



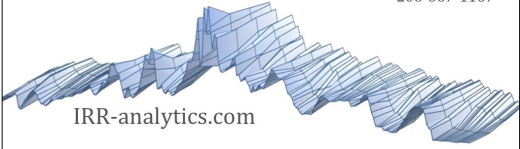
Link to WBA Playback: <https://www.westernbankers.com/post/45-minute-deposit-study>

# The 45-Minute Deposit Study

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# The 45-Minute Deposit Study

- ▶ Develop and document key deposit assumptions used in most ALM models
  - Beta (EaR and EVE)
  - Decay (EVE)
- ▶ Nonmaturity deposits (and CD betas)
- ▶ Quantitative: Can be measured using accepted methods
- ▶ Qualitative: Adjustments to quantitative analysis that can't be measured



## The 45-Minute Deposit Study

- ▶ Review accepted methods for supporting deposit assumptions
- ▶ Evaluate advantages and disadvantages
- ▶ Walk through each method with examples



## The 45-Minute Deposit Study

- ▶ Regulatory guidance: “The regulators remind institutions to document, monitor, and regularly update key assumptions used in IRR measurement models” (2010)
- ▶ Regulatory guidance: “At a minimum, institutions should ensure the reasonableness of asset prepayments, NMD price sensitivity (beta) and decay rates, and key rate drivers for each interest rate shock scenario” (2010)
- ▶ Good business practice: Opposite of “garbage in/ garbage out”



## The 45-Minute Deposit Study



- ▶ Pitfalls: Common weaknesses, oversights, or errors



- ▶ Big Picture: Certain decisions related to assumptions development can be simplified by considering what the assumptions represent, the impact on model output, and certain practical applications.



## The 45-Minute Deposit Study Provides:

- ▶ Documentation that is transparent and understandable to ALCO, board members, non-technical members of management, and examiners
  - ▶ Promotes discussion about deposit pricing and retention
- ▶ A reasonable quantitative baseline estimate of beta and decay assumptions
  - ▶ Beta: Different beta factors for rising/falling rate shifts
  - ▶ Floors: Minimum rates in the falling rate shifts
  - ▶ Decay: Same decay rates across all rate shifts



## The 45-Minute Deposit Study DISCLAIMER:

- ▶ The 45-Minute Deposit Study may take longer than 45 minutes!
- ▶ Quantitative deposit study results may require qualitative adjustments
- ▶ Deposit study results are always just estimates
- ▶ Assumptions are typically used for standard policy monitoring, including a single assumption set, simplified rate shifts/shocks, and static balance sheets (see next slide)



## The 45-Minute Deposit Study DISCLAIMER:

Strong programs recognize that selected beta and decay assumptions are estimates and incorporate additional analysis (aka: The Fun Modelling Stuff)

- ▶ Assumption sensitivity testing to evaluate a range of possible outcomes/exposures in isolated or combined scenarios
- ▶ Expected rate paths to evaluate expected performance; not necessarily the base case / rates unchanged scenario
- ▶ Adverse nonparallel rate shifts to evaluate exposure to yield curve risk (i.e. rising/flattening, falling/flattening, inverted, twisted, etc.)
- ▶ Dynamic balance sheet fluctuations to evaluate non-static balance sheet performance



## Common and Accepted Methods for Supporting Deposit Assumptions?

### Beta



- ▶ Regression analysis
- ▶ Benchmarking ← 45-Minute Deposit Study Method
- ▶ Other: Management surveys, forward-looking pricing strategies, etc.

### Decay



- ▶ Measure actual historical decay by balance
- ▶ Weighted Average Age ← 45-Minute Deposit Study Method
- ▶ Other: Opened/closed accounts, account balance trendlines, etc.



