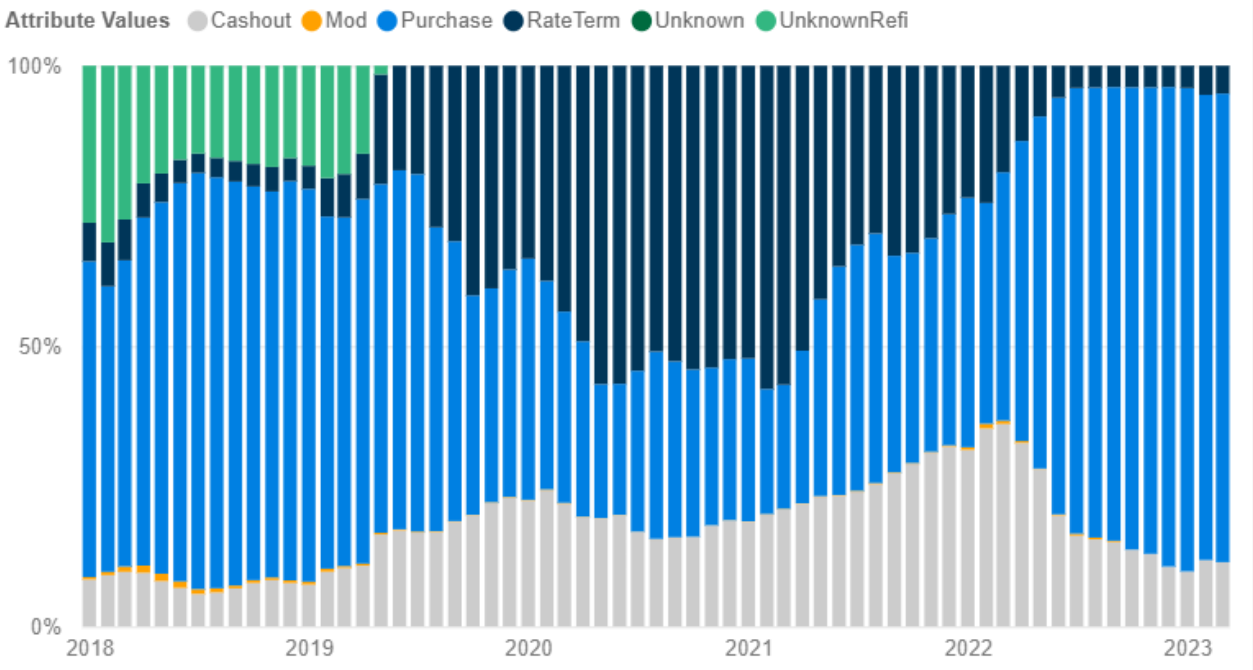
# Economics post-pandemic: Home Prices (FHFA)



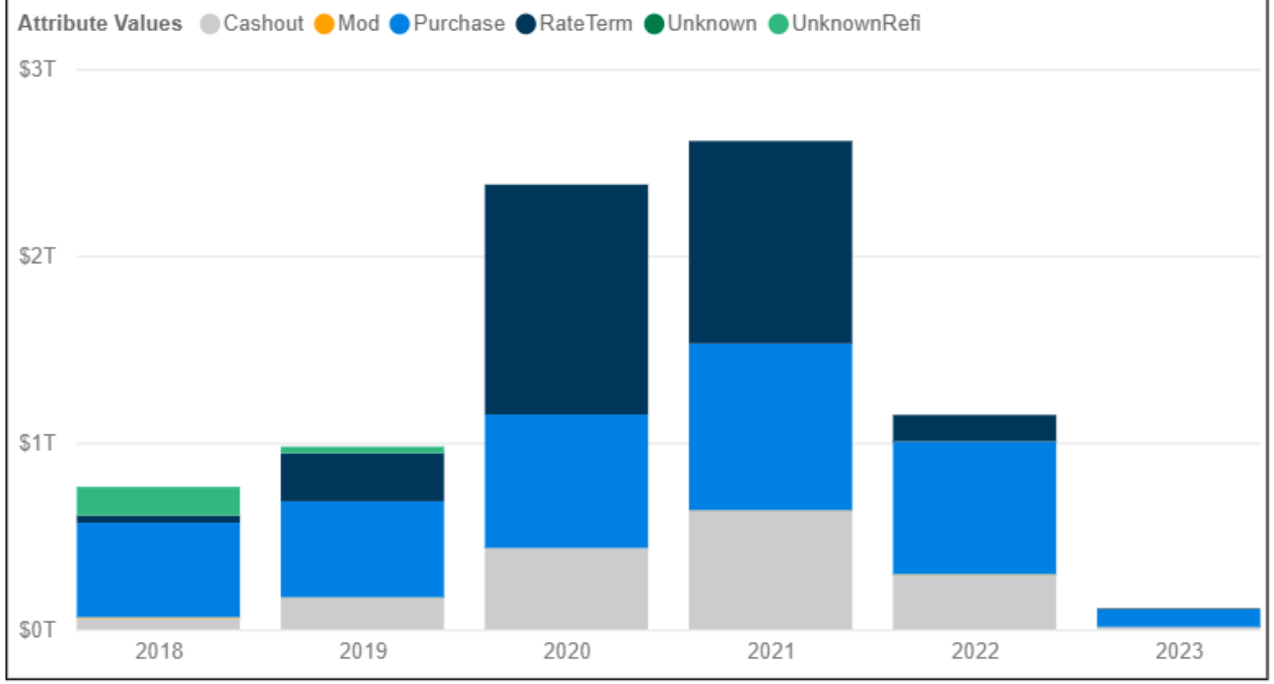

Moody's Economy.com – FHFA All Transactions Home Price Index, (Index 1980Q1=100, NSA)

