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Credit Loss Modeling Best Practices – ALM, Capital Stress Testing , Concentration Risk, and CECL

Credit Modeling Best Practices

Wilary Winn Background

Founded in 2003, Wilary Winn provides independent and objective, fee-based, financial advice to credit unions and banks located across the country. We currently have more than 375 clients in 49 states and the District of Columbia, including 27 of the top 100 credit unions.

Credit Modeling Best Practices

Today's Presenters

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, and the NCUA. Mr. Winn began his career as a practicing CPA for Arthur Young & Company - now Ernst & Young.

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Credit Modeling Best Practices

Today's Presenters

Matt Erickson - Manager

Mr. Erickson leads Wilary Winn's asset liability management (ALM) business line. He consults with ALM clients on interest rate, credit, concentration and liquidity risks as well as capital stress testing, risk-based pricing and real return optimization. Matt uses his knowledge of credit risk analytics and quantitative analysis skills to strengthen the firm's proprietary valuation models, develop assumption input databases, and track industry-wide performance trends on loans and deposits.

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Topics Covered Today

- Balance sheet risk
- Credit loss models – focus on discounted cash flow
- Loan stratification
- Predictive credit indicators
- Capital stress testing
- Concentration limits and sub-limits
- Risk-based pricing and real return analyses
- CECL implementation

Balance Sheet Risk

- Primary risks are credit, interest rate and liquidity which are ideally measured on an integrated basis.

- Credit is the most critical because losses incurred on loans and investments have been key factors in banking crises and failures.

- Credit risk is best measured from the bottom up.

Estimating Credit Losses

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

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 Losses	Annual CRR%	Annual CDR%	Annual 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%

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%
Repeat for FICO Buckets														
	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%

