



Implementing CECL

Presented by Wilary Winn Risk Management, LLC

**Douglas Winn, President
Frank Wilary, Principal
May 22, 2017**



Wilary Winn Risk Management Background

Founded in 2005, Wilary Winn Risk Management provides independent and objective, fee-based, financial advice to credit unions and banks located across the country. We currently have more than 425 clients in 49 states and the District of Columbia, including 30 of the top 100 credit unions.



Wilary Winn LLC

Today's Presenter

Douglas Winn – President

Mr. Winn co-founded Wilary Winn in the summer of 2003 and his primary responsibility is to set the firm's strategic direction.



Mr. Winn is a nationally recognized expert in financial institution accounting and regulatory reporting and has led seminars on the subject for many of the country's largest public accounting firms, the AICPA, the FDIC, the FFIEC, and the NCUA. Mr. Winn began his career as a practicing CPA for Arthur Young & Company - now Ernst & Young.



Wilary Winn LLC

Today's Presenter


Frank Wilary - Principal

Mr. Wilary co-founded Wilary Winn in 2003 and has over twenty years of diversified experience in the financial services industry.



His areas of expertise include asset-liability management, capital markets, derivatives, information systems and valuation of illiquid financial instruments. Frank's primary responsibility is to lead the research, development and implementation of Wilary Winn's new business lines. He works to ensure that new products and services meet our firms' high standards and makes the critical determination of whether to buy or build valuation software and how to best utilize the system selected.

CECL Basics

- **Why** – GAAP did not properly reflect risk before the financial crisis because of the delayed recognition of credit losses
 - **What** – ASU 2016-13 Measurement of Credit Losses on Financial Instruments
 - **When** – Issued June 16th, effective 2021 for credit unions, early adoption permitted beginning 2019
 - **How** – Adopt a cumulative effect adjustment to retained earnings
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CECL Applicability

CECL applies to:

- Loans
- HTM securities – OTTI no longer exists
- Net investments in leases
- Off balance sheet credit exposures:
 - Loan commitments
 - Standby letters of credit
 - Financial guarantees/similar instruments

CECL Major Provisions

- Departs from the incurred loss model – the probable threshold was removed and CECL results in day one life of asset loss recognition.
- Loss is recognized through an allowance for financial assets, including HTM debt securities, and through a liability for off balance sheet exposures.
- Changes in the allowance – positive and negative are recorded immediately through credit loss expense.

Measuring Credit Losses

- Net carrying amount should be based on the cash flows an entity expects to collect
- Contractual cash flows are adjusted for expected prepayments and defaults
 - Cash flows should not be adjusted for extensions, renewals, or modifications unless a TDR is reasonably expected
- Cash flows expected to be collected are discounted at the effective interest rate when using a discounted cash flow method
 - Credit loss is carrying amount less present value of expected cash flows
- Measure expected losses on a pool basis whenever similar risk characteristics exist



Estimating Expected Credit Losses

- Consider relevant information – internal and external
- Do not rely solely on past events – adjust historical loss information for:
 - Current asset specific risk characteristics
 - Current conditions
 - Reasonable and supportable forecasts
- Life of loan estimate – to estimate losses after reasonable forecast time period revert to historical loss rates


CECL Modeling Techniques

- Permits allowance calculation to be based on methods which “implicitly” include the time value of money
 - DCF explicitly considers time value of money
 - Loss-rate, roll-rates, probability of default methods, and provision matrices implicitly consider discount
- Contemplates use of mean and not mode if using statistical modeling

Regulatory Perspective

- Standard does not specify a single method for measuring expected credit losses
- Smaller and less complex institutions do not have to use costly and complex models
- Institutions may apply different modeling methods to different groups of financial assets

Our Perspective

- Big opportunity – software companies are creating a big hullabaloo
 - Credit unions can apply methodologies used by their lenders and best practices from other industries
 - External auditors will be in an interesting position reviewing the calculations
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Predictive Credit Indicators

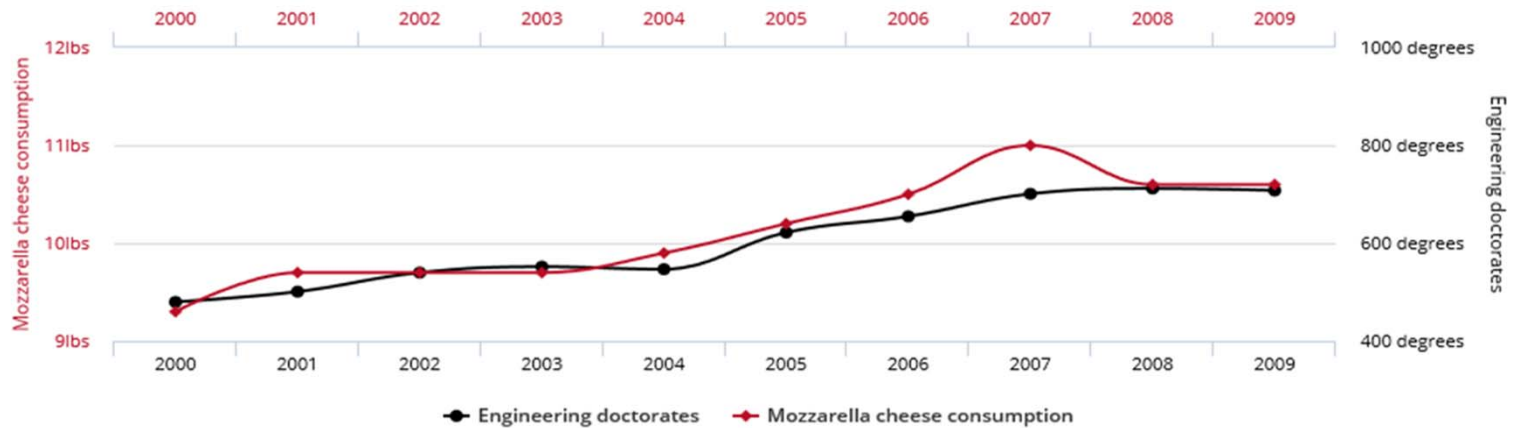
- Research conducted by others
 - Ratings agencies – approach by type of securitization
 - Credit reporting bureaus
- Appropriate level to model – loan or cohort
- Need to have cohorts that perform similarly
 - FICO Distribution
- Correlation is not causation



Correlation is not Causation

Per capita consumption of mozzarella cheese
correlates with
Civil engineering doctorates awarded

Correlation: 95.86% ($r=0.958648$)



Source: Spurious Media LLC tylervigen.com

Predictive Inputs

Examples:

- Performance of auto loans is highly correlated to type of loan, FICO score and unemployment rate
- Performance of residential real estate loans is highly correlated to FICO **and** CLTV
- Performance of C & I loans is correlated to industry