# Purchase vs Refi Market

## Volume Distribution By Loan Purpose



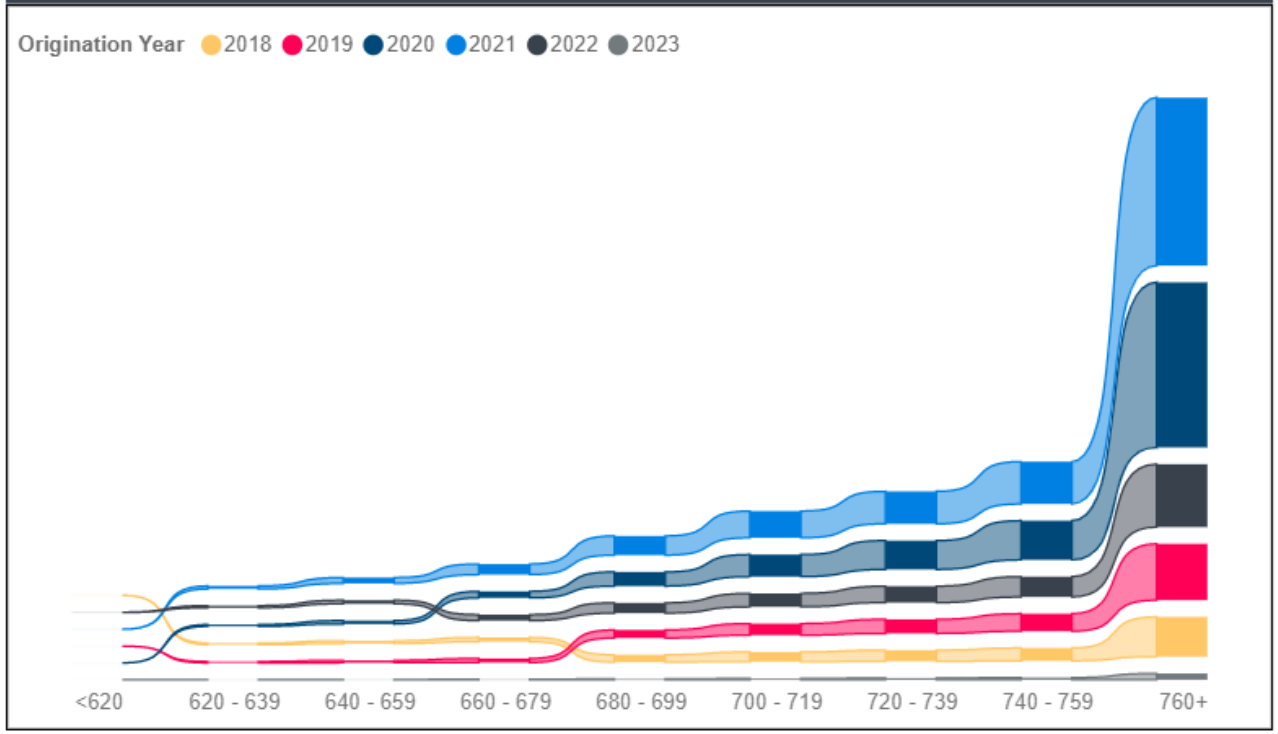

## Volume By Loan Purpose



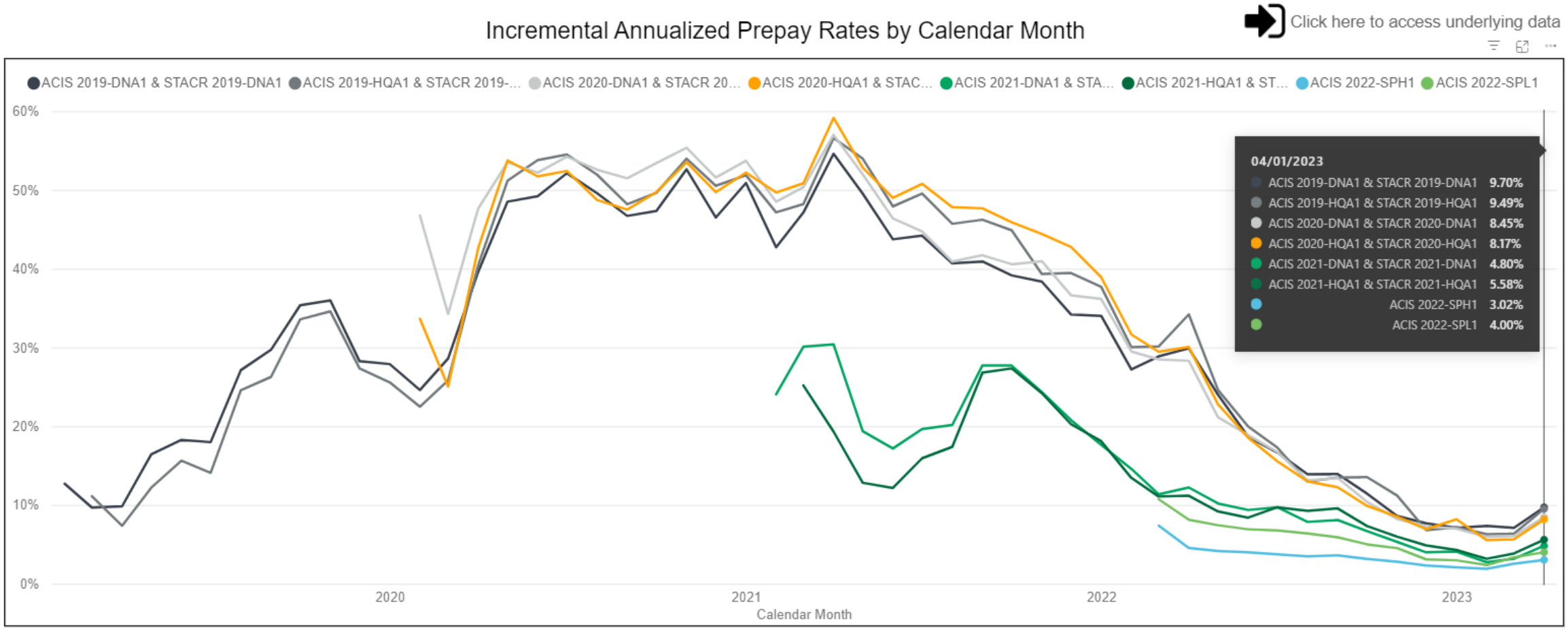
# FICO Trends

## Average FICO By Investor


## Volume Comparison For FICO

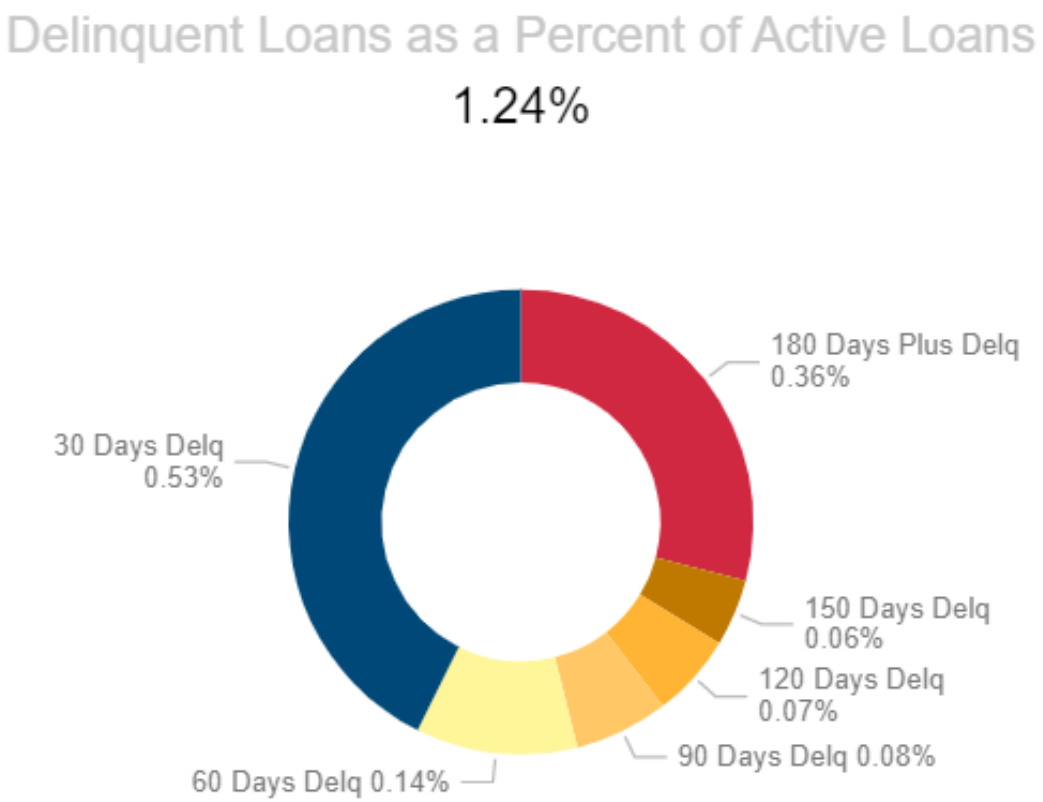


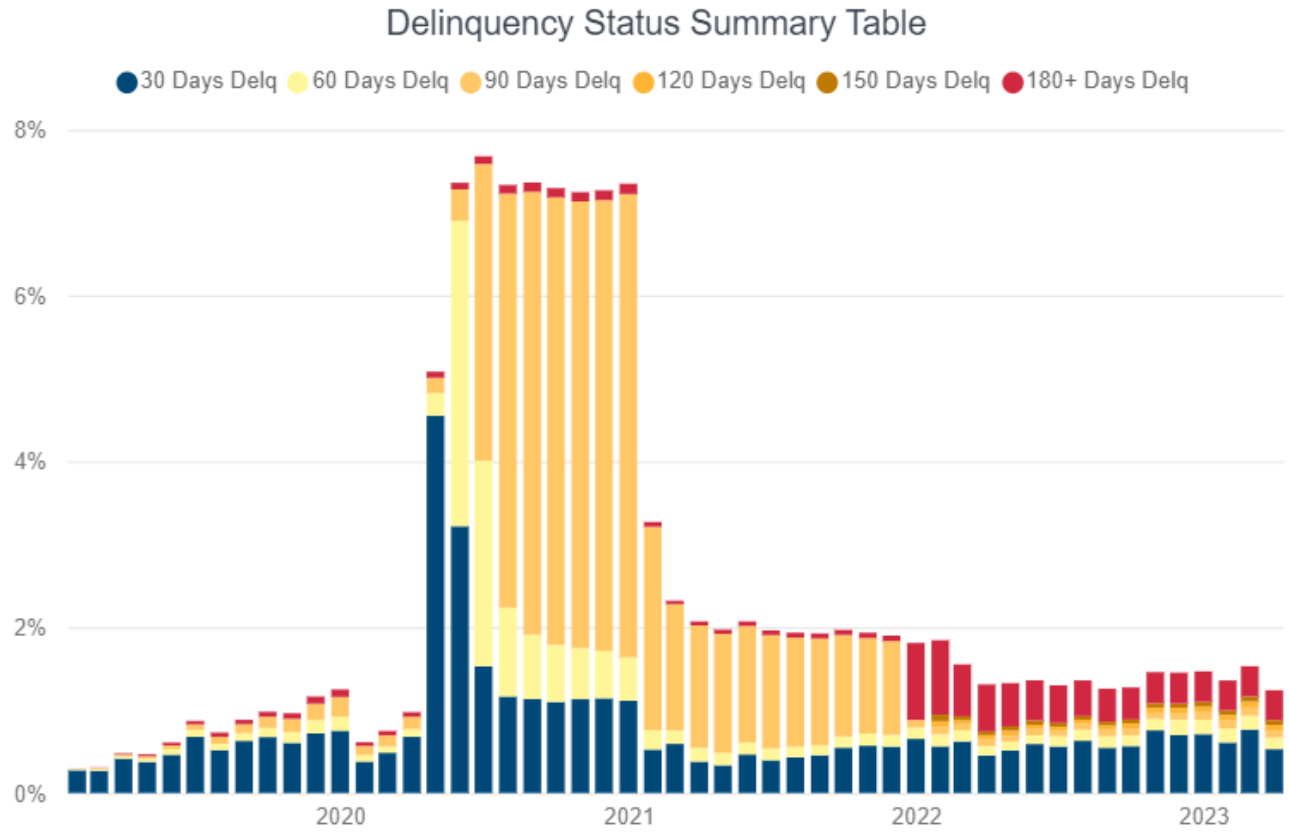
# Prepayment Speeds




Milliman M-PIRe - Annualized Prepayment Rate - Select ACIS transactions, 2019 through 2022 - Data through April 2023