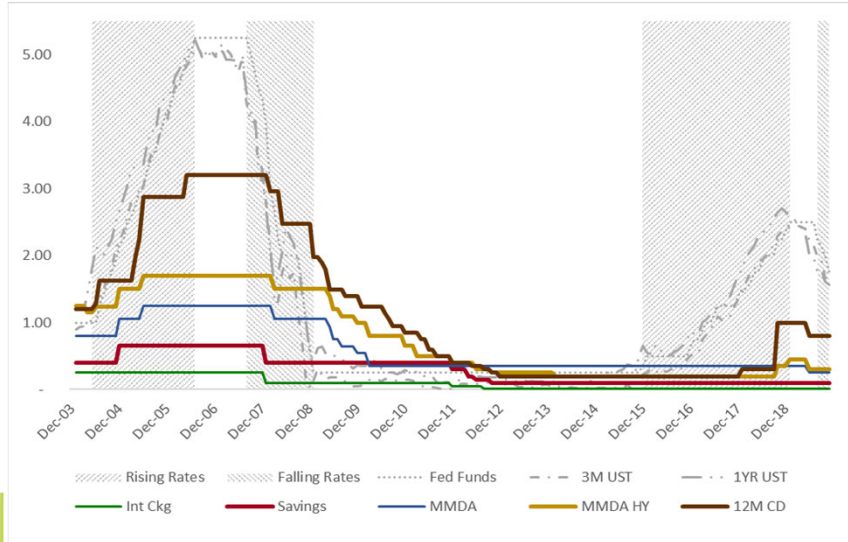
## Data for Beta Analysis

### Best Data Sources for Historical Rates:

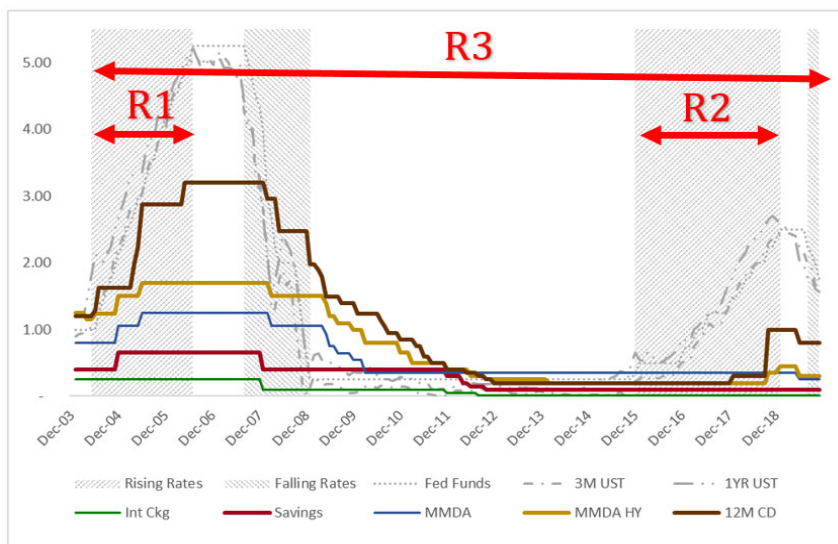
- ▶ Historical market rates widely available
- ▶ Internal Pricing Data
  - ▶ Old ALM/model reports
  - ▶ Tracking reports
  - ▶ Old rate sheets (best for CDs)
  - ▶ Regulatory Reports (UBPR)
- ▶ Consider data aggregation in ALM model



## Beta Example

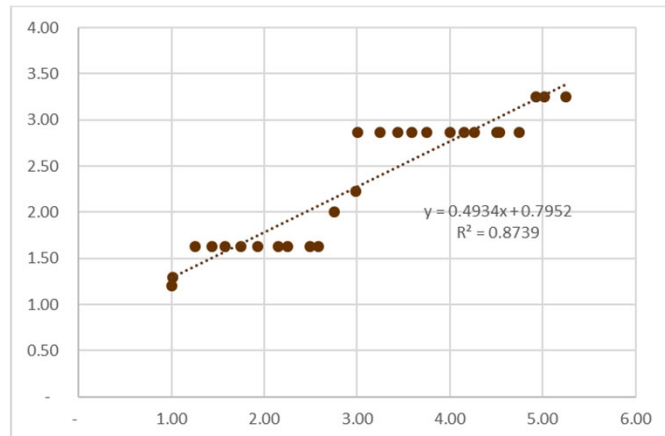


## Beta Example - Regression Analysis



## Beta Example - Regression Analysis

### 12M CD Scatterplot



## Beta Example - Regression Analysis

### Strengths

- ▶ Most sophisticated method
- ▶ Most common method used by ALM firms and big banks



### Weaknesses

- ▶ Often poorly designed data sets (e.g. using entire date set)
- ▶ Calculation errors common (e.g. switching dependent/independent variables)
- ▶ Requires more data points than benchmarking
- ▶ Less intuitive than benchmarking
- ▶ What to do when significance indicators not met?
- ▶ What to do when results fail reasonableness tests?