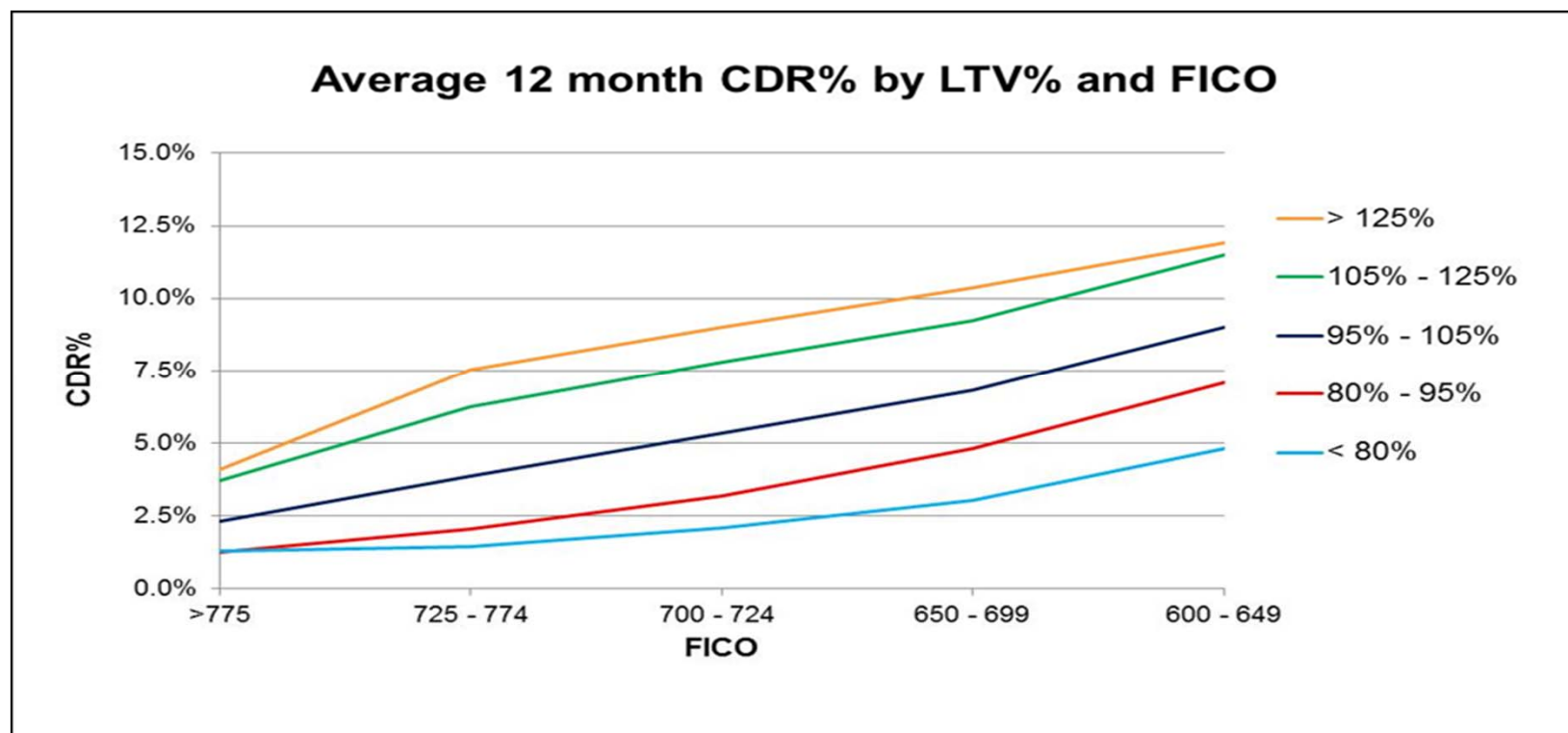
Loan Stratification - Cohort

Collateral Type	FICO Cohort	CRR%	CDR%	Severity %	Future Loss %
New Vehicle - Direct	660 - 719	23.53%	0.07%	33.56%	0.04%
Used Vehicle - Direct	660 - 719	23.53%	0.16%	34.78%	0.08%
New Vehicle - Indirect	660 - 719	23.53%	0.39%	36.95%	0.22%
Used Vehicle - Indirect	660 - 719	23.53%	0.48%	35.48%	0.26%

Loan Stratification - Cohort

Collateral Type	CRR%	CDR%	Severity %
Used Vehicle - Direct Current 780+	23.60%	0.02%	35.48%
Used Vehicle - Direct Current 720 - 779	23.58%	0.05%	36.23%
Used Vehicle - Direct Current 660 - 719	23.53%	0.16%	34.78%
Used Vehicle - Direct Current 620 - 659	23.33%	0.43%	39.95%
Used Vehicle - Direct Current 500 - 619	20.78%	4.63%	37.72%
Used Vehicle - Direct Current under 500	6.84%	20.09%	39.42%
Used Vehicle - Direct Delinquent 30-59	4.00%	45.00%	35.26%

Predictive Inputs



Loan Stratification – Cohort NAICs

SBA Default Rates by NAICS Code


Economic Variable	2007	2008	2009	2010	2011	2012
Bowling Centers	2.49	3.66	4.81	6.07	1.37	7.17
Car Washes	2.37	7.28	9.00	9.21	3.18	3.48
Gasoline Stations	2.57	4.14	6.55	7.55	3.83	4.04
Hotels and Motels	1.75	3.45	5.03	7.91	3.31	3.00
Machine Shops	1.22	3.59	4.09	3.29	2.03	1.32
Offices of Dentists	0.84	2.28	4.13	3.60	1.50	1.77
Offices of Lawyers	0.60	1.89	1.89	4.13	2.14	0.66
Veterinary Services	0.23	0.70	1.95	0.63	1.15	0.41

Loan Cohorts

Should be based on credit union's lending strategy,
loan portfolio composition and concentration



Credit Loss Models

- Average charge-off method
 - Historical loss rates for similar pools, e.g. new vehicle
 - Static pool
 - Historical loss rates on pools with similar attributes, e.g. used indirect prime credit
 - Vintage analysis
 - Historical loss rates based on origination year generally includes annual loss curves
 - Migration or roll-rate
 - Likelihood of loan migrating to default
 - Discounted cash flow
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Estimating Credit Losses

- Modeling should be based on type of loan
- For example, MBLs that are CRE – re-underwrite higher risk loans and use migration analysis for lower risk loans
- Residential real estate and consumer loans are best modeled statistically:
 - Roll rate analyses
 - Probability of default analyses
 - Discounted cash flow analyses

Estimating Credit Losses

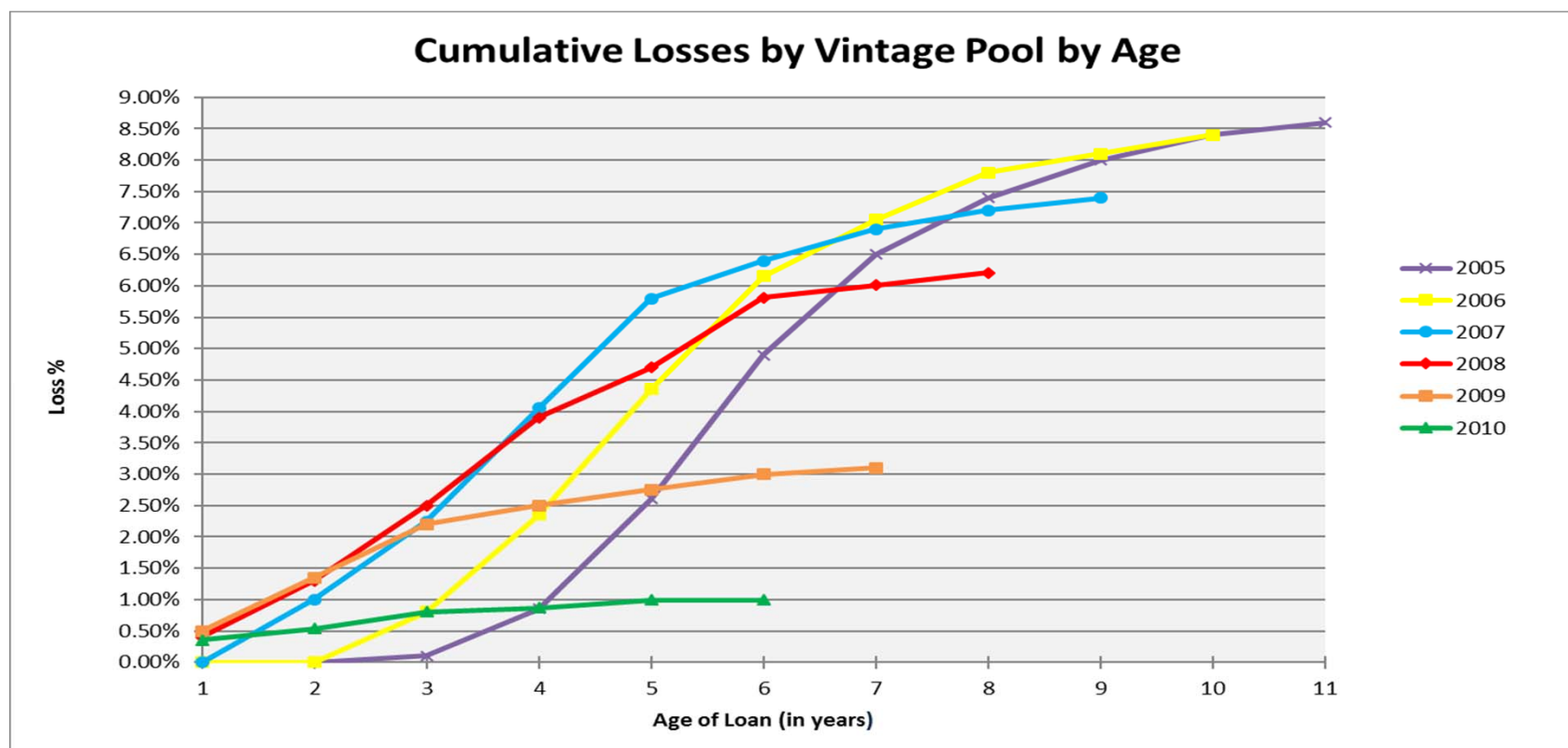
Simplified vintage analysis

Vintage Year	Actual Cumulative Losses by Years Since Origination				Projected Cumulative Losses by Year Since Origination			
	1	2	3	4	1	2	3	4
2011	0.5%	1.0%	1.5%	2.0%	0.5%	1.0%	1.5%	2.0%
2012	1.0%	2.0%	3.0%		1.0%	2.0%	3.0%	4.0%
2013	0.0%	1.0%			0.0%	1.0%	1.5%	2.0%
2014	0.5%				0.5%	1.0%	1.5%	2.0%
Average	0.5%	1.3%	2.3%	2.0%	0.5%	1.3%	1.9%	2.5%

