THC Financial Engineering

Markets

# Bridge Report

Banking

Connecting Bankers and Capital Market Opportunities
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## COVID-19 Impact on Balance Sheet Management



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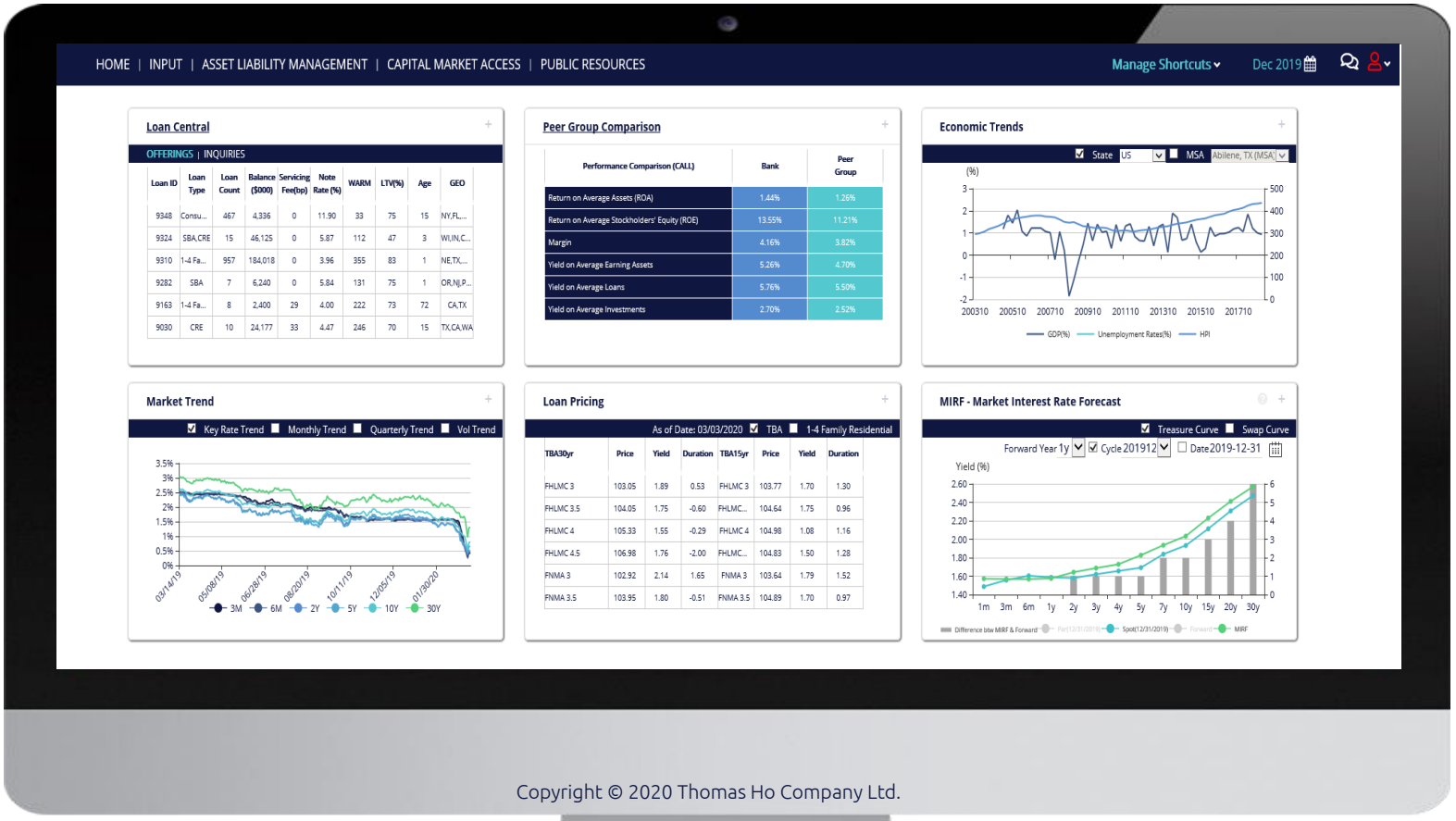
# THC Financial Engineering:
# Consolidated Information for Balance Sheet Management