## Beta Example - Regression Analysis (with Reasonableness Test)

Deposit Category	Regression Analysis Beta Results*		
	Rising Rates '04-'06	Rising Rates '15-'18	Full Data Set '04-'19
Interest Checking	0%	0%	4%
Savings	6%	0%	9%
MMDA	13%	0%	18%
MMDA - HY	14%	5%	26%
12M CD	49%	27%	55%

\*Red font indicates significance indicators not met

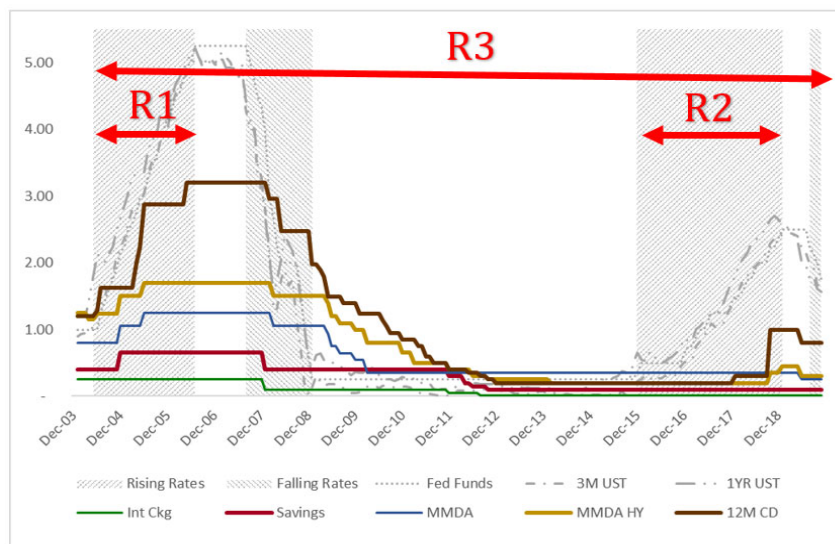
Simulated +350bp Deposit Rates**		Historical Maximum	Variance
MMDA at 13% beta	0.71%	1.25%	-0.54%
MMDA at 14% beta	0.78%	1.70%	-0.92%
12M CD at 49% beta	2.50%	3.25%	-0.75%

\*\* +350bp represents difference between current FF and peak FF from data set

Do these results pass reasonableness testing?

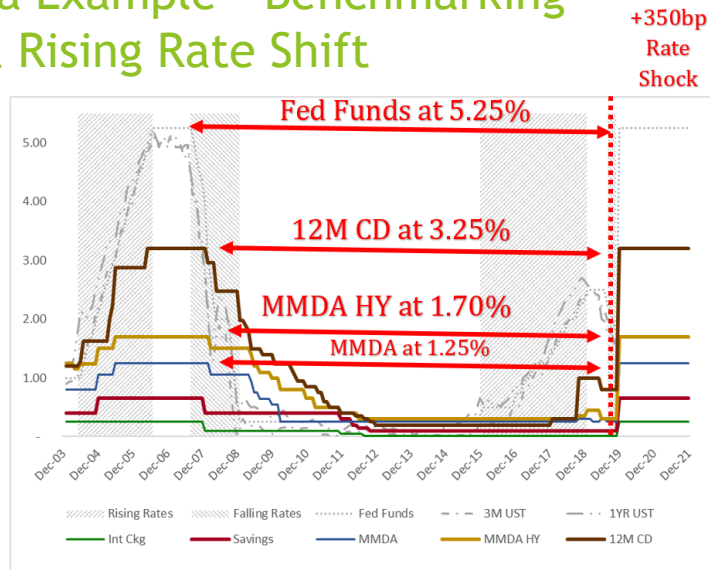


## Beta Example - Regression Analysis





## Beta Example - Benchmarking in a Rising Rate Shift



## Beta Example - Benchmarking in a Rising Rate Shift

Deposit Category	Current Rate (4Q'19)	Historical Minimum Rate (≈ 4Q'15)	Historical Maximum Rate (≈ 4Q'06)
Fed Funds Rate	1.75%	0.25%	5.25%
Change from Current		-1.50%	+3.50%
Interest Checking	0.01%	0.01%	0.25%
Savings	0.10%	0.10%	0.65%
MMDA	0.25%	0.25%	1.25%
MMDA - HY	0.30%	0.30%	1.70%
12M CD	0.80%	0.20%	3.25%

Benchmarking Method (12M CD Rising):

Historical Maximum Rate	3.25%	<-- Benchmark Rate
Less: Current Rate	0.80%	
Expected increase in +350bp	2.45%	div. by 3.50% = 70%