Static Pools – Cumulative Loss

15 year mortgage, 660-719 FICO, 80% LTV				Actual Cumulative Loss by Year Since Origination														
Origination Year	Original Balance	Losses to Date \$	Losses to Date %	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
2000	1,000,000	10,000	1.0%	0.0%	0.0%	0.0%	0.0%	0.1%	0.2%	0.3%	0.4%	0.5%	0.6%	0.7%	0.8%	0.9%	1.0%	1.0%
2001	1,000,000	13,500	1.4%	0.0%	0.0%	0.0%	0.0%	0.1%	0.2%	0.3%	0.4%	0.6%	0.9%	1.1%	1.2%	1.3%	1.4%	1.4%
2002	1,000,000	21,000	2.1%	0.0%	0.0%	0.0%	0.0%	0.1%	0.2%	0.3%	0.7%	1.2%	1.7%	1.8%	1.9%	2.0%	2.1%	
2003	1,000,000	30,000	3.0%	0.0%	0.0%	0.0%	0.1%	0.2%	0.6%	1.1%	1.7%	2.2%	2.6%	2.7%	2.9%	3.0%		
2004	1,000,000	40,500	4.1%	0.0%	0.0%	0.0%	0.1%	0.5%	1.5%	2.6%	3.4%	3.6%	3.8%	4.0%	4.1%			
2005	1,000,000	86,000	8.6%	0.0%	0.0%	0.1%	0.9%	2.6%	4.9%	6.5%	7.4%	8.0%	8.4%	8.6%				
2006	1,000,000	84,000	8.4%	0.0%	0.0%	0.8%	2.4%	4.4%	6.2%	7.1%	7.8%	8.1%	8.4%					
2007	1,000,000	74,000	7.4%	0.0%	1.0%	2.3%	4.1%	5.8%	6.4%	6.9%	7.2%	7.4%						
2008	1,000,000	62,100	6.2%	0.4%	1.3%	2.5%	3.9%	4.7%	5.8%	6.0%	6.2%							
2009	1,000,000	31,000	3.1%	0.5%	1.4%	2.2%	2.5%	2.8%	3.0%	3.1%								
2010	1,000,000	9,945	1.0%	0.4%	0.5%	0.8%	0.9%	1.0%	1.0%									
2011	1,000,000	1,000	0.1%	0.0%	0.0%	0.0%	0.0%	0.1%										
2012	1,000,000	-	0.0%	0.0%	0.0%	0.0%												
2013	1,000,000	-	0.0%	0.0%	0.0%													
2014	1,000,000	-	0.0%	0.0%														
2015	1,000,000	-	0.0%	0.0%														
Average				0.1%	0.3%	0.6%	1.1%	1.9%	2.7%	3.4%	3.9%	4.0%	3.8%	3.1%	2.2%	1.8%	1.5%	1.2%

Static Pools – Cumulative Loss





Disadvantages of Basic Models

Average charge-off, static pool or vintage – difficult to:

- Include voluntary prepayments as required under the standard
- Adjust for changes in underwriting standards
- Adjust for differences in current and projected macroeconomic conditions



Discounted Cash Flow Analysis

Key Valuation Inputs:

- Conditional Repayment Rate (CRR)
- Conditional Default Rate (CDR)
- Conditional Prepayment Rate (CPR = CRR + CDR)
- Loss Severity
- Discount Rate – depends on accounting context - for CECL it is original yield

Loan Example – 660-719 FICO

Loan Example - 660-719 FICO group
 Sched. P&I payment \$ 37,680.50

Discounted Annual Annual Annual
 Losses CRR% CDR% Severity%
 \$ 75,927 6.0% 1.0% 20%

Valuation Month	Loan Payment Month	Remaining Loan Balance	Actual Amort	Voluntary Prepays	Repo Prin Recoveries	Total Prin Collected	Interest	Total P&I Collected	DQ Balance	Repo Balance	Liquidations	Repo Prin Losses	Monthly CRR%	Monthly CDR%	Monthly Severity%
0	81	6,525,000													
1	82	6,478,309	13,201	33,490	-	46,691	24,448	71,139	5,463	-	-	-	0.51%	0.08%	20%
2	83	6,431,916	13,171	33,222	-	46,393	24,253	70,646	10,882	-	-	-	0.51%	0.08%	20%
3	84	6,385,819	13,141	32,956	-	46,097	24,059	70,156	16,257	-	-	-	0.51%	0.08%	20%
4	85	6,340,016	13,112	32,691	-	45,803	23,866	69,669	21,590	-	-	-	0.51%	0.08%	20%
5	86	6,294,505	13,082	32,428	-	45,511	23,674	69,185	26,879	-	-	-	0.51%	0.08%	20%
6	87	6,249,285	13,053	32,167	-	45,220	23,484	68,704	32,126	-	-	-	0.51%	0.08%	20%
7	88	6,204,354	13,023	31,908	-	44,931	23,295	68,226	31,869	5,463	-	-	0.51%	0.08%	20%
8	89	6,159,710	12,994	31,650	-	44,644	23,107	67,751	31,613	10,882	-	-	0.51%	0.08%	20%
9	90	6,115,351	12,965	31,394	-	44,359	22,920	67,279	31,358	16,257	-	-	0.51%	0.08%	20%
10	91	6,065,813	12,935	31,140	4,370	48,445	22,735	71,180	31,105	16,127	5,463	1,093	0.51%	0.08%	20%
11	92	6,016,601	12,906	30,887	4,335	48,129	22,551	70,679	30,854	15,998	5,419	1,084	0.51%	0.08%	20%
12	93	5,967,712	12,877	30,636	4,300	47,814	22,368	70,182	30,605	15,869	5,376	1,075	0.51%	0.08%	20%
13	94	5,919,144	12,848	30,387	4,266	47,501	22,186	69,687	30,357	15,742	5,332	1,066	0.51%	0.08%	20%
14	95	5,870,896	12,819	30,139	4,232	47,190	22,005	69,196	30,111	15,615	5,290	1,058	0.51%	0.08%	20%
15	96	5,822,966	12,790	29,893	4,198	46,881	21,826	68,707	29,867	15,489	5,247	1,049	0.51%	0.08%	20%
16	97	5,775,351	12,762	29,649	4,164	46,574	21,648	68,222	29,624	15,364	5,205	1,041	0.51%	0.08%	20%
17	98	5,728,049	12,733	29,406	4,130	46,269	21,471	67,740	29,383	15,240	5,163	1,033	0.51%	0.08%	20%
18	99	5,681,059	12,704	29,165	4,097	45,966	21,295	67,261	29,143	15,116	5,121	1,024	0.51%	0.08%	20%
19 - 280	100 - 360	0	2,507,970	2,676,847	396,993	5,581,811	1,966,882	7,548,693	-	-	496,241	99,248	0.51%	0.08%	20%
Total			2,741,087	3,240,056	435,085	6,416,229	2,378,073	8,794,302			543,856	108,771	0.51%	0.08%	20%