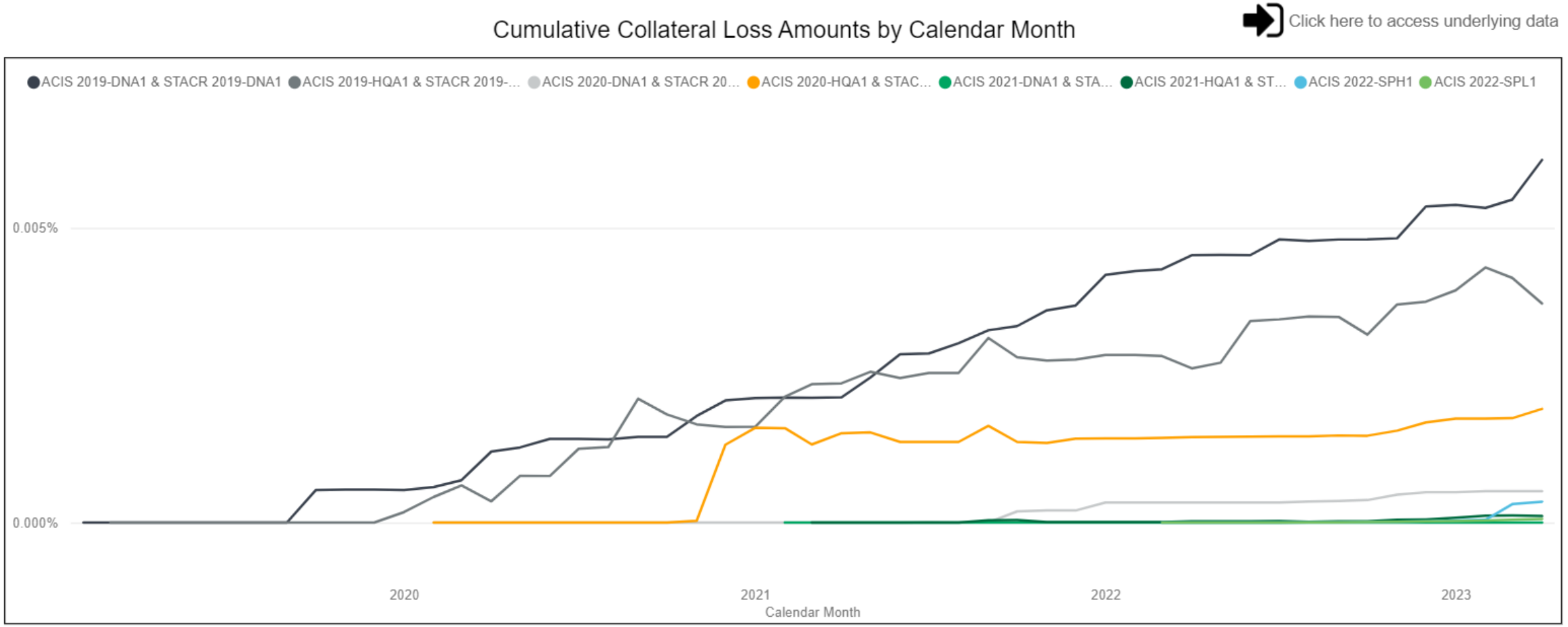
# Delinquency Rates




Milliman M-PIRe – Current and Historical Delinquencies - Select ACIS transactions, 2019 through 2022 - Data through April 2023

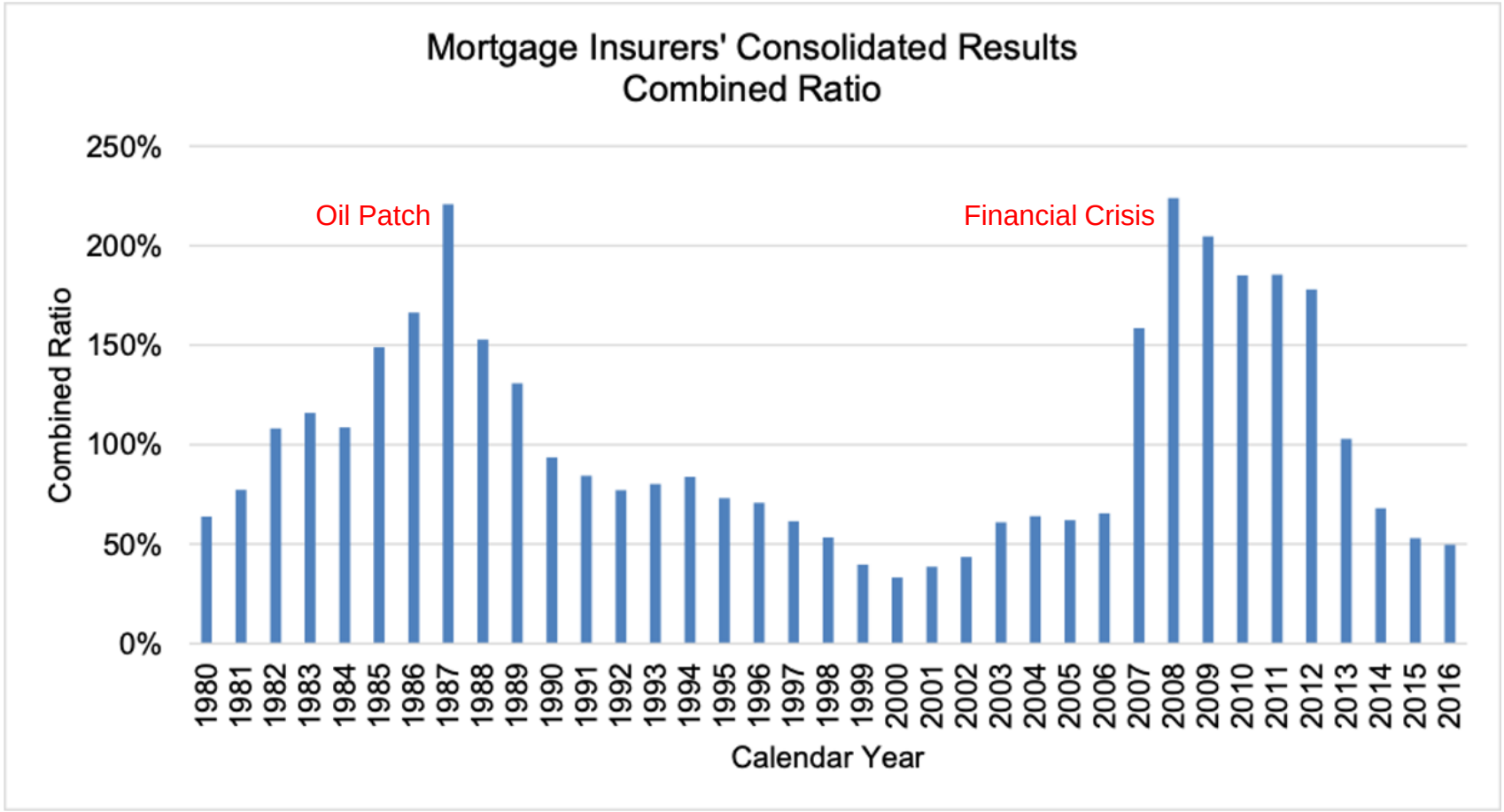
# Net Loss Rates



# Mortgage Insurance Cycles

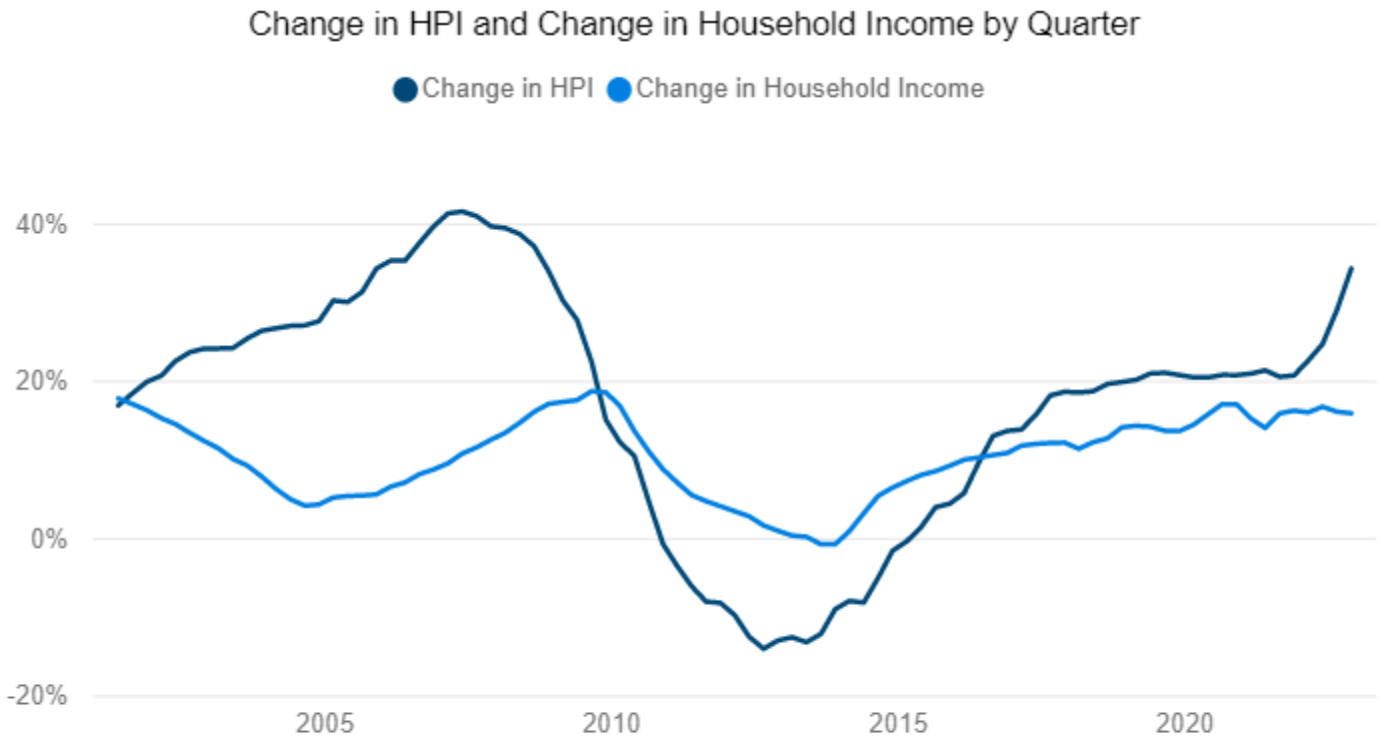
## Housing Economics – Managing the Supply and Demand Curve

- Historical performance fundamentally impacted more by economics than credit
- However, credit shifts fundamentally linked by product changes as a results of economics:
  - No or negative amortization features
  - Limited terms
  - Downpayment / CLTV
  - Property Types
- Avoidance of “financing one’s way into a home”



# Economics

## House Prices vs. Personal Income

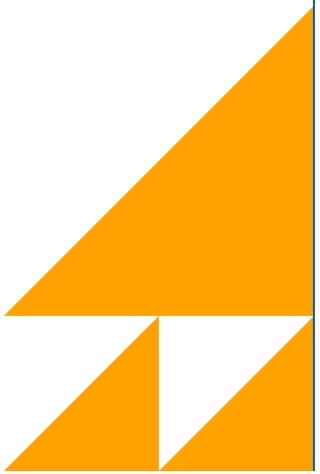



Change in HPI and Household Income is calculated by taking the prior years value over the value from 5 years prior. For example, The change in HPI for 1/1/2019 is calculated by taking the HPI as of 1/1/2018 over the HPI as of 1/1/2014

Source: Milliman M-PIRe

# Considerations for Defining a Mortgage PML

**Mortgage credit risk reinsurance is structured and modeled quite differently than traditional P&C exposures. Therefore, the PML approach is often unique for mortgage reinsurance.**



1

**What considerations are there to ensure that the measure of risk is consistent across the enterprise**

- Aligning magnitude of stress with firm-wide risk tolerances
- Aligning underlying modeling drivers to maintain consistency across firm
  - E.g., if using a deterministic scenario, is it internally consistent with other similar business lines (e.g., unemployment rate shock)
- Should the PML decline over-time if there is a strong housing market or strong performance to-date?
- Should the PML increase over-time if there is an adverse housing market or sudden increase in defaults?