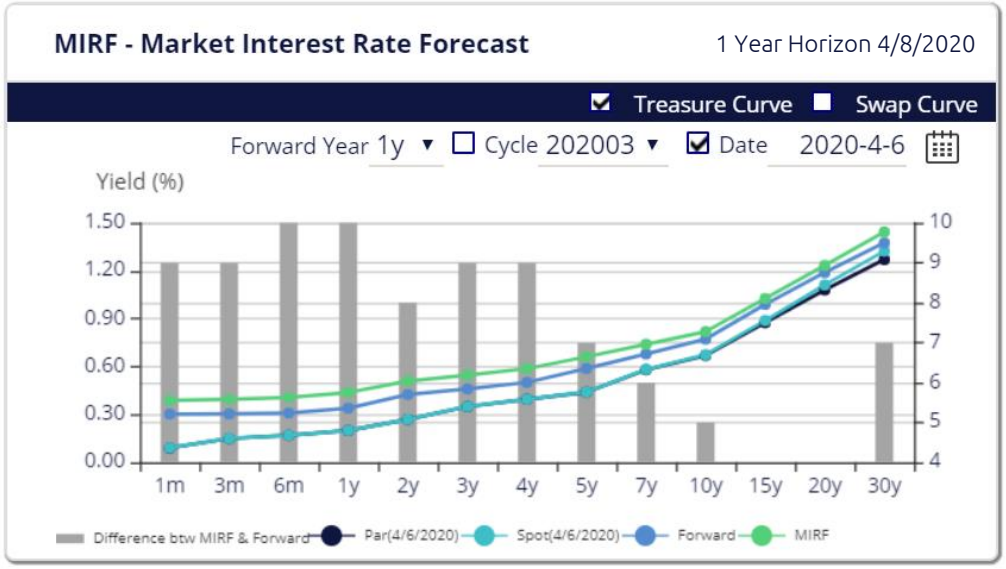
Peer Group Comparison, TBA analysis, Secondary Mortgage Analysis, Loan Markets, Rate Movements, Advances Funding Rates, Credit Risk-Based Pricing, Credit-Loss induced Contingency Funding Plan.



# **Market-Base Rate Forecast:** What Is Market Signalling for Interest Rates?

*Market Interest Rate Forecast (MIRF) suggests that the rates will rise in one year*

We all know the Coronavirus has disrupted the interest rate markets potentially leading to a recession, as rates have fallen. However the market estimated interest rate probability distribution tells a different story. Rates are expected to go up, as investors are bidding up the out-of-the-money swaptions to bet that interest rates will go up.




| Time | 1y | 3y | 5y | 7y | 10y |
|---|---|---|---|---|---|
| Par Curve | 0.200 | 0.350 | 0.440 | 0.580 | 0.670 |
| MIRF Curve | 0.406 | 0.547 | 0.662 | 0.740 | 0.819 |

**Actionable Information:**

Interest rate forecasting is used in ALCO for planning and balance sheet management.

THC offers the Market Interest Rate Forecast (MIRF), a systematic and objective forecast derived from market pricing.

**The MIRF model indicates rising rates.**

*Source: Market Interest Rate Forecast (MIRF), see Appendix*

# **Current Opportunity:** Buying/Selling 30yr FRM

*Buying/selling loans in a low rate regime*

**Why sell long duration loans?** Today's rate environment affords the opportunity to originate and keep 30-yr FRMs on the books by minimizing interest rate risk with longer term, low rate funding. Price and yield attribution provide price and yield transparency for effective decision making when originating and holding or selling loans.

| **PRICING ANALYSIS** cashflow value or yield is the sum of its sub-items | | | |
|---|---|---|---|
| **Price Attribution** | **$** | **Yield Attribution** | **%** |
| Indicative Price | 100.800 | Yield | 3.345 |
| Servicing Cost | 0.000 | Servicing Fees | 0.000 |
| Option Cost | 0.378 | Funding (FTP) | 1.086 |
| Credit Reserve (CECL) | 0.989 | Option Spread | 0.026 |
| Unexp Loss Reserve | 0.729 | Credit Spread (CECL) | 0.156 |
| Loan Net Profit | 14.357 | Unexp Loss Reserve Spread | 0.115 |
| Cash Flow Value | 117.253 | Profit Margin | **1.962** |

## Actionable Information:

The low and inverted yield curve provides profitable funding for 30-yr FRMs with *matching duration*, if you have enough capital capacity. The pick up in margin from holding the loan vs. selling the loan in the examples is 1.74%. The methodology extends easily to origination/sale decisions made every day.