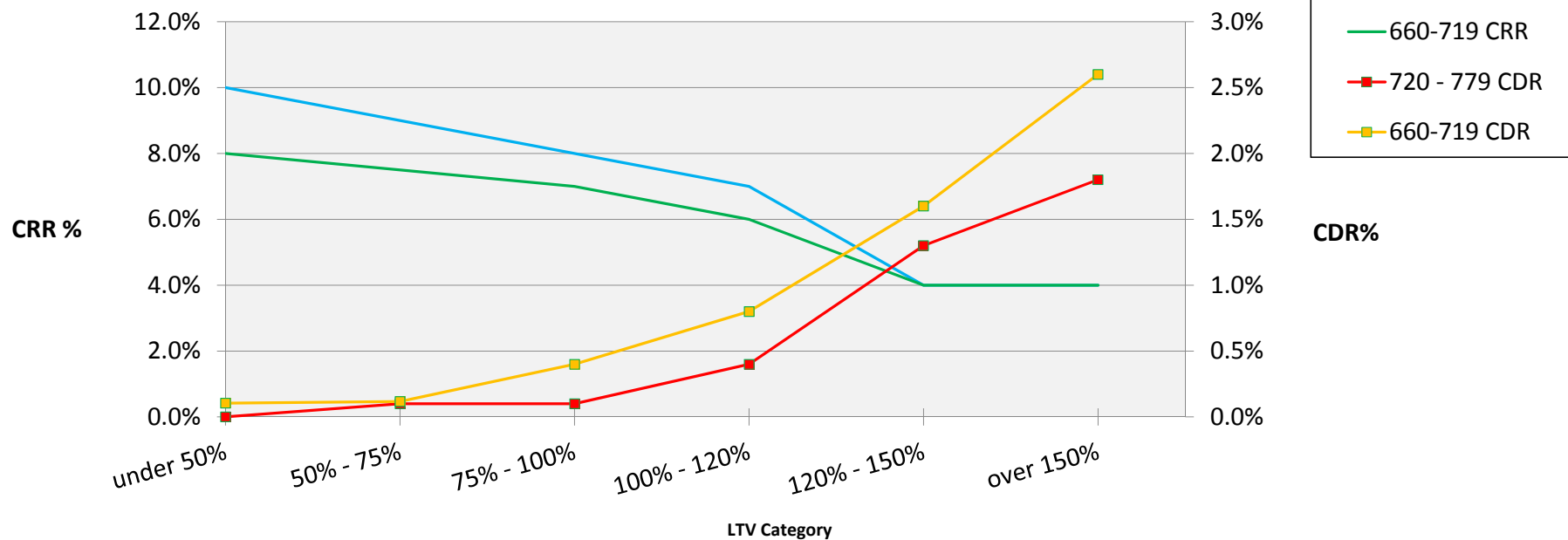
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Discounted Cash Flow Analysis

Loan Type	Payment Status	Credit Score	LTV Status	LTV %	Ending Balance	Annual Prepay % (CRR)	Annual Default % (CDR)	Loss Severity %	Avg Life	Gross Future Losses	Discount Rate (WAC)	Discounted Future Losses	Discounted Lifetime Future Losses %	Discounted Annual Future Losses %
Fixed	Current	720+	Under 50%	45%	13,500,000	10.0%	0.0%	0%	7.0	-	4.0%	-	0.0%	0.0%
	Current	720+	50% - 75%	65%	9,450,000	9.0%	0.1%	0%	7.1	-	4.0%	-	0.0%	0.0%
	Current	720+	75% - 100%	85%	5,400,000	8.0%	0.1%	6%	7.6	2,416	4.0%	1,793	0.0%	0.0%
	Current	720+	100% - 120%	115%	3,150,000	7.0%	0.4%	30%	8.0	30,865	4.0%	22,510	0.7%	0.1%
	Current	720+	120% - 150%	140%	1,350,000	4.0%	1.3%	43%	9.5	71,685	4.0%	49,327	3.7%	0.4%
Current	720+	Over 150%	175%	450,000	4.0%	1.8%	54%	9.0	39,790	4.0%	27,902	6.2%	0.7%	
<i>Repeat for FICO Buckets</i>														
Current	660-719		by LTV bucket	101%	6,525,000	6.0%	1.0%	20%	8.2	108,771	4.5%	75,927	1.2%	0.1%
Current	620-659		by LTV bucket	70%	2,115,000	5.0%	3.5%	0%	8.0	-	5.0%	-	0.0%	0.0%
Current	500-619		by LTV bucket	88%	1,350,000	4.0%	13.0%	9%	6.0	90,243	5.5%	65,452	4.8%	0.8%
Current	Under 500		by LTV bucket	85%	1,462,500	4.0%	20.0%	6%	5.0	86,463	5.5%	66,066	4.5%	0.9%
Delinquent	30-59 days			70%	45,000	4.0%	30.0%	0%	4.1	-	4.0%	-	0.0%	0.0%
Delinquent	60-89 days			88%	135,000	2.0%	50.0%	9%	3.3	18,928	4.0%	16,649	12.3%	3.8%
Delinquent	90+ days			85%	67,500	2.0%	75.0%	6%	2.7	7,994	4.0%	7,195	10.7%	4.0%
ARM	repeat all FICO & LTV buckets above			125%	30,000,000	8.0%	2.5%	36%	6.0	1,620,000	4.2%	1,269,286	4.2%	0.7%
Total Mortgages				95%	75,000,000	7.9%	2.1%	19%	6.8	2,077,155	4.2%	1,602,106	2.1%	0.3%

Assumptions by LTV and FICO

CRR% and CDR% by LTV and FICO

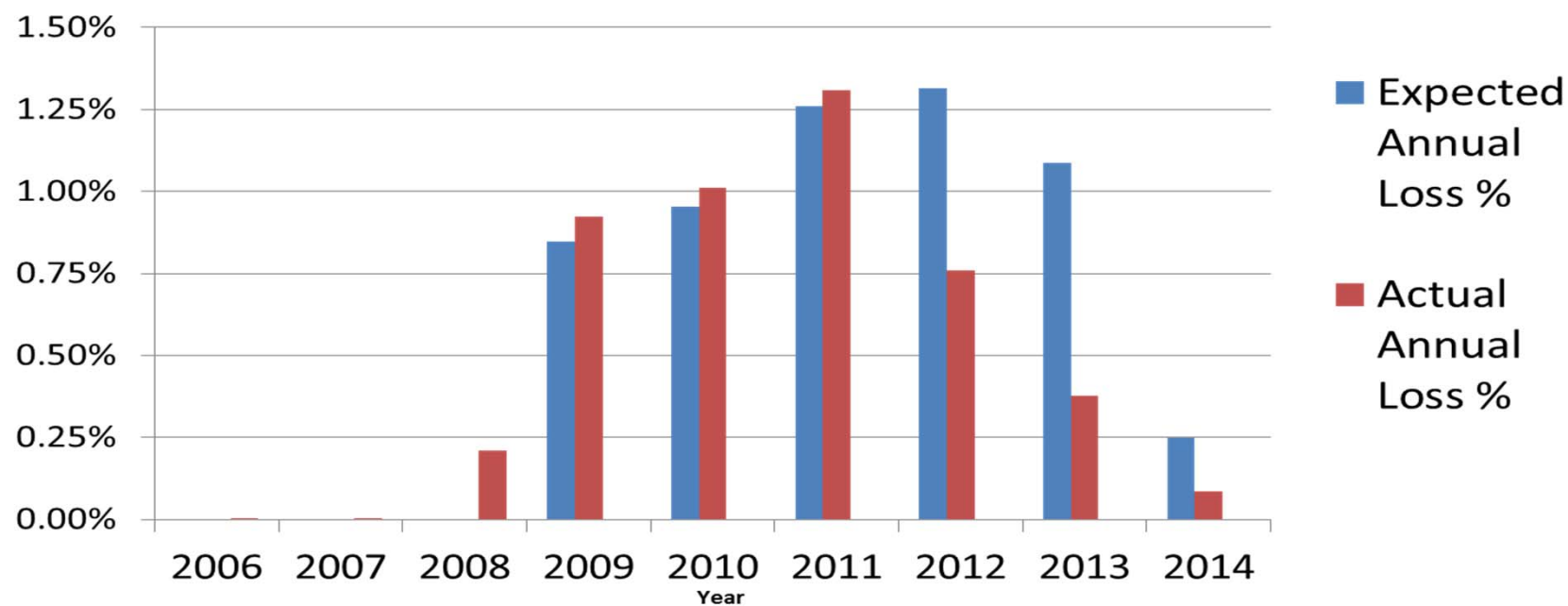


Discounted Cash Flow Analysis

It is very important to note that while we are applying our statistical inputs at the loan level in order to achieve a more accurate result for the aggregated cash flows, we do not for a moment believe our results are accurate for any given loan. In fact, we show a small percentage of each loan prepaying and defaulting each year – the latter, of course, being impossible. We are not re-underwriting individual loans, we are applying inputs – prepayment rates, default rates and loss given defaults, which we have derived from our statistical analysis to a pool of loans. Our results are intended to be accurate and to be used only in the aggregate.