Check: 70% beta times 3.50% rate shock plus 0.80% current rate equals 3.25%



## Beta Example - Benchmarking in a Falling Rate Shift

Deposit Category	Current Rate (4Q'19)	Historical Minimum Rate ( $\approx$ 4Q'15)	Historical Maximum Rate ( $\approx$ 4Q'06)
Fed Funds Rate	1.75%	0.25%	5.25%
Change from Current		-1.50%	+3.50%
Interest Checking	0.01%	0.01%	0.25%
Savings	0.10%	0.10%	0.65%
MMDA	0.25%	0.25%	1.25%
MMDA - HY	0.30%	0.30%	1.70%
12M CD	0.80%	0.20%	3.25%

Benchmarking Method (12M CD Falling):

Historical Minimum Rate	0.20%	<-- Benchmark Rate
Less: Current Rate	0.80%	
Expected decrease in -150bp	-0.60%	div. by -1.50% = 40%

Check: 40% beta times -1.50% rate shock plus 0.80% current rate equals 0.20%



## Benchmarking - Additional Considerations

- Consistent beta in rising and falling rate shifts
  - Example: 12M CD beta = 70% (all rising) and 40% (all falling)
- Benchmark rates should represent estimate of maximum/minimum simulated rates at the extreme rate shocks
- Use floors for falling rate shift scenarios that represent zero or negative rates



## Benchmarking - Additional Considerations

- ▶ Benchmark rates do not need to be actual historical rates
  - ▶ Peer rates at appropriate percentile ranking
    - ▶ Can be used for more relevant sensitivity/stress testing
  - ▶ Estimate of future pricing in extreme rate shocks
  - ▶ Actual historical rates best for documentation purposes, but alternate benchmarks may be more appropriate in some cases
- ▶ Interpolate/extrapolate for other rate shocks
  - ▶ Model will do this, but may be useful to create a “butterfly” table to double check model (see next slide)



## Butterfly Table

Reconcile with Model Output

Fed Funds	Shock	Sim. Rate	Incr. Beta	Cum. Beta
0.00	-400	0.20	0%	15%
0.00	-300	0.20	0%	20%
0.00	-200	0.20	0%	30%
0.25	-150	0.20	40%	40%
0.75	-100	0.40	40%	40%
1.75	0	0.80	-	-
2.75	+100	1.50	70%	70%
3.75	+200	2.20	70%	70%
4.75	+300	2.90	70%	70%
5.25	+350	3.25	70%	70%
5.75	+400	3.60	70%	70%

Floors at 0.20%  
 Benchmark (Low)  
 Current Rate  
 Benchmark (High)



## Beta Maintenance

- ▶ If deposit rates remain unchanged, rising-rate betas will decrease as interest rates decrease using the benchmarking method (and vice versa)
  - ▶ Example: If Fed Funds rate falls to 1.00% and the 12M CD rate remains at 0.80%, then the beta will decrease from 70% to 58% in our example
- ▶ Institution may elect to keep betas unchanged so historical model output will be more relevant for trend analysis



## Beta Maintenance

- ▶ Beta assumptions should be reviewed at least annually per regulatory guidance, but do not necessarily need to be changed.
- ▶ Beta assumptions do not need to exactly match benchmarking results
  - ▶ This is just the starting point for documenting the quantitative analysis
  - ▶ Qualitative adjustments may be applied to quantitative analysis results



## Benchmarking Method - Summary

### Strengths

- ▶ Simple and transparent
- ▶ Intuitive for wide audience and promotes discussion about pricing strategies
- ▶ Generally accepted by regulators

### Weaknesses

- ▶ May result in less favorable beta assumptions than regression analysis
  - Note: This makes benchmarking useful for reasonableness testing of assumptions developed using regression analysis*
- ▶ May have trouble identifying appropriate benchmarks
  - ▶ Pricing strategies in '06 may not reflect current pricing strategies
  - ▶ Rate increases from '15-'18 totaled just 225bp with limited deposit pricing response

*Note: These issues also apply to regression analysis*



## Data for Decay Analysis

- ▶ Best Data Sources for Balances:
  - ▶ Historical Trial Balances
- ▶ Decay Measurement versus Wtd. Average Age (WAA)
  - ▶ WAA only needs most recent trial balance
  - ▶ Fields: Account Balance, Opened Date, Rate (optional)
- ▶ Actual Historical Decay Requires Multiple Time Horizons
  - ▶ Pre-2013 versus Post-2013
    - ▶ Rate environment
    - ▶ Economic factors
  - ▶ Fields: Account Number, Balance, Product (optional), Rate (optional)



## Decay Example - Measure Actual Historical Decay by Balance

### Strengths

- ▶ Most accurate method
- ▶ Calculated across multiple time horizons
- ▶ Useful for monitoring actual deposit retention

### Weaknesses

- ▶ Requires more data than the weighted average age (WAA) method
- ▶ Requires more computing power than the WAA method
- ▶ What to do when data set doesn't include -200bp or +400bp rate shift?
- ▶ What to do when actual decay is very low or negative?