***See the THC Loan Central to evaluate additional Loan Tear Sheets***

### Sale

**Loan Sale at 102 (Service Released):**

| | |
|---|---|
| Sale Price: | 102.0 |
| *Cost of origination: | (100.8) |
| Net income | 1.2 |
| **Annual amortized income (%) of sale premium (6.317 yr. WAL):** | **0.19** |

**Par origination of 100 plus 80 bp commission*

### Keep on the Balance Sheet

**Loan origination with long-term funding (%):**

| | |
|---|---|
| Profit Margin (ref Yield Attribution) | 1.96 |
| *Funding difference | (0.22) |
| Additional Profit Margin | **1.74** |

**Funding difference to fund with 6 yr CD (1.30-1.086)*

### Breakeven Analysis

**Sell 9.15 (=1.74/0.19) loans**

*Sources: Bankers Bank (WI) funding rate.*
*THC Loan transaction: Sale Price*

# Ranking Banks' Product Profitability

*Use Clean OAS to evaluate the net profit*

Implementing an objective risk-based lending strategy can allow your institution to originate profitable products while meeting the needs of your community. But understanding the inherent risk of different loan structures requires a robust and objective financial model. The Clean OAS is the profitability measure. Yield attribution identifies the cost components.

| Description | Released Price | Int. Rate (%) | Margin (%) | FICO | YTM | Funding cost | Option Spread | Credit Spread | Clean OAS |
|---|---|---|---|---|---|---|---|---|---|
| -30 Year Mortgag 599 or < | 101.26 | 4.875 | 0.00 | 599 | 4.673 | 0.990 | 0.072 | 0.602 | 3.009 |
| -30 Year Mortgage 600-649 | 100.96 | 4.750 | 0.00 | 600 | 4.626 | 1.016 | 0.068 | 0.587 | 2.954 |
| -30 Year Mortgage 650-699 | 100.49 | 4.500 | 0.00 | 650 | 4.441 | 0.968 | 0.084 | 0.404 | 2.985 |
| -30 Year Mortgage 700+ | 101.94 | 4.375 | 0.00 | 700 | 3.917 | 0.934 | 0.096 | 0.290 | 2.597 |
| -5/1 Year Adjustable Rate Mortgage | 100.29 | 7.180 | 4.25 | 599 | 6.881 | 0.749 | 0.061 | 0.453 | 5.618 |
| -5/1 Year Adjustable Rate Mortgage | 100.07 | 6.680 | 3.75 | 600 | 6.489 | 0.773 | 0.060 | 0.465 | 5.191 |
| -5/1 Year Adjustable Rate Mortgage | 99.84 | 6.180 | 3.25 | 650 | 6.137 | 0.774 | 0.062 | 0.440 | 4.861 |
| -5/1 Year Adjustable Rate Mortgage | 101.36 | 5.680 | 2.75 | 700 | 4.892 | 0.764 | 0.101 | 0.413 | 3.613 |

**Actionable Information:**

While market competition often sets the price, you can adjust the loan structure and features, such as credit exposure, to seek higher clean OAS. Yield attribution enables you to adjust your estimated credit spread and funding cost based on your institution's experience and current funding structure. For example, the yield attribution explains the difference of clean OAS between FRMs and ARMs because of the difference in the estimated funding cost, as the result of the shape of the yield curve and the difference in projected cash flow.

# Optimize Performance by Benchmarking Risk Capacity

*Have you initiated your Credit-Loss Induced Contingency Funding Plan?*

***What to expect the changes in Q1 2020 Performance Report?***

## Paradigm Shift

Prepare for changes in Q1 performance reports – higher asset sensitivity and lower projected margin

- Market rates and e.g., 30 yr FRM rates, have fallen over 100 bp in 2019. Margin has started to tighten. ROE is proforma Figure 1.
- Falling rates result in faster prepayment and increased asset sensitivity. An opportunity to adjust the balance sheet sensitivity Figure 2.