Predictive Inputs

1st Mortgages



Predictive Inputs

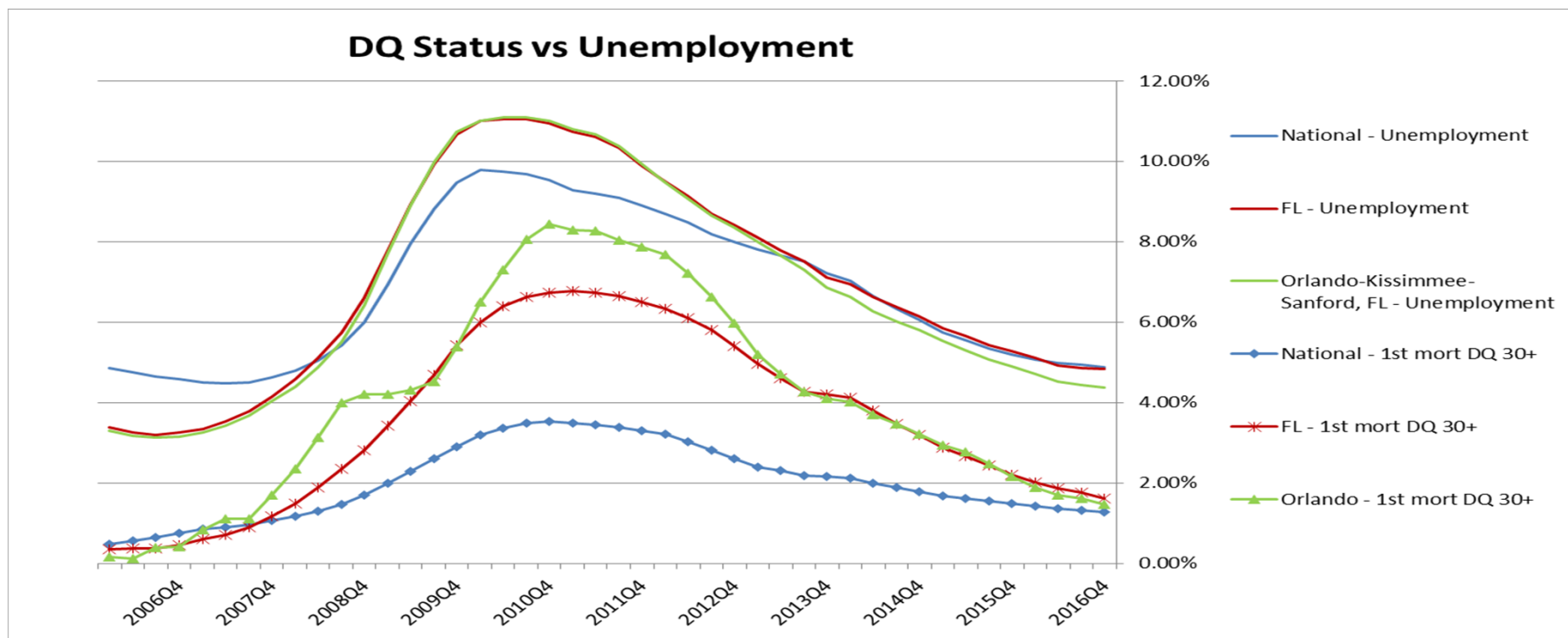


Predictive Inputs

Quantifying the relationship between unemployment and defaults:

- Perform regression analysis to determine best fit trend line including beta and R-squared
- Perform roll rate analysis to determine estimated default rates for any given unemployment rate
- Utilize changes between scenarios to determine default factors