2

**How will this be used to make business decisions and/or impact financials**

- Will this figure be the constraint on capacity/new writings?
- Should historical cashflows be considered?
- Will this figure impact financial statements?
- Ultimate vs. Accident Year PML
  - Mortgage has unique/prolonged loss development
  - Is the business concerned with summarizing lifetime losses in one figure or appreciating how losses develop over-time
- Measuring Gross or Net Loss
- Understanding how the PML changes period to period and key drivers of change

# PML Analytical Methods

Design of a PML Scenario

**Separate from the business considerations/implications of the PML, several different analytical techniques/choices can be defended when choosing a methodology.**

## Single Scenario

- Using a single scenario to set PML
  - Simplicity / Interpretability
    - Senior stakeholders can easily understand a single scenario
  - Married to one view
    - Layering-in conservatism and exploring results sensitivity becomes difficult without other benchmarks to consult

## Multiple Scenarios

- Using an average of multiple scenarios or stochastic trials to set PML
  - Flexibility
    - Multiple stress dynamics can be averaged/ weighted to account for different downside risks
  - Stability
    - E.g., TVaR vs. VaR; avg over part of the dist.

## Deterministic

- Defining macroeconomic forecast inputs
  - Simplicity / Interpretability
    - Senior stakeholders can easily understand the inputs and it does not change over time
  - Calibration
    - Given inputs are selected, it may be difficult to understand what VaR this represents

## Stochastic

- Simulating future mortgage performance
  - Consistency
    - If other business lines use a 99$^{th}$ pct'l PML, you can select the same for mortgage
  - Stability
    - If the distribution is conditioned on to-date performance, it may change month-to-month

Milliman

Arch | MI

# CAS Seminar on Reinsurance
# Global Perspective: Mortgage Insurance in Australia

*Alan Tiernan, FIA, FCAS, FSAI*
*Chief Actuary, Global Mortgage Group*
*Arch Capital Group Ltd.*

# Discussion Topics

1. **Mortgage Insurance in Australia vs. the U.S.**
   How do the markets and products compare structurally?

2. **Historical Economic Trends and Performance**
   Discussion of how Australia has experienced a relatively “stress-free” history, even during the Global Financial Crisis (GFC).

3. **Current State and Outlook**
   How are the economic factors that affect housing trending now, and how does that compare to the U.S.?

# Market Comparison

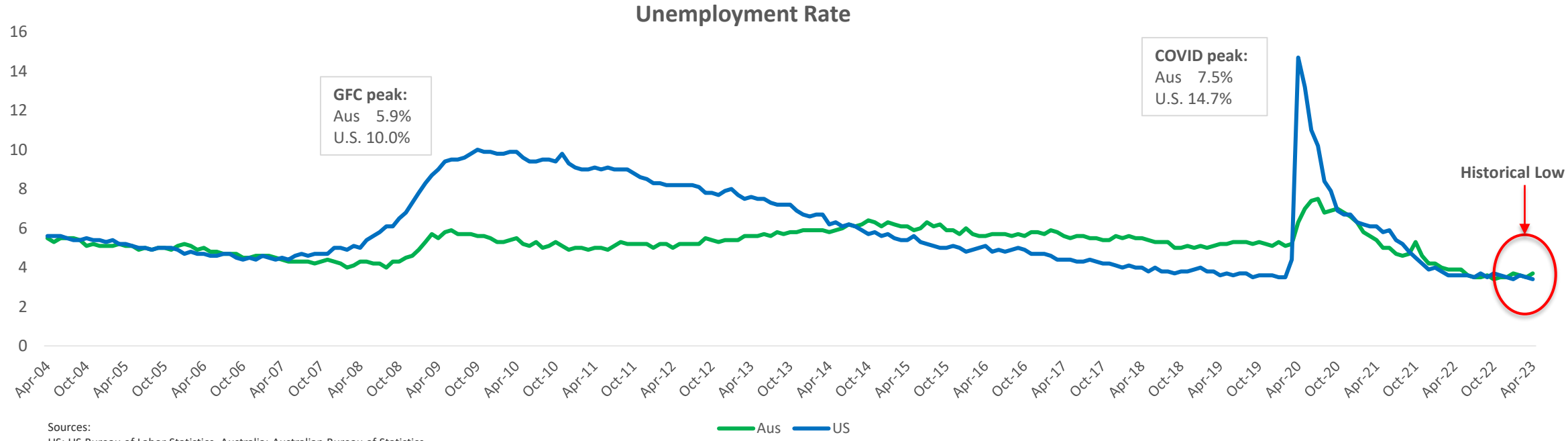
## The Mortgage Insurance market in Australia exhibits key structural differences to the U.S. market

| Characteristic |  |  |
|---|---|---|
| **Mortgage Interest Rates** | Predominately fixed-rate | Predominately variable-rate |
| **Full Recourse Lending** | No | Yes |
| **MI Requirement** | • Required for conventional mortgages with >80% LTV (i.e. Loan is >80% of property value) in order to be sold to the Government Sponsored Entities (GSEs), also known as Fannie Mae and Freddie Mac<br>• May be significantly transferred later via GSE Credit Risk Transfer (CRT) programs | • Not a formal requirement but market convention where LTV is >80% |
| **MI Market Size** | 2022 Gross Earned Premium of ~ US$5.8B | 2022 Gross Written Premium of ~ US$0.6B |
| **MI Coverage Level** (% of loan amount insured) | Approximately 25% coverage | 100% coverage |
| **MI Premium** | Primarily monthly premium business | Primarily single premium business |
| **MI Relationships** | Lenders have relationships with multiple insurers | Lenders typically have a direct relationship with one insurer |
| **MI Market players** | 6 primary mortgage insurers (Arch, Essent, NMI, Enact, Radian, MGIC) | 4 main players, each having a relationship with one of the 4 major banks, which control 80% of the lending market. (CBA-Helia, Westpac-Arch, NAB-QBE, ANZ-own captive) |
| **Reinsurance Participation** | Reinsurance participation on GSE CRT program (ACIS and CIRT) and reinsurance (XOL and QS) of primary mortgage insurers | Reinsurance capacity (XOL and QS) provided to primary mortgage insurers |
| **Capital Markets Participation** | Capital markets participation on GSE CRT (STACR and CAS) and Mortgage insurance linked notes (MILNs) from primary mortgage insurers | Market not developed |

Arch | MI

# Limited Economic Stress

## Australia historically has seen very low unemployment rate volatility



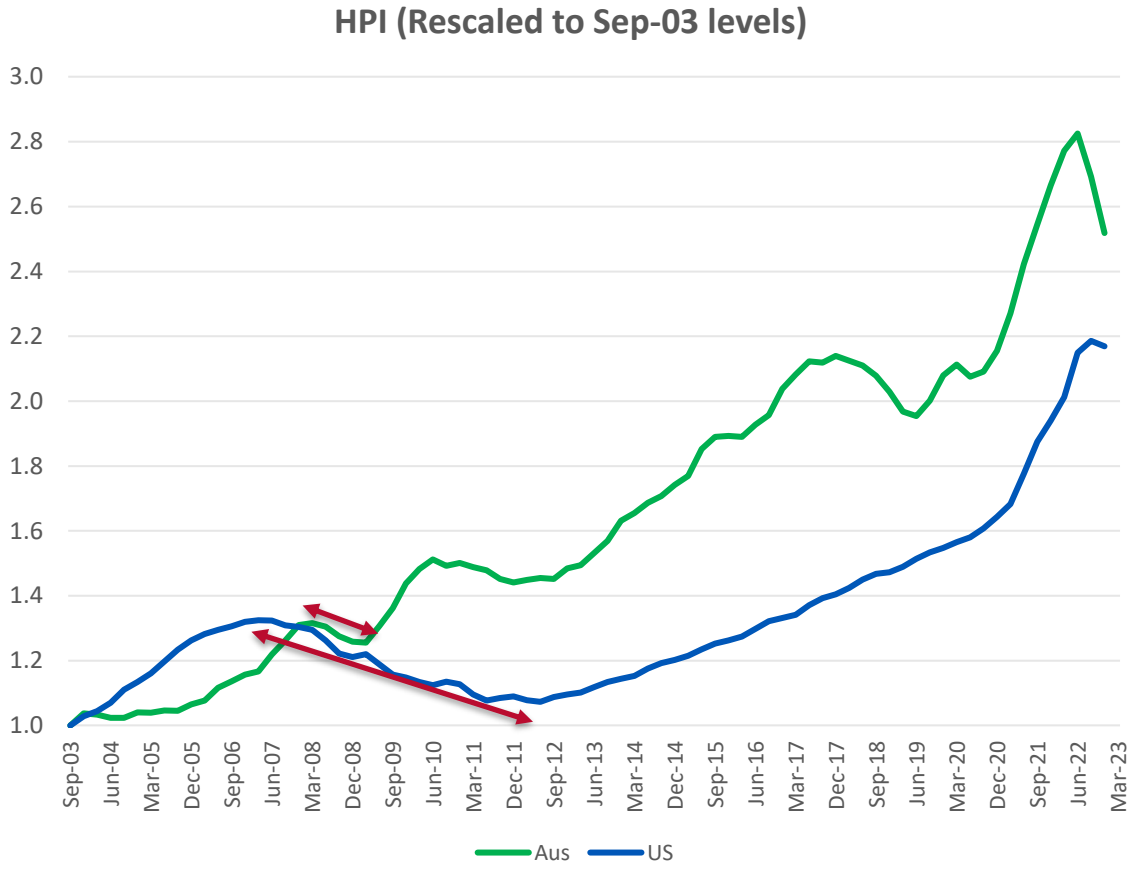

Sources:
US: US Bureau of Labor Statistics, Australia: Australian Bureau of Statistics