***Sell Investments/Buy Loans while Meeting Liquidity Policy Limits?***

## Strategic Solutions

Rotate out of investments and use contingency funding plan report to ensure sufficient liquidity

- Loan/Deposit is high and may cap lending capacity. May consider risk-based pricing to maintain profitability. Figure 3.
- Loan/Investment 200bp spread on average. Rotating investments to more liquid loans Figure 4. Use Contingency Funding Plan report to manage liquidity.

***Evaluate alternative strategies***

## Pricing Solutions

Establish systematic product relative profitability with minimum offer rates

- Beyond conforming residential loans, evaluate alternative products, such as seasoned prime ARM loans. Yield 2.85% duration 2.66 yr. *(see THC Bridge)*
- Compare risk/return of Residential, CRE, SBA in Loan Central *(see THC Bridge)*

Figure 1. Performance

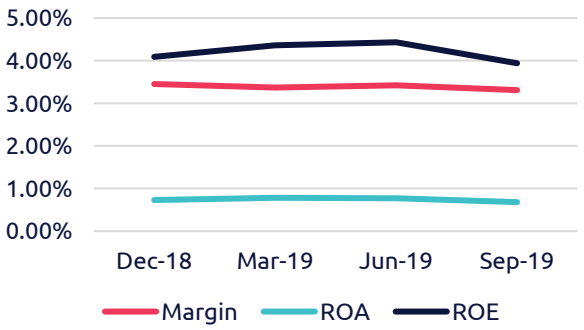



Figure 2. Duration

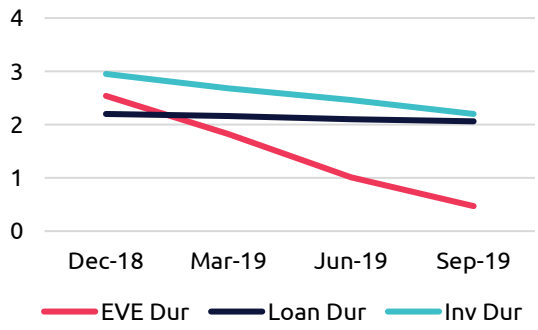
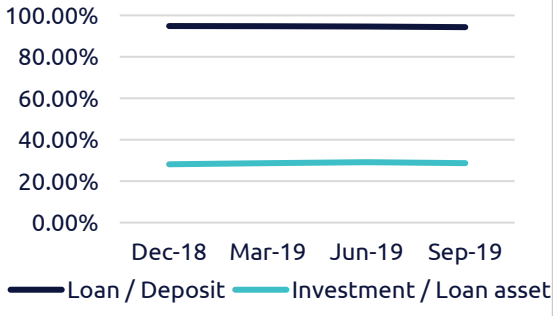



Figure 3. Loan/Deposit & Inv/Loans



# Conclusion

**ASSESS MULTIPLE OPTIONS TO ASCERTAIN APPROPRIATE STRATEGIES BEFORE EXECUTING.**
**THC IS STANDING BY TO ASSIST WITH SYSTEM, ADVISORY, AND LOAN PURCHASE OPPORTUNITIES.**

**FinBex LLC: Seasoned prime ARM pools offer attractive yield to alternative.** Varying risk profiles offer opportunity to match your risk capacity. Available optional Loan Allowance Warranty (LAW) further enhances credit protection.

**Loss Allowance Warranty (LAW) is available from seller to enhance credit protection**

Both pools priced at 101.00 at 15CPR

| Loan Pool | Net WAC | Yield (15 CPR) | Yield to Roll | DM after Roll | WAL | CECL bps | Yield pickup to security - bps | DM pickup after roll |
|---|---|---|---|---|---|---|---|---|
| Seasoned 10-1m - IO | 3.04 | 3.17 | 3.04 | 1L+150 | 5.06 | 0.92 | 135 | 81 |
| Seasoned 7-1m | 2.78 | 2.88 | 2.78 | 1L+225 | 4.66 | 1.03 | 107 | 136 |