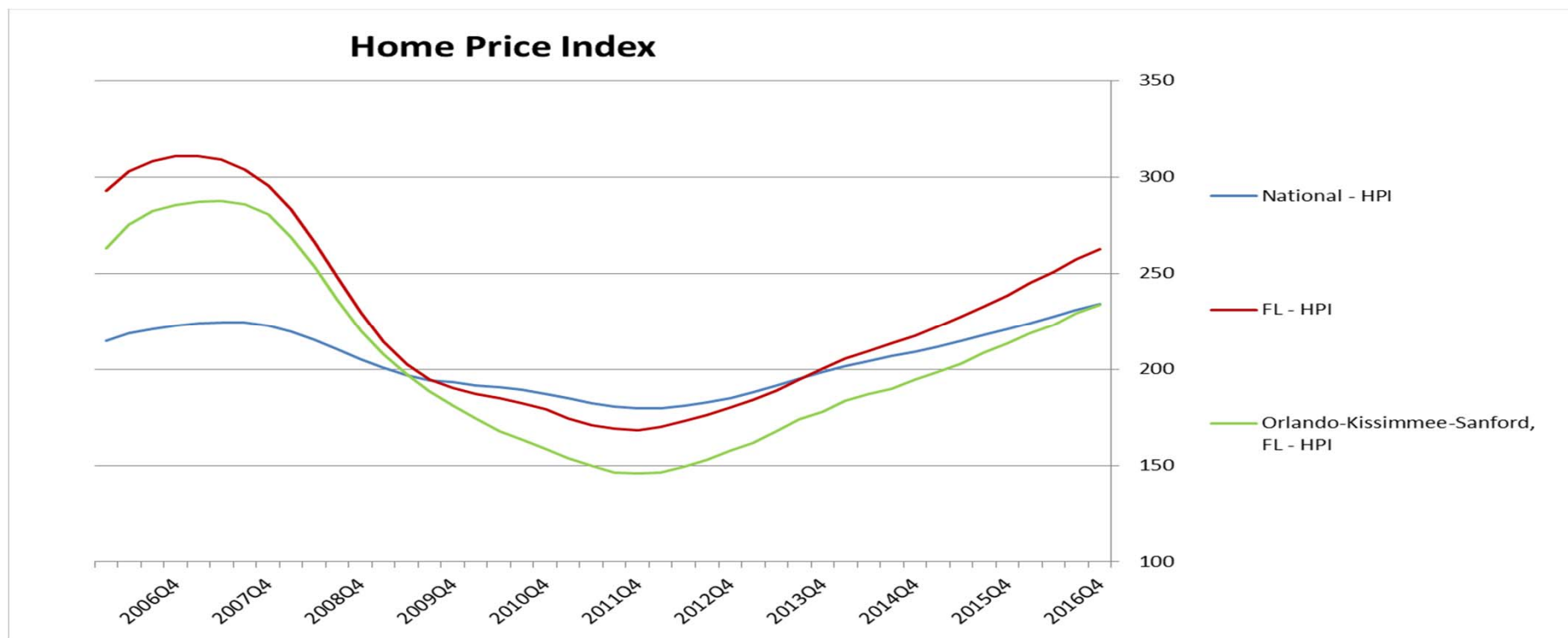
Predictive Inputs



Predictive Inputs – Orlando MSA

		Unemployment and Default Factors by Year - Cyclical Assumptions									
Market	Loan Category	Yr 1 2017	Yr 2 2018	Yr 3 2019	Yr 4 2020	Yr 5 2021	Yr 6 2022	Yr 7 2023	Yr 8 2024	Yr 9 2025	Yr 10 2026
Unemployment											
National		4.50%	6.00%	9.50%	9.20%	8.80%	7.60%	7.00%	5.70%	4.90%	4.80%
Orlando MSA		4.50%	7.10%	11.10%	11.10%	10.00%	8.30%	7.20%	6.20%	5.30%	5.00%
Estimated Default Factors											
Orlando MSA	1st Mortgage - Fixed	129%	381%	769%	769%	662%	497%	391%	294%	207%	178%
Orlando MSA	1st Mortgage - Adjust	106%	154%	228%	228%	207%	176%	156%	137%	120%	115%
Orlando MSA	Other RE - Fixed	111%	206%	352%	352%	312%	250%	210%	173%	140%	129%
Orlando MSA	Other RE - Adjust	106%	158%	239%	239%	217%	182%	160%	140%	122%	116%
Orlando MSA	Credit Card	106%	154%	229%	229%	209%	177%	156%	138%	121%	115%
Orlando MSA	Other Consumer	103%	132%	175%	175%	163%	145%	133%	122%	112%	109%
Estimated Default Rates											
Orlando MSA	1st Mortgage - Fixed	0.55%	1.63%	3.28%	3.28%	2.82%	2.12%	1.67%	1.25%	0.88%	0.76%
Orlando MSA	1st Mortgage - Adjust	0.57%	0.82%	1.22%	1.22%	1.11%	0.94%	0.83%	0.73%	0.64%	0.62%
Orlando MSA	Other RE - Fixed	0.33%	0.61%	1.04%	1.04%	0.92%	0.74%	0.62%	0.51%	0.41%	0.38%
Orlando MSA	Other RE - Adjust	0.58%	0.86%	1.30%	1.30%	1.18%	0.99%	0.87%	0.76%	0.66%	0.63%
Orlando MSA	Credit Card	1.47%	2.14%	3.19%	3.19%	2.90%	2.46%	2.17%	1.91%	1.68%	1.60%
Orlando MSA	Other Consumer	1.19%	1.51%	2.01%	2.01%	1.87%	1.66%	1.52%	1.40%	1.29%	1.25%

Predictive Inputs



Predictive Inputs

HPI Impact by Year - Cyclical Assumptions										
Yr 0	Yr 1	Yr 2	Yr 3	Yr 4	Yr 5	Yr 6	Yr 7	Yr 8	Yr 9	Yr 10
	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026
Florida										
Appreciation/(Depreciation) %	-7.4%	-24.9%	-14.6%	-11.6%	-2.0%	13.1%	10.5%	10.4%	10.1%	8.2%
LTV %	90%	96%	126%	143%	154%	145%	117%	97%	80%	65%
Severity %	17%	28%	33%	37%	34%	25%	18%	15%	15%	15%
CDR %	0.4%	1.1%	2.4%	2.4%	2.0%	1.5%	1.1%	0.8%	0.6%	0.5%
Losses %	0.0%	0.0%	0.0%	0.2%	0.5%	0.6%	0.5%	0.3%	0.1%	0.1%
Orlando MSA										
Appreciation/(Depreciation) %	-10.6%	-26.4%	-9.2%	-6.7%	-1.9%	8.7%	13.0%	7.7%	9.7%	8.6%
LTV %	90%	99%	133%	143%	146%	138%	116%	94%	79%	64%
Severity %	19%	30%	33%	34%	32%	25%	16%	15%	15%	15%
CDR %	0.6%	1.6%	3.3%	3.3%	2.8%	2.1%	1.7%	1.3%	0.9%	0.8%
Losses %	0.0%	0.0%	0.0%	0.2%	0.5%	0.5%	0.4%	0.3%	0.1%	0.1%

Capital Stress Testing – Credit

Loan Category	Balance	Base			Mid-Stress			Max Stress		
		Credit Losses \$	Credit Losses %	Decrease in NW Ratio	Credit Losses \$	Credit Losses %	Decrease in NW Ratio	Credit Losses \$	Credit Losses %	Decrease in NW Ratio
New Vehicle - Direct	50,000,000	100,601	0.20%	0.01%	113,710	0.23%	0.01%	125,645	0.25%	0.01%
Used Vehicle - Direct	50,000,000	341,920	0.68%	0.03%	405,474	0.81%	0.03%	457,622	0.92%	0.04%
New Vehicle - Indirect	75,000,000	504,161	0.67%	0.04%	561,793	0.75%	0.04%	615,706	0.82%	0.05%
Used Vehicle - Indirect	75,000,000	1,008,952	1.35%	0.08%	1,158,644	1.54%	0.09%	1,291,239	1.72%	0.10%
Total Vehicles	250,000,000	1,955,635	0.78%	0.17%	2,239,622	0.90%	0.18%	2,490,212	1.00%	0.20%
Fixed Rate Mortgage	300,000,000	1,835,005	0.61%	0.15%	5,457,824	1.82%	0.44%	9,161,662	3.05%	0.73%
ARM	150,000,000	480,000	0.32%	0.04%	1,656,062	1.10%	0.13%	5,352,943	3.57%	0.43%
Home Equity	50,000,000	310,423	0.62%	0.02%	599,056	1.20%	0.05%	1,287,246	2.57%	0.10%
HELOC	50,000,000	109,838	0.22%	0.01%	212,501	0.43%	0.02%	551,142	1.10%	0.04%
Total Real Estate	550,000,000	2,735,266	0.50%	0.23%	7,925,443	1.44%	0.63%	16,352,993	2.97%	1.31%
Credit Card	100,000,000	3,046,598	3.05%	0.24%	3,516,541	3.52%	0.28%	4,030,767	4.03%	0.32%
Member Business Loans	50,000,000	407,492	0.81%	0.03%	642,816	1.29%	0.05%	839,108	1.68%	0.07%
Other Consumer	50,000,000	1,031,567	2.06%	0.08%	1,212,913	2.43%	0.10%	1,391,954	2.78%	0.11%
Total Loans	1,000,000,000	9,176,558	0.92%	0.73%	15,537,334	1.55%	1.24%	25,105,035	2.51%	2.01%

Current Net Worth Ratio	9.00%	9.00%	9.00%
Adjusted Net Worth Ratio (add back existing ALLL)	9.60%	9.60%	9.60%
Net Worth Ratio After Credit Losses	8.87%	8.36%	7.59%
Change in Net Worth to Account for Losses	-0.13%	-0.64%	-1.41%

Capital Stress Testing – Credit

Loan Category	Current Balance	Concentration % of Net Worth	Proposed Limit	Balance at Proposed Limit	Base		Decrease in NW Ratio
					Credit Losses \$	Credit Losses %	
Example #1 - Current Concentration							
Used Vehicle - Indirect	75,000,000	66.67%	66.67%	75,000,000	1,008,952	1.35%	0.08%
<i>Prime</i>	37,841,433	33.64%	33.64%	37,841,433	24,498	0.06%	0.002%
<i>Near Prime</i>	23,881,117	21.23%	21.23%	23,881,117	82,689	0.35%	0.007%
<i>Subprime</i>	13,277,450	11.80%	11.80%	13,277,450	901,765	6.79%	0.072%
Example #2 - Prime Focused Lending							
Used Vehicle - Indirect	75,000,000	66.67%	100.00%	112,500,000	619,580	0.55%	0.05%
<i>Prime</i>	37,841,433	33.64%	80.00%	90,000,000	58,265	0.06%	0.005%
<i>Near Prime</i>	23,881,117	21.23%	15.00%	16,875,000	58,430	0.35%	0.005%
<i>Subprime</i>	13,277,450	11.80%	5.00%	5,625,000	382,033	6.79%	0.031%
Example #3 - Non Credit Selective Lending							
Used Vehicle - Indirect	75,000,000	66.67%	100.00%	112,500,000	2,701,011	2.40%	0.22%
<i>Prime</i>	37,841,433	33.64%	33.33%	37,500,000	24,277	0.06%	0.002%
<i>Near Prime</i>	23,881,117	21.23%	33.33%	37,500,000	129,845	0.35%	0.010%
<i>Subprime</i>	13,277,450	11.80%	33.33%	37,500,000	2,546,889	6.79%	0.204%