## Decay Example - Measure Actual Historical Decay by Balance

Account Number	Balance 01/01/2018	Balance 12/31/2018
*****2345	24,851	26,583
*****2346	50	50
*****2347	164,055	108,848
*****2348	679	30,718
*****2349	8,882	12,466
	<u>198,517</u>	<u>178,665</u>

Change in Beginning Account Balances: (19,852)  
 Annual Decay: 10%  
 Average Life (Years): 10

**Note: Ignore new accounts opened during the year**



## Decay Example - Measure Actual Historical Decay by Balance

		Vintage Date				
		Jan 1, 2014	Jan 1, 2015	Jan 1, 2016	Jan 1, 2017	Jan 1, 2018
+ Years	0	228,134,530	251,535,766	268,579,553	408,614,414	449,778,844
	1	220,458,060	248,580,099	254,275,889	369,138,927	419,995,158
	2	218,474,610	231,472,587	242,721,760	353,025,549	
	3	202,144,601	223,467,151	239,038,492		
	4	202,334,573	219,968,956			
	5	197,243,948				

		Annual Decay Rate				
		2014	2015	2016	2017	2018
+ Years	1	3%	1%	5%	10%	7%
	2	1%	7%	5%	4%	
	3	7%	3%	2%		
	4	0%	2%			
	5	3%				

5 Years of annual data = 15 annual periods

Simple Average --> 4.0%

Note: Can also calculate average by vintage or decay year



## Decay Example - Measure Actual Historical Decay by Balance

Decay Rate	Est Average Life (Years) <sup>1</sup>
1%	26
5%	16
10%	10
15%	7
20%	5
25%	4

Very low or negative decay often capped at X years WAL

<sup>1</sup>Truncated at 30 years.



## Decay Example - Measure Weighted Average Age

Account Number	Balance 12/31/2018	Opened Date	Avg. Age (Years)	Wtd. Avg. Age Calc.
*****2345	26,583	03/04/92	27	713,590
*****2346	50	12/30/18	0	0
*****2347	108,848	10/30/16	2	236,186
*****2348	30,718	05/15/79	40	1,218,200
*****2349	12,466	07/20/03	15	192,728
	<u>178,665</u>			<u>2,360,704</u>

Wtd. Average Age (Years):

**Still capped at X years WAL?**



## Wtd. Average Age - Additional Considerations

- ▶ Decay/WAL assumptions do not need to exactly match the analysis
  - ▶ Explain variances with qualitative factors
- ▶ Consistent decay/WAL across all rate shifts
  - ▶ Example: If cap of 6YR WAL applied to example above, then that decay/WAL assumption would be used across all rate shifts
  - ▶ Reduces “noise” in model output that is unrelated to balance sheet
  - ▶ Difficult to find relevant data to support different decay assumptions across rate shifts
- ▶ Decay assumptions are typically changed less frequently than beta assumptions





## Weighted Average Age - Summary

### Strengths

- ▶ Simple to calculate and understand
- ▶ Intuitive for wide audience and promotes discussion about retention strategies
- ▶ Sufficient for decay/WAL documentation at many institutions
  - ▶ Discussion on next slide

### Weaknesses

- ▶ Not appropriate for all institutions including those with:
  - ▶ Elevated risk profile
  - ▶ High deposit balance volatility
  - ▶ Recently acquired deposits
  - ▶ Very low WAA (e.g. de novo)
- ▶ Typically requires significant qualitative adjustments
- ▶ Calculating actual historical decay rates is a superior method and more useful to bank management
  - ▶ Provided resources are available to measure and track



## Weighted Average Age - Summary

Weighted Average Age method most appropriate for institutions with:

- ▶ Asset duration < 5 years
- ▶ Deposit base with high WAA, strong retention, and low decay
  - ▶ Decay/WAL caps in place
- ▶ Small percentage of funding with NMDs
- ▶ Low risk profile based on EVE
  - ▶ Decay does not impact EaR in most models



## Common and Accepted Methods for Supporting Deposit Assumptions?

### Beta



- ▶ Regression analysis
- ▶ Benchmarking ← 45-Minute Deposit Study Method
- ▶ Other: Management surveys, forward-looking pricing strategies, etc.

### Decay



- ▶ Measure actual historical decay by balance
- ▶ Weighted Average Age ← 45-Minute Deposit Study Method
- ▶ Other: Opened/closed accounts, account balance trendlines, etc.



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