**Introduction of CECL accounting Q1 2020 may result in seasoned loan flows**

Recent Private Label Securities for Comparison

| CUSIP | Series | Rating | CPN % | CE% | WAL | CPR | Spread /DM | Approx. Yield /DM |
|---|---|---|---|---|---|---|---|---|
| 64830TAD0 | 20-1A | AAA | 3.5 | 26 | 3 | n/15 | 76 | 1.77% |
| 64830NAA9 | 19-RPL3 | AAA | 2.75 | 39 | 2.9 | n/10 | 89 | 1.90% |
| 64830HAA2 | 19-RPL2 | AAA | 3.25 | 38 | 3 | n/10 | 78 | 1.79% |
| 89177XAA5 | 19-HY3 | AAA | L1+100 | 14 | 2.4 | d/20 | 90 | 1L+ 90 |
| 89177HAA0 | 19-HY2 | AAA | L1+100 | 14 | 2.4 | d/20 | 89 | 1L+ 89 |
| 89177EAA7 | 19-HY1 | AAA | L1+100 | 20 | 2.2 | d/20 | 88 | 1L+ 88 |

**THC LOAN CENTRAL**

**Sample Flow Transactions:**
for sale: CRE (NYC), Auto (OH), 1-4 30 yr FRM (NE);
to purchase: conforming 1-4 Resi loans

Contact: James George, FinBex LLC, james.george@finbex.io

*THC Financial Engineering: residential prepayment-default model codeveloped with FHFA. See FHFA mortgage analytical platform.*

# About Thomas Ho Company Ltd.

New York-based financial technology company licensing asset-liability management solutions and facilitating loan pool distribution with consulting services including model validation, exit pricing, return attributions as recursive back testing, CECL reporting

- Support our clients with 35+ years of experience, research, innovation, and technology
- Maintain an extensive network providing access to information
- Pioneered the cloud-solution for community financial institutions since 2006
- Leader in valuation and risk models calibrated to capital market analytics
- Hold a portfolio of proprietary technologies including 14 T byte analytical database; Latent Transactional Demand (LTD) in data analytics; valuation models of a broad range of loan types.

## About the Editor

**Thomas S.Y. Ho, Ph.D.**
**CEO & Founder, Thomas Ho Company Ltd. (THC)**

Revolutionized the financial services industry with groundbreaking research and development of interest rate, risk management and complex securities valuation models. Named one of the most prolific authors in finance, Tom Ho literally wrote the book on financial modeling with his longtime collaborator, Sang Bin Lee, Ph.D. Their book, The Oxford Guide to Financial Modeling, Oxford University Press, 2003, is one of four Tom has authored or co-authored.

## About the Contributor

**Gnanesh Coomaraswamy, Ph.D., FRM, CFA**
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Contributed research on the seasoned ARM pools. Over 30 years' experience in Financial Engineering, managing $50 billion mortgage portfolio at FHLB Chicago, Portfolio Management and Risk Management. Senior positions at Morgan Stanley, GE Capital and Federal Home Loan Bank of Chicago.

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# Glossaries

Eff. Duration = (PV if yield curve shocked down 0.1% - PV if yield curve shocked up 0.1%) / (2 * PV * 0.1%), PV means present value;

DV01 = (PV if yield curve shocked down 0.1% - PV if yield curve shocked up 0.1%) / (2 * 10000 * 0.1%), PV means present value.

Modified Duration : The price sensitivity to the change in the YTM (Yield to Maturity);

Eff. Convexity = (PV if yield curve shocked up 0.1% + PV if yield curve shocked down 0.1% - 2 * PV) / (PV * 0.1% * 0.1%) / 100, PV means present value;

OAS : Option adjusted spread, the spread over an issuer's spot rate curve, on an option adjusted basis.

FTE yield : (yield - TEFRA yield adjustment) / (1-tax rate)

TEFRA = Cost of Funds * Disallowance * Federal Tax Rate (Disallowance = 20%) *Only applies to Bank Qualified Bonds

Credit Score/DSR duration :For Credit Score duration = % change in value for a 200 shift in FICO (note: the derivation of the duration is based on smaller shift)

LTV Duration =100*[F(LTV + 1%) – F(LTV ) ) / F(LTV) ]*0.01;
Defined as the % change in the loan value for a change of LTV=100.