Concentration Risk Policy

Determining Concentration Sub-limit

Loan Category	Current Balance	Current Concentration % of Net Worth	Proposed Limit	Balance at Proposed Limit	Loan Growth within Limit
New Vehicle - Direct	50,000,000	44.44%	65.00%	73,125,000	23,125,000
<i>Prime</i>	41,268,777	36.68%	50.00%	56,250,000	14,981,223
<i>Near Prime</i>	6,735,509	5.99%	10.00%	11,250,000	4,514,491
<i>Subprime</i>	1,995,714	1.77%	5.00%	5,625,000	3,629,286
Used Vehicle - Direct	50,000,000	44.44%	65.00%	73,125,000	23,125,000
<i>Prime</i>	31,567,705	28.06%	35.00%	39,375,000	7,807,295
<i>Near Prime</i>	12,085,300	10.74%	20.00%	22,500,000	10,414,700
<i>Subprime</i>	6,346,995	5.64%	10.00%	11,250,000	4,903,005
New Vehicle - Indirect	75,000,000	66.67%	85.00%	95,625,000	20,625,000
<i>Prime</i>	52,787,875	46.92%	60.00%	67,500,000	14,712,125
<i>Near Prime</i>	15,259,464	13.56%	15.00%	16,875,000	1,615,536
<i>Subprime</i>	6,952,661	6.18%	10.00%	11,250,000	4,297,339
Used Vehicle - Indirect	75,000,000	66.67%	85.00%	95,625,000	20,625,000
<i>Prime</i>	37,841,433	33.64%	45.00%	50,625,000	12,783,567
<i>Near Prime</i>	23,881,117	21.23%	30.00%	33,750,000	9,868,883
<i>Subprime</i>	13,277,450	11.80%	10.00%	11,250,000	(2,027,450)

Testing Concentration Limits

Loan Category	Balance at Proposed Limit	Base			Mid-Stress			Max Stress		
		Credit Losses \$	Credit Losses %	Decrease in NW Ratio	Credit Losses \$	Credit Losses %	Decrease in NW Ratio	Credit Losses \$	Credit Losses %	Decrease in NW Ratio
New Vehicle - Direct	73,125,000	275,131	0.38%	0.02%	310,376	0.42%	0.02%	342,315	0.47%	0.03%
Used Vehicle - Direct	73,125,000	604,568	0.83%	0.05%	716,733	0.98%	0.06%	808,679	1.11%	0.06%
New Vehicle - Indirect	95,625,000	788,092	0.82%	0.06%	877,526	0.92%	0.07%	960,940	1.00%	0.08%
Used Vehicle - Indirect	95,625,000	913,701	0.96%	0.07%	1,052,691	1.10%	0.08%	1,177,206	1.23%	0.09%
Total Vehicles	337,500,000	2,581,493	0.76%	0.22%	2,957,326	0.88%	0.24%	3,289,140	0.97%	0.26%
Fixed Rate Mortgage	345,000,000	2,110,256	0.61%	0.17%	6,276,498	1.82%	0.50%	10,535,911	3.05%	0.84%
ARM	172,500,000	552,000	0.32%	0.04%	1,904,471	1.10%	0.15%	6,155,884	3.57%	0.49%
Home Equity	57,500,000	356,987	0.62%	0.03%	688,915	1.20%	0.06%	1,480,333	2.57%	0.12%
HELOC	57,500,000	126,314	0.22%	0.01%	244,376	0.43%	0.02%	633,813	1.10%	0.05%
Total Real Estate	632,500,000	3,145,556	0.50%	0.27%	9,114,259	1.44%	0.73%	18,805,942	2.97%	1.50%
Credit Card	115,000,000	3,503,588	3.05%	0.28%	4,044,022	3.52%	0.32%	4,635,382	4.03%	0.37%
Member Business Loans	57,500,000	468,616	0.81%	0.04%	739,238	1.29%	0.06%	964,975	1.68%	0.08%
Other Consumer	57,500,000	1,186,302	2.06%	0.09%	1,394,850	2.43%	0.11%	1,600,747	2.78%	0.13%
Total Loans	1,200,000,000	10,885,554	0.91%	0.87%	18,249,696	1.52%	1.46%	29,296,185	2.44%	2.34%

Net Worth Ratio After Credit Losses

8.73%

8.14%

7.26%

Net Worth Ratio Target

7.50%

7.50%

7.50%

Net Worth Ratio Cushion

1.23%

0.64%

-0.24%

Pass/Fail

Pass

Pass

Fail

Testing Concentration Limits

Loan Category	Balance at Proposed Limit	Base			Mid-Stress			Max Stress		
		Credit Losses \$	Credit Losses %	Decrease in NW Ratio	Credit Losses \$	Credit Losses %	Decrease in NW Ratio	Credit Losses \$	Credit Losses %	Decrease in NW Ratio
New Vehicle - Direct	73,125,000	275,131	0.38%	0.02%	310,376	0.42%	0.02%	342,315	0.47%	0.03%
Used Vehicle - Direct	73,125,000	604,568	0.83%	0.05%	716,733	0.98%	0.06%	808,679	1.11%	0.06%
New Vehicle - Indirect	95,625,000	788,092	0.82%	0.06%	877,526	0.92%	0.07%	960,940	1.00%	0.08%
Used Vehicle - Indirect	95,625,000	913,701	0.96%	0.07%	1,052,691	1.10%	0.08%	1,177,206	1.23%	0.09%
Total Vehicles	337,500,000	2,581,493	0.76%	0.22%	2,957,326	0.88%	0.24%	3,289,140	0.97%	0.26%
Fixed Rate Mortgage	285,000,000	1,743,255	0.61%	0.14%	5,184,933	1.82%	0.41%	8,703,579	3.05%	0.70%
ARM	142,500,000	456,000	0.32%	0.04%	1,573,259	1.10%	0.13%	5,085,296	3.57%	0.41%
Home Equity	50,000,000	310,423	0.62%	0.02%	599,056	1.20%	0.05%	1,287,246	2.57%	0.10%
HELOC	50,000,000	109,838	0.22%	0.01%	212,501	0.43%	0.02%	551,142	1.10%	0.04%
Total Real Estate	527,500,000	2,619,516	0.50%	0.22%	7,569,749	1.44%	0.61%	15,627,263	2.96%	1.25%
Credit Card	115,000,000	3,503,588	3.05%	0.28%	4,044,022	3.52%	0.32%	4,635,382	4.03%	0.37%
Member Business Loans	57,500,000	468,616	0.81%	0.04%	739,238	1.29%	0.06%	964,975	1.68%	0.08%
Other Consumer	57,500,000	1,186,302	2.06%	0.09%	1,394,850	2.43%	0.11%	1,600,747	2.78%	0.13%
Total Loans	1,095,000,000	10,359,514	0.95%	0.83%	16,705,185	1.53%	1.34%	26,117,506	2.39%	2.09%

Net Worth Ratio After Credit Losses

8.77%

8.26%

7.51%

Net Worth Ratio Target

7.50%

7.50%

7.50%

Net Worth Ratio Cushion

1.27%

0.76%

0.01%

Pass/Fail

Pass

Pass

Pass



Analyzing Concentration Risk

Benefits of Stress Testing Credit Exposure:


- Stress testing can determine lifetime credit losses in adverse economic environments
- Results can quantify credit exposure in concentration policy limits by testing thresholds at fully lent out balances
- Leads to a dynamic process to set concentration risk sub-limits that can be integrated into organizational strategy
- Can show interrelated risks when incorporated into ALM (concentration, credit, interest rate, and liquidity risk)
- Add even further value when integrated into risk-based pricing and real return analysis

Risk-Based Pricing

Used Vehicle Indirect Pricing Matrix							
Vehicle Loan Category	760+	730 - 759	680 - 729	640 - 679	600 - 639	550 - 599	< 550
Used Vehicle - Indirect - 24 Month	2.49%	2.99%	3.99%	5.49%	7.49%	11.49%	13.49%
Used Vehicle - Indirect - 36 Month	2.49%	2.99%	4.49%	5.99%	7.99%	11.99%	13.99%
Used Vehicle - Indirect - 48 Month	2.99%	3.49%	4.99%	6.49%	8.49%	12.49%	14.49%
Used Vehicle - Indirect - 60 Month	3.49%	3.99%	5.49%	6.99%	8.99%	12.99%	14.99%
Used Vehicle - Indirect - 72 Month	3.99%	4.49%	5.99%	7.99%	9.99%	13.99%	15.99%
Used Vehicle - Indirect - 84 Month	4.49%	4.99%	6.49%	8.99%	10.99%	14.99%	16.99%

Real Return Analysis

Determined by calculating the internal rate of return of the cash flows received over the life of a loan. The analysis incorporates:

- Current pricing matrix by FICO and term
 - Average loan balance by term
 - Indirect dealer fees
 - Probability of delinquency and default for FICO and term cohorts
 - Lost interest on delinquent loans
 - Ultimate credit losses based on modeled default and severity rates
- 