- During the GFC, unemployment peaked at 5.9% (June ’09) vs. 10% (October ’09) in the U.S.
- Australia did not experience a large economic downturn during the GFC. However, the pace of economic growth slowed significantly and the unemployment rate rose amid heightened uncertainty.
- Australia’s economy was buoyed at the time by large resource exports to China (i.e., mining boom).
- The COVID-19 peak in Australia was a 7.5% unemployment rate (July ’20), approximately half of the U.S. peak of 14.7% (April ’20).
- Unemployment in both markets is currently at historically low levels (~3.5%).

Arch | MI

# Limited Economic Stress

## Home price declines in Australia were significantly less and more short-lived during the GFC, although periods of smaller home price corrections are historically more prevalent



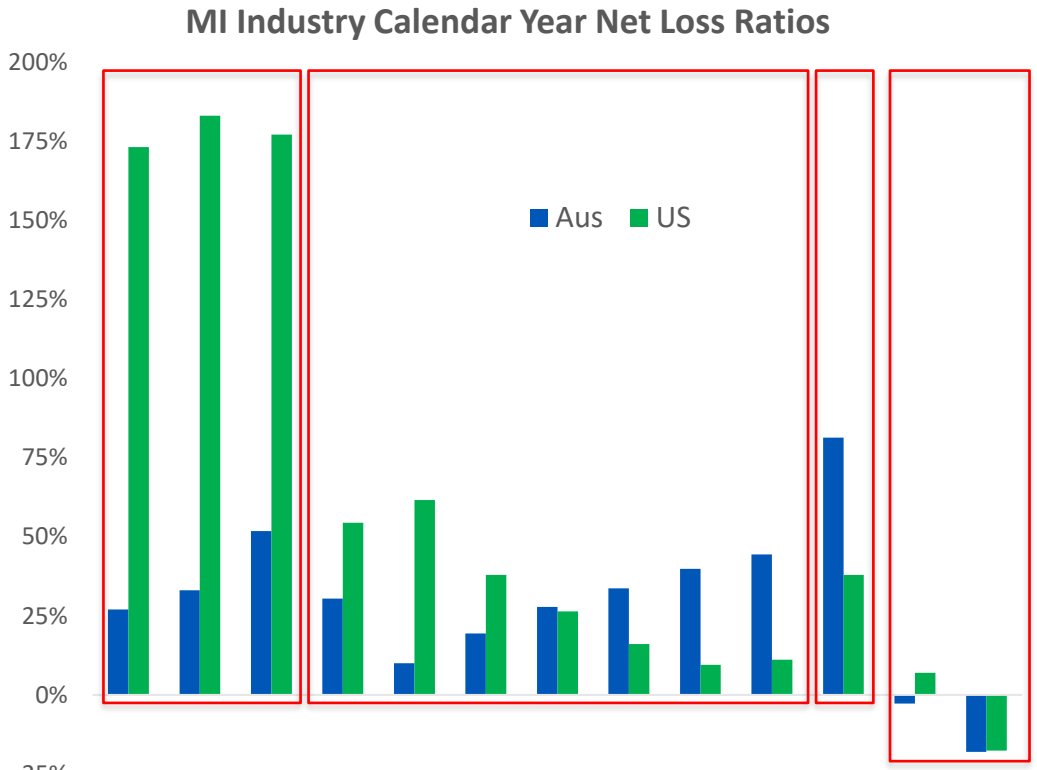

Sources:
US: US Federal Housing Finance Agency All-Transactions House Price Index
Australia: Australian Bureau of Statistics, CoreLogic Hedonic Home Value Index (monthly)

- Peak-to-trough national home price decline in Australia from GFC was ~8% (March ’08 to March ’09) vs. ~19% in US (March ’07 to June ’12).
- Both countries have seen a significant run-up in home prices following the pandemic.
- Although periods of smaller home price corrections have been more prevalent, this has not been historically correlated with elevated delinquency experience. This may be because of the full recourse nature of Australian lending, which potentially mitigates against the likelihood of strategic borrower default.

Arch | MI

# Limited Economic Stress = More Stable Historical Performance

## Lower economic volatility and lack of significant stress events in the Australian market drives more stable MI industry performance over time




| | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 | 2021 | 2022 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Aus | 27.0% | 33.0% | 51.8% | 30.4% | 10.0% | 19.4% | 27.8% | 33.6% | 39.9% | 44.4% | 81.4% | -2.7% | -18.1% |
| US | 173.2% | 183.2% | 177.2% | 54.4% | 61.6% | 38.0% | 26.4% | 16.1% | 9.4% | 11.1% | 38.0% | 7.0% | -17.6% |

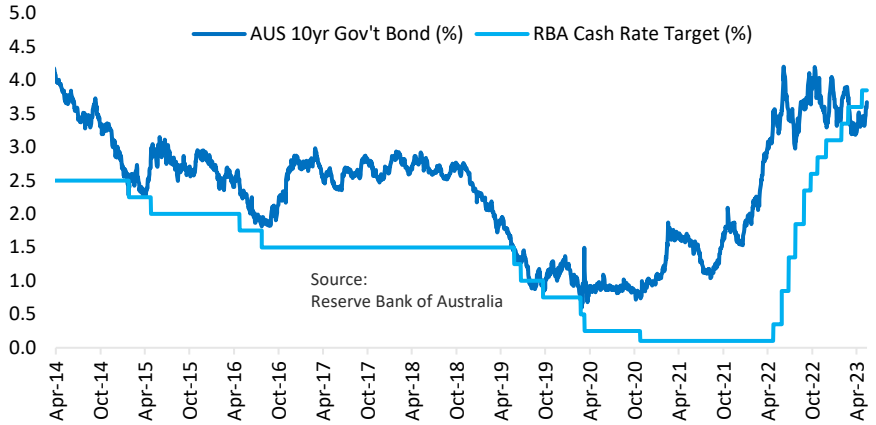
Sources:
US: Company Filings and Public Releases
Australia: APRA Quarterly General Insurance Institution-Level Statistics

- Mortgage Insurance is a capital intensive “cat-like” line of business, so stable economic performance has supported the MI industry in Australia. Loss experience during GFC was starkly different.
- There has been somewhat of an upward trend since 2014 in Australia due to late emergence of losses from regional mining towns following the end of the mining boom, but experience has been favorable on average.
- 2021 and 2022 have seen significant favorable reserve releases in both markets related to COVID delinquencies, as insurers quickly increased reserves in 2020.
- From an actuarial perspective, Australia’s lower historical volatility and lack of meaningful stress events significantly reduces the quantum of data available for use in predictive modeling.
- This is compounded by a lack of publicly available data, unlike in the U.S. (i.e. GSE data).

Arch | MI

# Recent Rate Rises Similar to U.S., but Potentially Different Impact

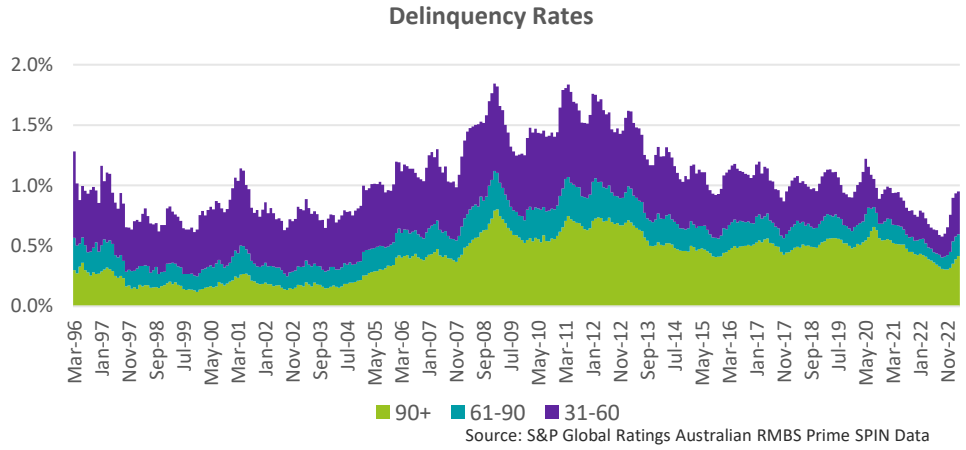
## Interest rates have increased significantly over the past year, consistent with U.S.