Credit Convexity = largest potential loss excess of duration loss for a combined shift of LTV and FICO, with the shift presented by Normalized Shift

Model Price :cash flow discounting model using the spot yield curve and arbitrage-free interest rate models for embedded option pricing and CECL for credit analysis

Yield spread = Yield - Treasury Spot Rate at WAL;

Prepayment Duration = (PV prepay 1% slower - PV prepay 1% faster) / (2 * PV * 1%); % change in price sensitivity to the 100 bpt shock in conditional prepayment speed; can be used to adjust the clean price for alternative assumptions of the conditional prepayment speed;

Default Duration = CDR Duration = (PV - PV with CDR curve shift up 10bpts) / (PV * 0.001); % change in price to 100 bpt shock in the conditional default rate, can be used to adjust the clean price for alternative assumptions of the conditional default rate;

OAS Duration = (PV - PV if OAS shocks up 0.1%) / (PV * 0.1%), PV means present value; % change in price to 100 bpt shock in the option adjusted spread, can be used to adjust the clean price for alternative assumptions of the option adjusted spread;

MIRF (Market Interest Rate Forecast) the mean of the rate distribution implied by the Local Volatility interest rate model calibrated from out-of-the-money options

LAW (Loss Allowance Warranty) payments to loan buyers by the seller in case of 90+ day delinquent, a skin-in-the-game feature in loan transaction

# Appendix: THC Financial Technologies

## Market Interest Rate Forecast (MIRF)

MIRF reverse-engineers capital market prices to determine the rate probability distributions. THC has shown in THC White Papers [3], [4], and [5] that an interest rate model, the Local Volatilities Model, can recover the Rate Distribution from the capital market prices, using both at-the-money and at-the-money swaptions.

MIRF differs from typical interest rate forecasting for the following reasons: (1)the rate forecast is objective, based on capital market prices of fixed income instruments and derivatives; (2) the rate distributions can be customized in multiple ways, particularly for risk management, stress testing, and total return analysis, and are not confined to rates rising or falling; (3) the rate is consistent with the capital market pricing of fixed income instruments, and therefore, the normative nature of the arbitrage-free model relates the expected rates and capital market pricing of fixed-income instruments and derivatives, thus providing transparency of profitable transactional opportunities.

Furthermore, MIRF presents a normative model, as the forecast rate is "ought to be," based on the arbitrage activities in the capital market. If the market is efficient, then the expected values genuinely reflect the market consensus of future rates. If the expected rates are inappropriate, then, the model suggests arbitrage opportunities may be available, barring frictions in transactions. For this reason, MIRF offers multiple investment and asset-liability management strategies.

## Credit Parametric Analysis

LTV Duration: % Value increase with 100% shift in LTV. An LTV duration of 19.33 means a 100% shift in LTV would lead to a drop in value of 19.33%. Similarly, a change in LTV from 80 to 90, would lead to a drop in value of 1.933%. From equation (2) $\Delta V/V\% = D_{LTV}\,\Delta LTV\%$, such that $\Delta$ LTV= 0.1 means a shift of LTV 10%. Since Value and LTV are inversely related, the duration has a negative sign.

FICO Duration: the % increase in value given a %increase in FICO. A FICO Duration of 4.94 means a FICO increase of 200% would increase the value by 4.94%. $\Delta V/V\% = D_{FICO}\,\Delta$ FICO%, such that $\Delta$ FICO= 0.1 means FICO increase from 600 -> 620, and the value would increase 0.494%.

Credit Convexity is the % value change (increase or decrease) with maximum accelerated value (curvature) change with a combination of $\Delta$ LTV and $\Delta$ FICO, such that $s^2 = \Delta LTV^2 + \Delta FICO^2 = 1$. (s) is called the Stress. Note: when $\Delta$ LTV = 0, $\Delta$ FICO = 1 or $\Delta$ LTV = 1, $\Delta$ FICO = 0, both consistent with the definitions of duration, where $\Delta$ LTV = 1 and $\Delta$ FICO = 1 in each. Therefore, Credit Convexity depends on the combination of $\Delta$ LTV and $\Delta$ FICO to give the largest acceleration of drop of value. Credit Convexity is calculated by min eigenvalue of the Hessian Matrix ($2^{nd}$ order derivatives of V with respect to LTV and FICO). The mathematical symbol for the eigenvalue is typically $\lambda$, and then Convexity = $\frac{1}{2}\,\lambda$ 100/V. Note, for a loan at origination, typically, V = 100. Then the convexity is $\frac{1}{2}\,\lambda$. When the credit convexity is -95.09, the curvature effect contributes to a drop in value of -95.09 where compared with duration effects of 19.33 and 4.94 from LTV and FICO, respectively. The result shows that large stress (s = 1), the convexity effect is significant.

**Disclaimer**

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