Real Return Analysis

Estimated Real Return - Base Economic Environment							
Vehicle Loan Category	760+	730 - 759	680 - 729	640 - 679	600 - 639	550 - 599	< 550
Used Vehicle - Indirect - 24 Month	1.98%	2.35%	3.27%	3.08%	3.89%	3.39%	0.89%
Used Vehicle - Indirect - 36 Month	1.98%	2.30%	3.70%	3.49%	4.39%	3.74%	1.21%
Used Vehicle - Indirect - 48 Month	2.47%	2.74%	4.13%	3.90%	4.89%	4.09%	1.53%
Used Vehicle - Indirect - 60 Month	2.97%	3.18%	4.39%	4.53%	4.50%	4.01%	1.51%
Used Vehicle - Indirect - 72 Month	3.45%	3.51%	4.27%	5.09%	3.62%	3.73%	2.34%
Used Vehicle - Indirect - 84 Month	3.94%	3.84%	4.14%	5.19%	3.73%	4.04%	3.35%

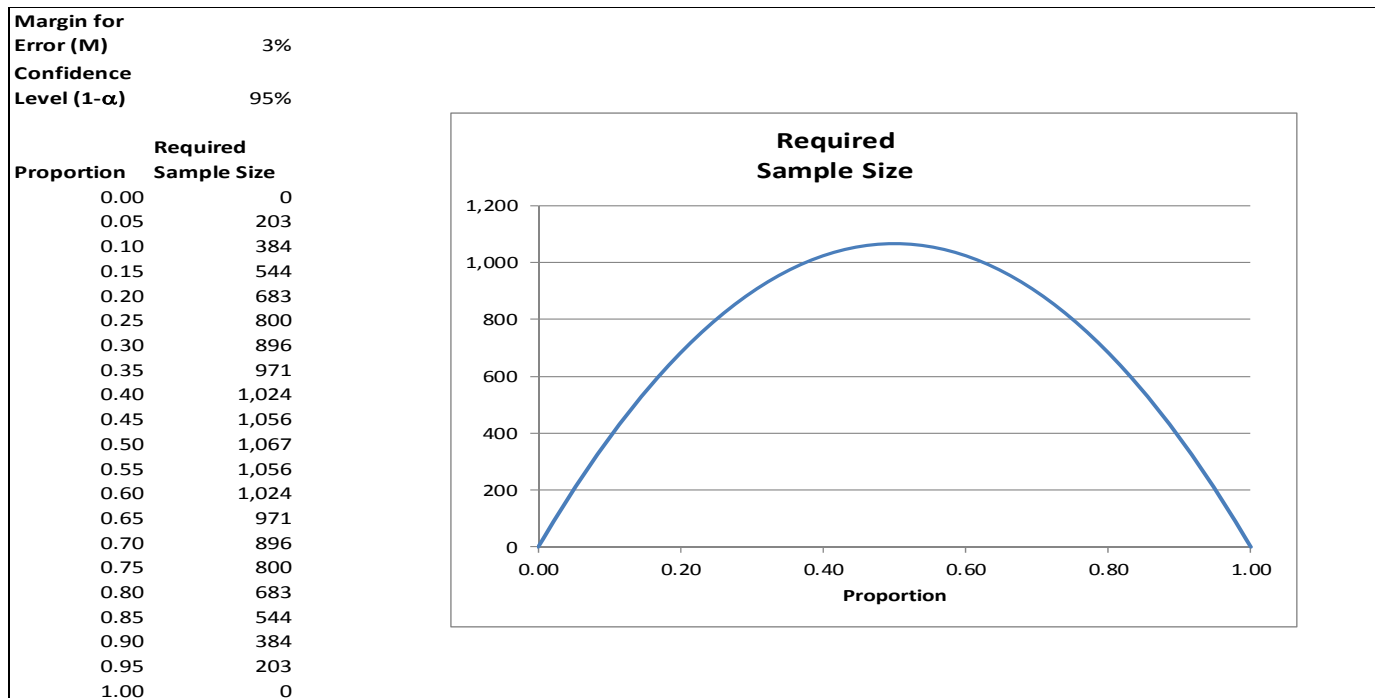
Estimated Real Return - Max Stress Economic Environment							
Vehicle Loan Category	760+	730 - 759	680 - 729	640 - 679	600 - 639	550 - 599	< 550
Used Vehicle - Indirect - 24 Month	1.97%	2.24%	3.10%	1.64%	1.57%	-2.31%	-8.19%
Used Vehicle - Indirect - 36 Month	1.96%	2.15%	3.47%	1.99%	2.07%	-2.07%	-8.00%
Used Vehicle - Indirect - 48 Month	2.45%	2.55%	3.85%	2.33%	2.57%	-1.84%	-7.82%
Used Vehicle - Indirect - 60 Month	2.95%	2.94%	3.94%	3.06%	1.51%	-2.36%	-8.23%
Used Vehicle - Indirect - 72 Month	3.42%	3.15%	3.35%	3.28%	-0.79%	-3.59%	-7.52%
Used Vehicle - Indirect - 84 Month	3.90%	3.35%	2.75%	2.72%	-1.34%	-3.80%	-6.51%

Granularity

The more granular the loan cohorts the more predictive and more likely a credit union will not have sufficient data to be statistically significant.



Statistical Significance and Creditability



Source: Edward (Jed) Frees, Professor – Risk and Insurance, Hickman-Larson Chair of Actuarial Science, University of Wisconsin Madison

Data Collection

Dependent on:

- Type of loans being assessed
- Credit risk model(s) credit union plans to use
- Be certain to include data that includes all of the most recent business cycle – should go back as far as 2008
- Data collection for CECL white paper


Data Collection Residential Real Estate Loan

- Current credit indicators
 - Payment status
 - Updated FICO
 - Updated LTV

- Macroeconomic conditions
 - Unemployment rate
 - Historical – Bureau of Labor Statistics
 - Forecasted – state, county, MSA
 - Housing prices
 - Historical – FHFA or Case Shiller
 - Forecasted – Short-term versus long-term


Data Collection

Macroeconomic Information – for analysis of past performance:

- Unemployment rate by quarter
 - Real median income by quarter
 - Changes in GDP by quarter
 - Change in housing prices by quarter
 - Change in used auto prices by quarter
 - Interest rate indices by quarter ideally going back to 2008
- 

Data Collection


Aggregate Loan Data – for analysis of past performance:

- Delinquency rates by loan grouping by quarter
 - Gross charge offs by quarter
 - Gross recoveries by quarter ideally going back to 2008
 - Balance of the defaulted loan and the date of the default
 - Proceeds from liquidation of the defaulted loan
 - FICO and combined LTV of the loan at the time of default
 - Balance of a prepaid loan and date of the prepayment
- 


DCF Modeling Advantages

- Widely used and the math is standardized
- Technique explicitly includes voluntary prepayments
- Models are prospective in nature
 - Current economic conditions relatively easily implemented
 - Base case run with current FICOs and updated CLTVs
 - Change in economic conditions relatively easily implemented
 - Near-term forecasts for unemployment and change in housing prices
- DCF model inputs can be based on industry-wide data adjusted for credit union's own experience
- Uses key credit indicators that credit unions use to make loans facilitating communication across the organization


Other Uses of DCF Modeling

- Technique can be used for capital stress testing
 - Results of capital stress testing can be used to set quantitative concentration limits
 - Technique relatively easily adapted to risk-based pricing and real return analyses
 - Inputs can be integrated into ongoing ALM modeling to determine interrelated risks
- 

CECL Resources

- Implementing CECL – November 2016
 - Data Collection for CECL – February 2017
 - The Business Case for CECL Part I – ALM and Capital Stress Testing – December 2016
 - The Business Case for CECL Part II – Concentration Risk – February 2017
- 

Steps to Take Now

- Identify areas of concentration
 - Identify predictive inputs
 - Identify credit loss model(s) to be used
 - Accumulate and group data based on credit loss model(s) selected
 - Estimate effect CECL will have on existing ALLL
- 



Wilary Winn LLC

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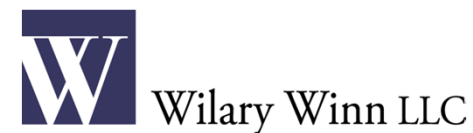
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