## Australian borrowers are potentially impacted more adversely by interest rate increases

| Impact of rising rates |  |  |
|---|---|---|
| Monthly Mortgage Payment | **Neutral** Primarily a fixed rate market | **Negative** Primarily a variable rate market |
| Affordability | **Negative** | **Negative** |

## There are signs of an uptick in delinquencies, but this is relative to an historically low level




Source: S&P Global Ratings Australian RMBS Prime SPIN Data

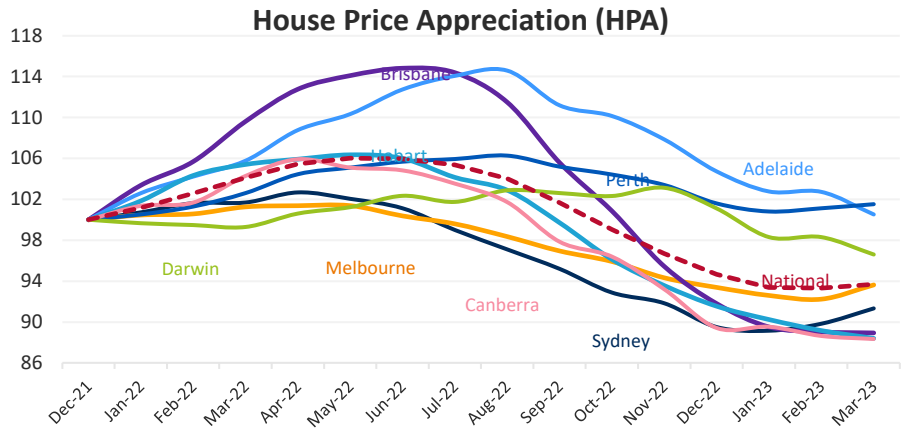
- The following serve as mitigants against borrower stress from recent rate hikes:
  - The Australia regulator (APRA) requires new borrowers to prove they can service their mortgages at an interest rate 300bps in excess of the initial rate.
  - Households are generally ahead on their repayments (almost 40% of loans were two or more years ahead as of Dec. 2022).
  - Historically low rate of unemployment.

## But affordability has certainly been impacted…

Arch | MI

# Home Price Correction has Bitten Earlier in Australia

## Reduced affordability due to rising rates has resulted in home price declines of 8.5% nationally since the peak in April 2022




Source: CoreLogic. Hedonic Home Value Index (monthly)

**Peak to trough declines in dwelling values**

| Region | COVID trough to peak growth | Decline from recent peak | Month of peak |
|---|---|---|---|
| Sydney | 27.7% | -12.3% | Jan-22 |
| Melbourne | 17.3% | - 9.1% | Feb-22 |
| Brisbane | 42.7% | - 10.9% | Jun-22 |
| Adelaide | 44.7% | - 2.4% | Jul-22 |
| Perth | 25.9% | - 0.4% | Jul-22 |
| Hobart | 37.7% | - 12.9% | May-22 |
| Darwin | 31.1% | - 2.0% | Aug-22 |
| Canberra | 38.3% | - 9.5% | Jun-22 |
| Combined capitals | 25.5% | - 9.0% | Apr-22 |
| Combined regionals | 41.6% | - 7.5% | Jun-22 |
| **National** | **28.6%** | **- 8.5%** | **Apr-22** |

Source: CoreLogic.

- Home prices remain well above pre-COVID levels.
- This home price correction has hit Australia sooner than the U.S.
- A 10-month streak of home price reductions was broken in March 2023 with national dwelling values rising by 0.6%, led by a 1.4% increase in Sydney. It remains to be seen if this represents a turning point.
- Factors favoring home prices in Australia are generally consistent with U.S. experience and include:
  - Low supply: Active listings down 3% year-over-year and 26% below 5-year average.
  - Low rental vacancy rates: National vacancy rate of 0.8%, which is a record low.
  - Low unemployment.
  - Renewed international in-migration since COVID.

Arch | MI

# Summary of Takeaways

- Understanding key similarities and differences between Australian and U.S. Mortgage Insurance markets.
- The Australian economy has experienced significantly less volatility over time, which has supported favorable and consistent Mortgage Insurance industry performance.
- But the lack of volatility presents actuarial challenges in that a true stress event is not present in historical data.
- The Australian economy is seeing similar trends to the U.S. currently:
  - Interest rates have risen, which has the potential to impact borrowers' ability to repay in Australia, as well as impacting affordability.
  - Home price declines have already begun, and although it is too early to say if they are at an end, various economic factors are a definite counter force, consistent with the U.S.

Arch | MI

## For more information, please reach out to:


**Alan Tiernan**

**Chief Actuary, Global Mortgage Group**

Arch Capital Group Ltd.

**+1 441 278 9197**

atiernan@archgroup.com

GuyCarpenter

# MORTGAGE CREDIT RISK TRANSFER – THE REINSURANCE MARKET

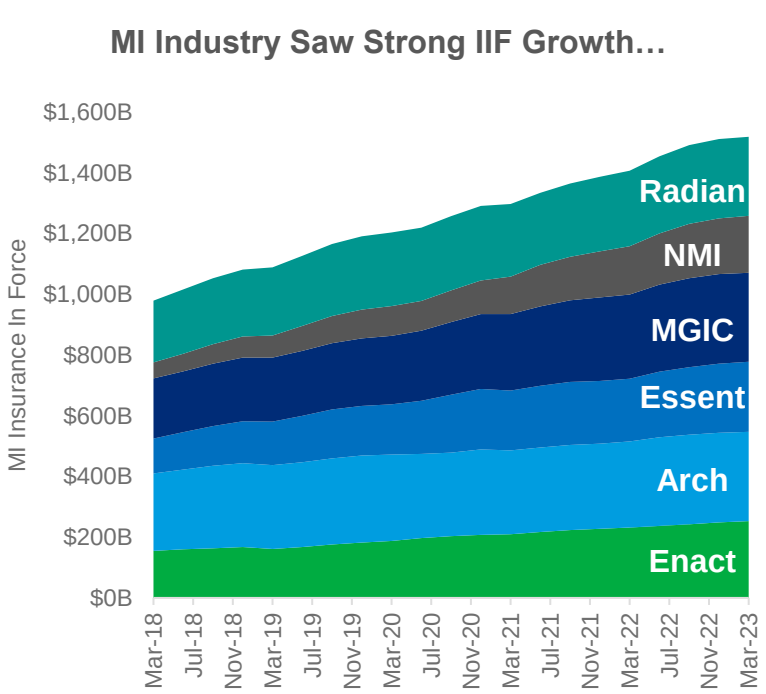
Jonathan Berenbom, FCAS, MAAA
Managing Director, Guy Carpenter

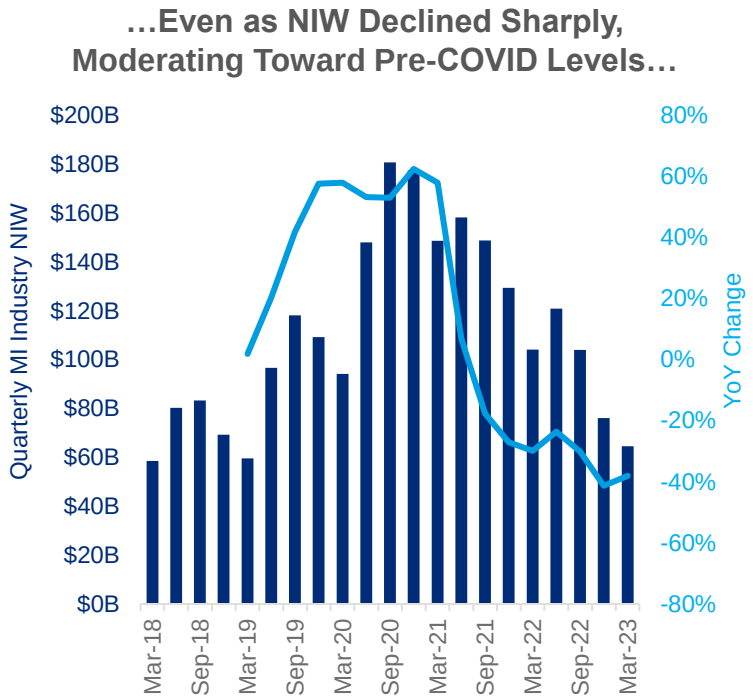
CARe Seminar
June 6, 2023

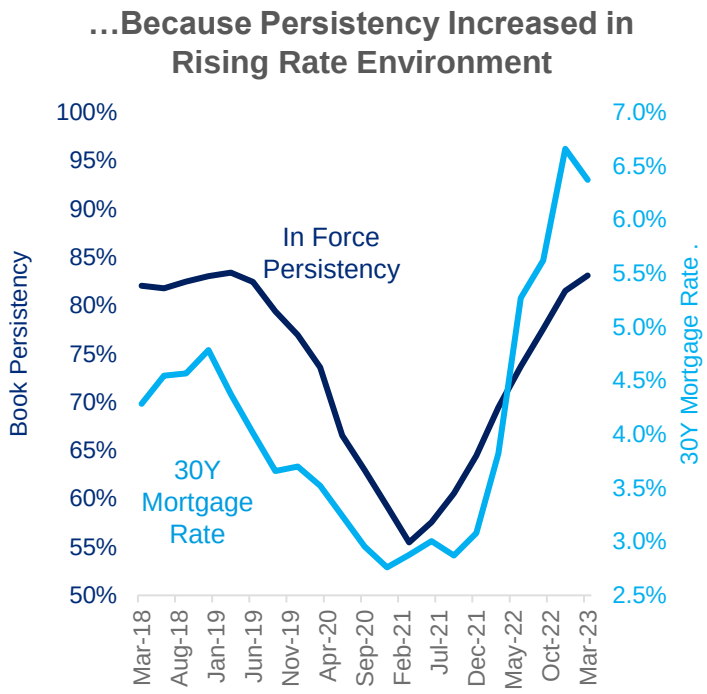
# Discussion Topics

- Mortgage Credit Risk Transfer (CRT) Market Updates
  - Private Mortgage Insurers (MIs)
  - Government Sponsored Enterprises (GSEs)
- PML Considerations for Reinsurers

# Industry Dynamics Continue to Lead to MI Growth

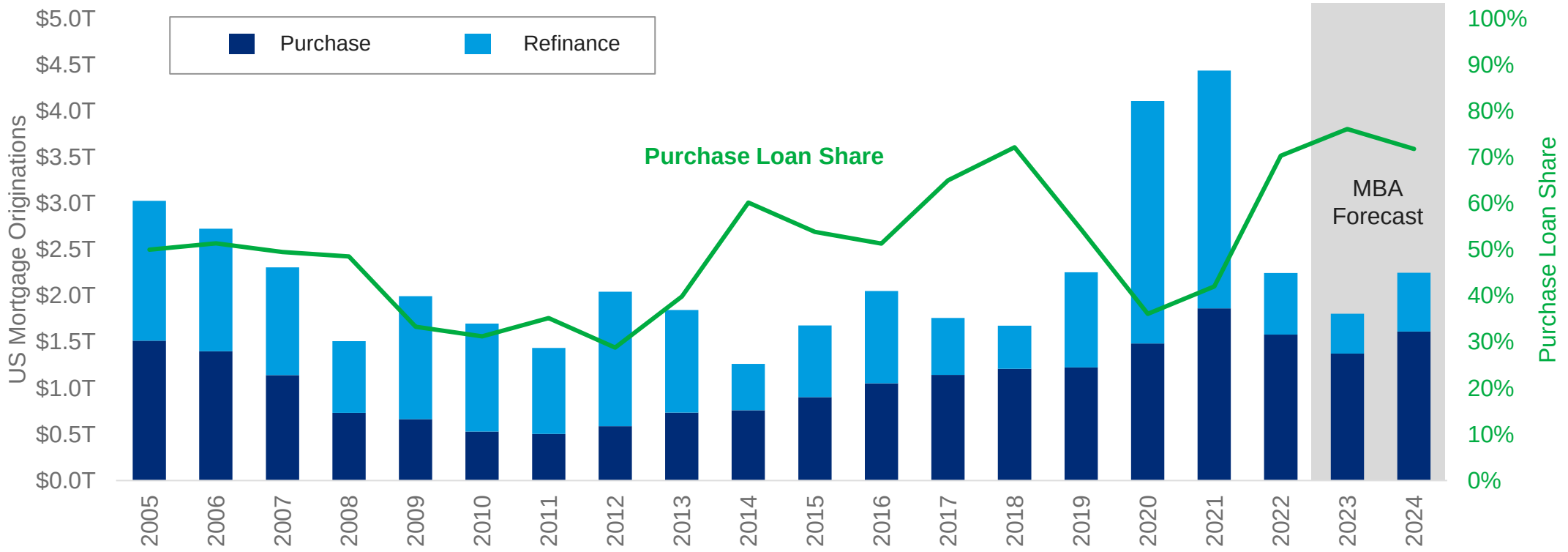



- Q1 MI IIF grew 8% YoY, even as NIW declined substantially
- Sharp rise in persistency supported growth, as prepays materially lower given lack of borrower rate incentive
- Higher persistency leads to longer premium streams for MIs and their reinsurers for their in-force book

# Origination Projections Support Continued Growth



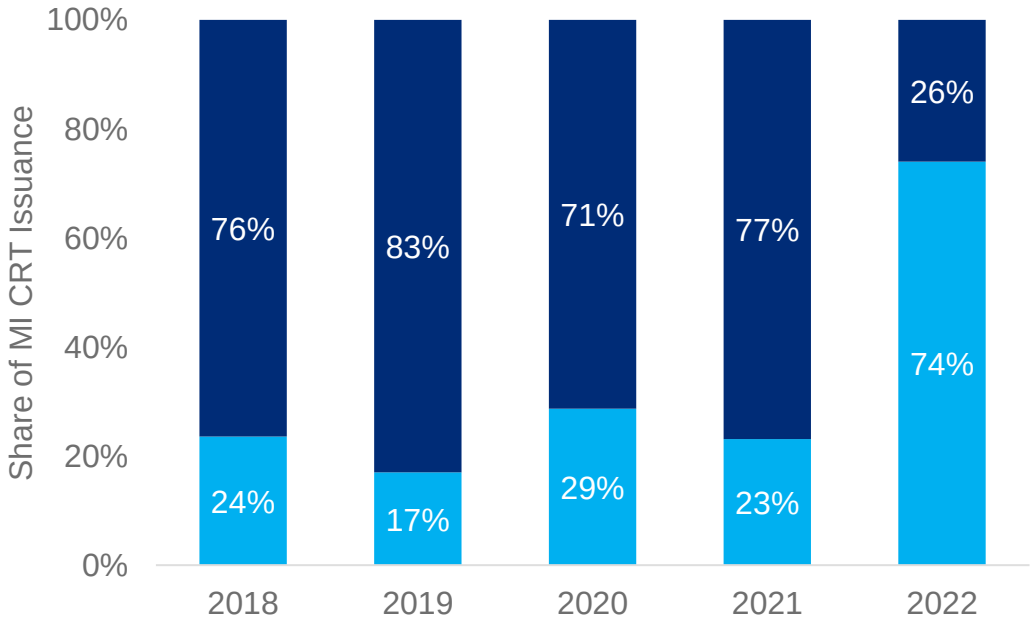

- Though originations to materially decline, purchase loan volumes expected to be largest in 16 years, except for 2020-2022
- MI penetration rates for purchase loans in mid 20%'s vs. low/mid single-digits for refis – purchase loan volumes drive NIW
- Low projected refis to support persistency



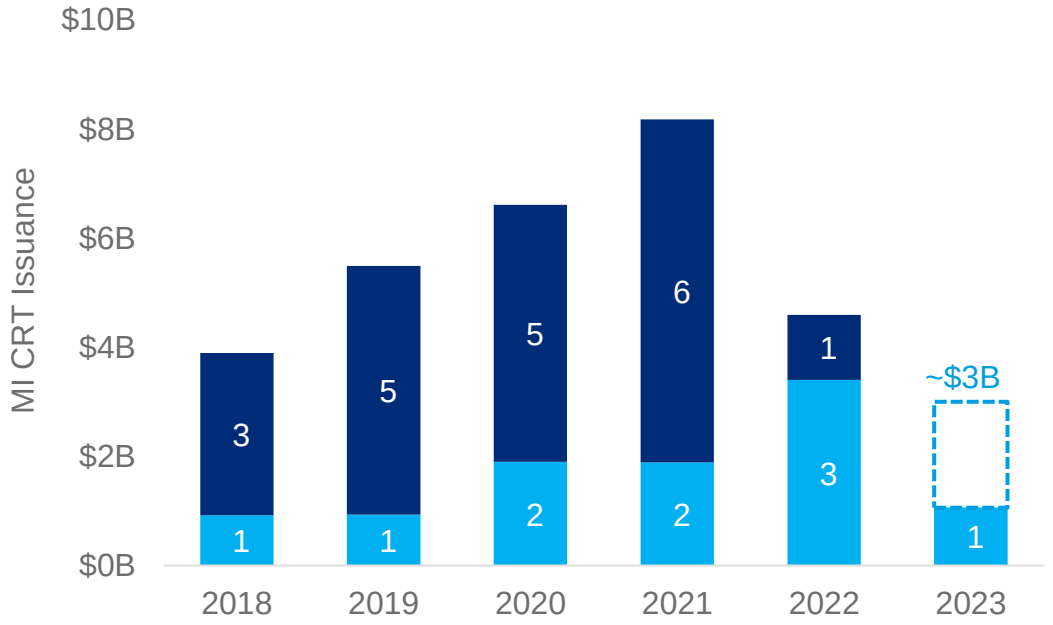
Source: Mortgage Bankers Association, MBA April 17 Mortgage Finance Forecast

# MIs Expected to Continue Elevated Reinsurance CRT Issuance

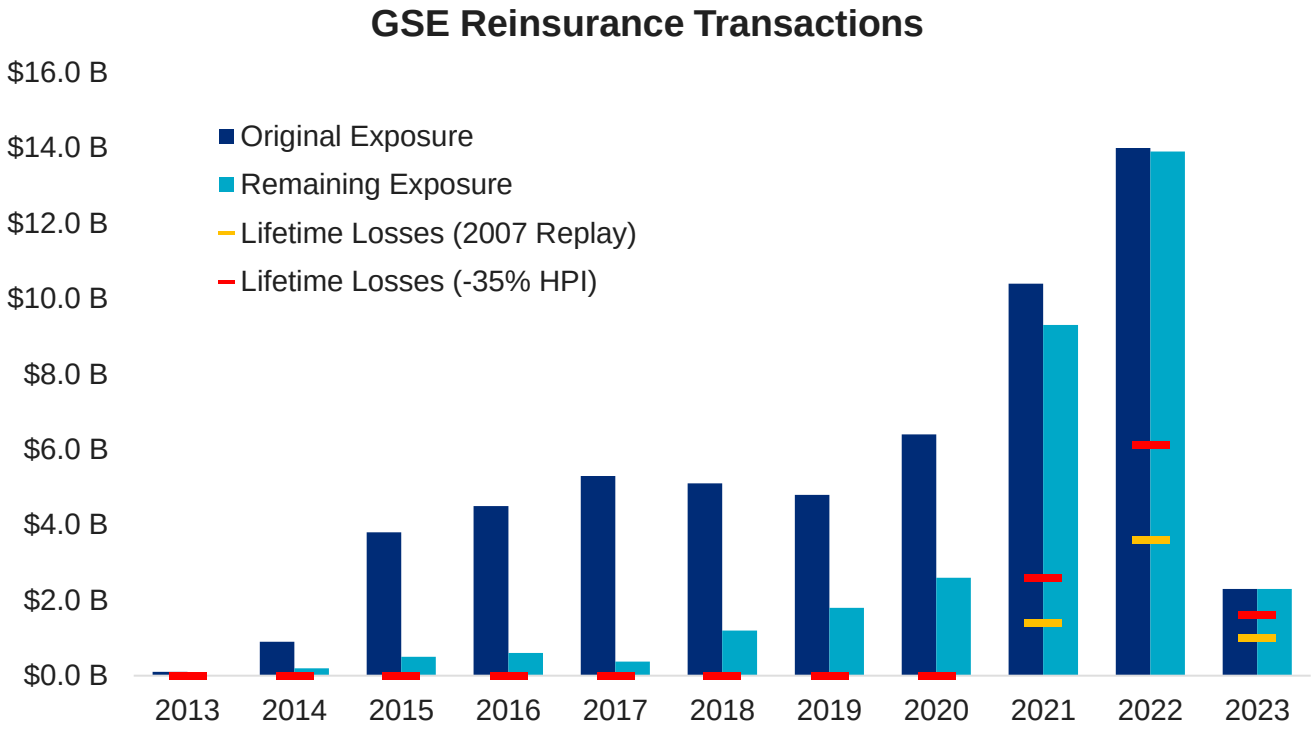
## Allocation to Reinsurance Market Grew in 2022




## Projected 2023 Issuance Near 2022 Level




# Record 2022 Issuance Impacting Available Capacity




Notes: Modeled results are based on M-PIRe MPM_2022.1 model as of May 2023, assuming an economic call

| Vintage | Original Limit | Remaining Limit | 2007 Replay | -35% HPI |
|---|---|---|---|---|
| **2013** | $.1 B | $0.0 B | $0.0 B | $0.0 B |
| **2014** | $.9 B | $0.2 B | $0.0 B | $0.0 B |
| **2015** | $3.8 B | $0.5 B | $0.0 B | $0.0 B |
| **2016** | $4.5 B | $0.6 B | $0.0 B | $0.0 B |
| **2017** | $5.3 B | $0.4 B | $0.0 B | $0.0 B |
| **2018** | $5.1 B | $1.2 B | $0.0 B | $0.0 B |
| **2019** | $4.8 B | $1.8 B | $0.0 B | $0.0 B |
| **2020** | $6.4 B | $2.6 B | $0.0 B | $0.0 B |
| **2021** | $10.4 B | $9.3 B | $1.4 B | $2.6 B |
| **2022** | $14.0 B | $13.9 B | $3.6 B | $6.1 B |
| **2023** | $2.3 B | $2.3B | $1.0 B | $1.6 B |
| **Total** | **$57.6 B** | **$32.8 B** | **$6.0 B** | **$10.3 B** |

- Reinsurers' GSE CRT portfolios have materially de-risked, as 43% of limit has runoff since program inception
- All vintages 2020 and prior have virtually no expected losses in both severe stress scenarios

# Mortgage PMLs Offer Unique Challenges

- Reinsurance contracts are long-duration, covering losses arising from delinquencies over 10-12½ years
- In most economic environments, limits amortize more slowly than risk
  - Most reinsurers measure their aggregate mortgage capacity by modeling their in-force portfolio
- Unlike property catastrophe, mortgage stress events occur over a multi-year period
- The risk of mortgage default is constantly changing, in response to a variety of factors, including
  - Home Price Appreciation/Depreciation since loan inception
  - Macroeconomic outlook (Home prices, interest rates, unemployment, etc.)
  - Ability of borrowers to afford monthly payments
  - Availability of GSE forbearance programs
- Reinsurers use a variety of modeling approaches
  - Deterministic (i.e. 2007 Replay scenario or home price decline of X%) or stochastic (i.e. 99$^{th}$ %ile of loss distribution)
  - Single scenario or a blend of multiple scenarios
  - Losses over the treaty term or the maximum in any one year

# Macro Environment Leading to Modeled Loss Increases

## Inception of CRT (2013) – 2Q 2022

| Economic Indicator | Mortgage Impact | Modeled Loss Impact |
|---|---|---|
| Housing Prices ↑ | Loan-to-Value Ratios ↓ | ↓ |
| Interest Rates ↓ | Prepay-ments ↑ | ↓ |
| **Modeled Loss** | | ↓ |

## 2Q 2022 - Present

| Economic Indicator | Mortgage Impact | Modeled Loss Impact |
|---|---|---|
| Housing Prices ↓ | Loan-to-Value Ratios ↑ | ↑ |
| Interest Rates ↑ | Prepay-ments ↓ | ↑ |
| **Modeled Loss** | | ↑ |

# PMLs Impacted by Modeled Loss Volatility

- After peaking in May 2022, home prices began to decline nationally for the first time since 2012
- Mortgage rates increased from 3.5% in January 2022 to 5.0% in April and 6.9% in October
- In a volatile economic environment, economic forecasts changed significantly from one month to the next
  - Stochastic models centered around an economic forecast experienced similar monthly volatility
- Increasing PMLs pose challenges for reinsurance underwriters
  - Difficult to explain
  - Long duration contracts limit ability to resize portfolio
  - Additional capacity may no longer be available
  - Risk of further increases may limit willingness to deploy capacity
- Both deterministic and stochastic approaches need to contemplate how to appropriately reflect changes in economic outlook as well as past home price declines
  - Should a deterministic scenario be tempered to reflect home price declines that have already occurred?
  - Should a change in the baseline economic outlook impact the extreme tail of the loss distribution?

# Questions?

# Disclaimer

## GC Analytics® Disclaimer

*The data and analysis provided by Guy Carpenter herein or in connection herewith are provided "as is," without warranty of any kind whether express or implied. The analysis is based upon data provided by the company or obtained from external sources, the accuracy of which has not been independently verified by Guy Carpenter. Neither Guy Carpenter, its affiliates, nor their officers, directors, agents, modelers, or subcontractors (collectively, "Providers") guarantee or warrant the correctness, completeness, currentness, merchantability, or fitness for a particular purpose of such data and analysis. The data and analysis is intended to be used solely for the purpose of the company's internal evaluation and the company shall not disclose the analysis to any third party, except its reinsurers, auditors, rating agencies and regulators, without Guy Carpenter's prior written consent. In the event that the company discloses the data and analysis, or any portion thereof, to any permissible third party, the company shall adopt the data and analysis as its own. In no event will any Provider be liable for loss of profits or any other indirect, special, incidental and/or consequential damage of any kind howsoever incurred or designated, arising from any use of the data and analysis provided herein or in connection herewith.*

*Statements or analysis concerning or incorporating tax, accounting or legal matters should be understood to be general observations or applications based solely on our experience as reinsurance brokers and risk consultants and may not be relied upon as tax, accounting or legal advice, which we are not authorized to provide. All such matters should be reviewed with the client's own qualified advisors in these areas.*

*There are many limitations on actuarial or modeling analyses, including uncertainty in the estimates and reliance on data. We will provide additional information regarding these limitations upon request.*

*As with any analysis, the results presented herein are subject to significant variability. While these estimates represent our best professional judgment, it is probable that the actual results will differ from those projected. The degree of such variability could be substantial and could be in either direction from our estimates.*

# Reliances and Limitations/Milliman M-PIRe Guidelines

- These slides are for general informational purposes only.  Action should not be taken solely on the basis of the information set out herein without taking specific advice.
- No portion of this presentation or supporting material may be provided to any other party without Milliman's prior written consent.
- Neither the presenter, his employer, nor the Casualty Actuarial Society shall have any responsibility or liability to any person or entity with respect to damages alleged to have been caused directly or indirectly by the content of this presentation.
- Any Milliman estimates referenced herein, including M-PIRe estimates, make no provision for extraordinary future emergence of new classes of losses or types of losses not sufficiently represented in historical mortgage performance databases or that are not yet quantifiable, including the potential impact of the emerging situation regarding the COVID-19 pandemic. There is substantial uncertainty regarding the impact of COVID-19 on the level of mortgage default, prepayment, and severity rates. Exposures, claim frequency, and claim severity will likely be affected in ways we cannot currently estimate. It is important to recognize that actual losses may emerge significantly higher or lower than the estimates in this analysis. It is unknown how the COVID-19 pandemic may affect the timeliness of future default losses.
- Milliman should be contacted directly in order to license M-PIRe and have a proper understanding of forecasts contained therein and all the inputs, methodologies, assumptions and qualifications and limitations surrounding such estimates.

# Limitations

These slides are for general informational purposes only. Action should not be taken solely on the basis of the information set out herein without taking specific advice.

## Accompanying Oral Discussion

- This document is not complete without the accompanying oral discussion and explanation of the underlying projection methodologies, results and variability.

## Limited Distribution

- This presentation is solely for discussion purposes only. This presentation should not be distributed, disclosed or otherwise furnished, in whole or in part, without the express written consent of Milliman. In the event such consent is provided, it must be provided in its entirety.
- Any reader of this presentation must possess a certain level of expertise in areas relevant to this analysis to appreciate the significance of the assumptions and the impact of these assumptions on the illustrated results. The reader should be advised by actuaries or other professionals competent in the area of actuarial projections of the type in this presentation, so as to properly interpret any communicated analytics.

# Resources Available to Explore Participating in Future Credit Risk Transfer Transactions


**Mike Schmitz**, Principal and Consulting Actuary
Milliman | 17335 Golf Parkway, Suite 100
Brookfield, WI 53045 USA
Direct: 262-796-3323 | Mobile: 262-352-1877
mike.schmitz@milliman.com

**Jonathan Berenbom**, Managing Director, GC Analytics
Guy Carpenter | 1166 Avenue of the Americas
New York, NY 10036
Direct: 917-937-3189 | Mobile: 646-954-2025
Jonathan.Berenbom@guycarp.com

**Alan Tiernan**, Chief Actuary, Global Mortgage Group
Arch Capital Group Ltd.
Direct 1 441 278 9197 | Mobile 1 441 591 9197
atiernan@archgroup.com


https://crt.freddiemac.com/offerings/acis.aspx

https://www.fanniemae.com/portal/funding-the-market/credit-risk/credit-insurance.html

Milliman

# Thank you