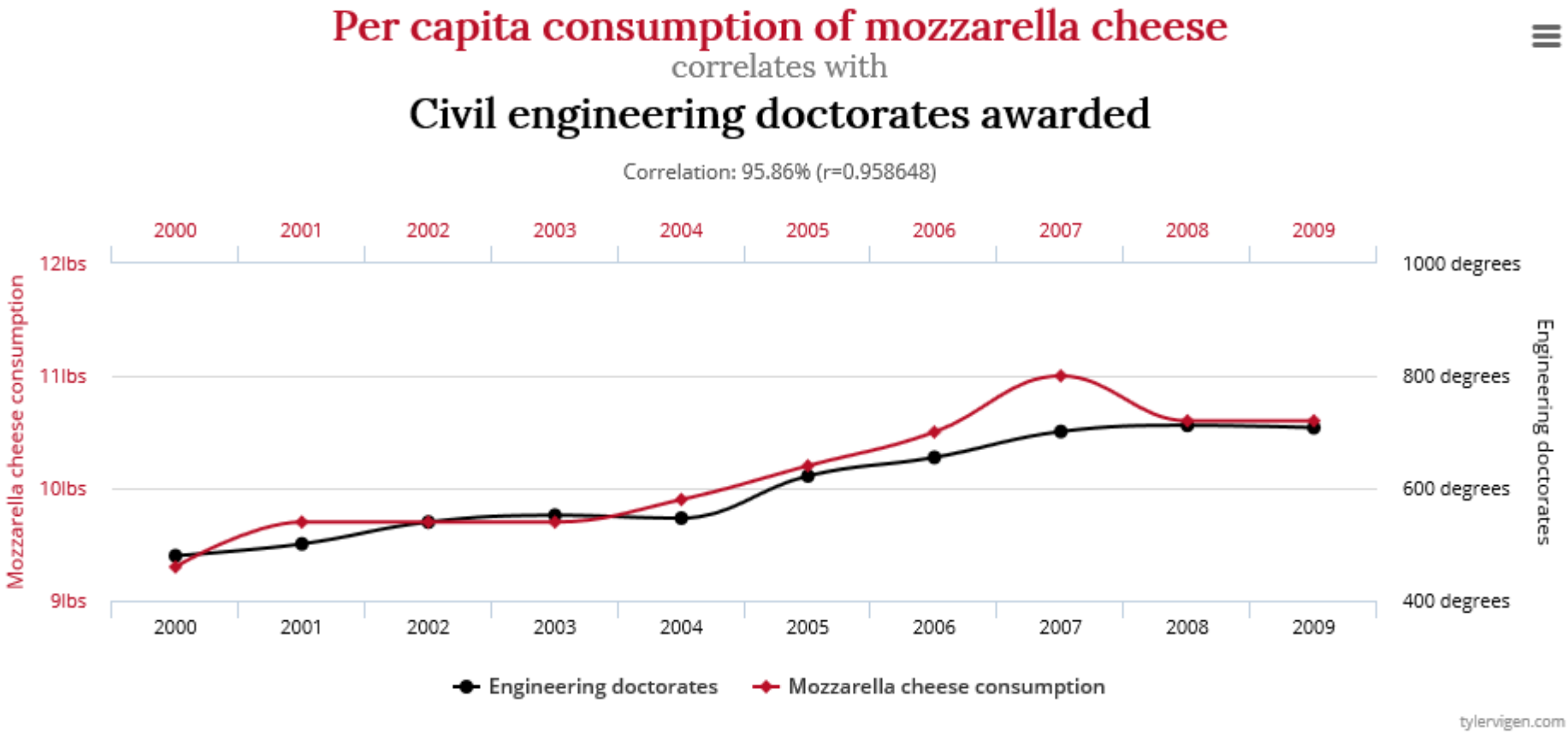
Discounted Cash Flow Analysis

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 Credit Indicators

- Correlation is not causation
- 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



Source: Spurious Media LLC

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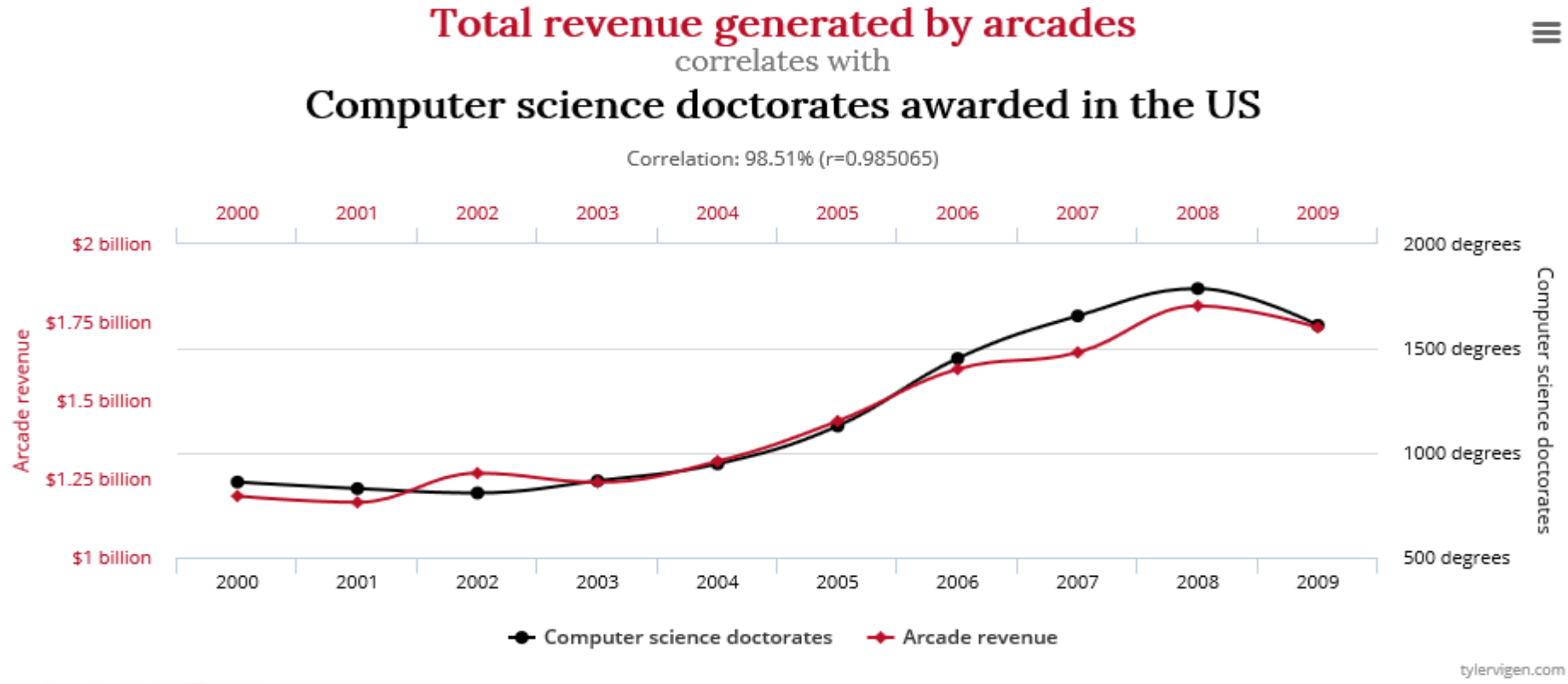
Correlation is not Causation



Source: Spurious Media LLC

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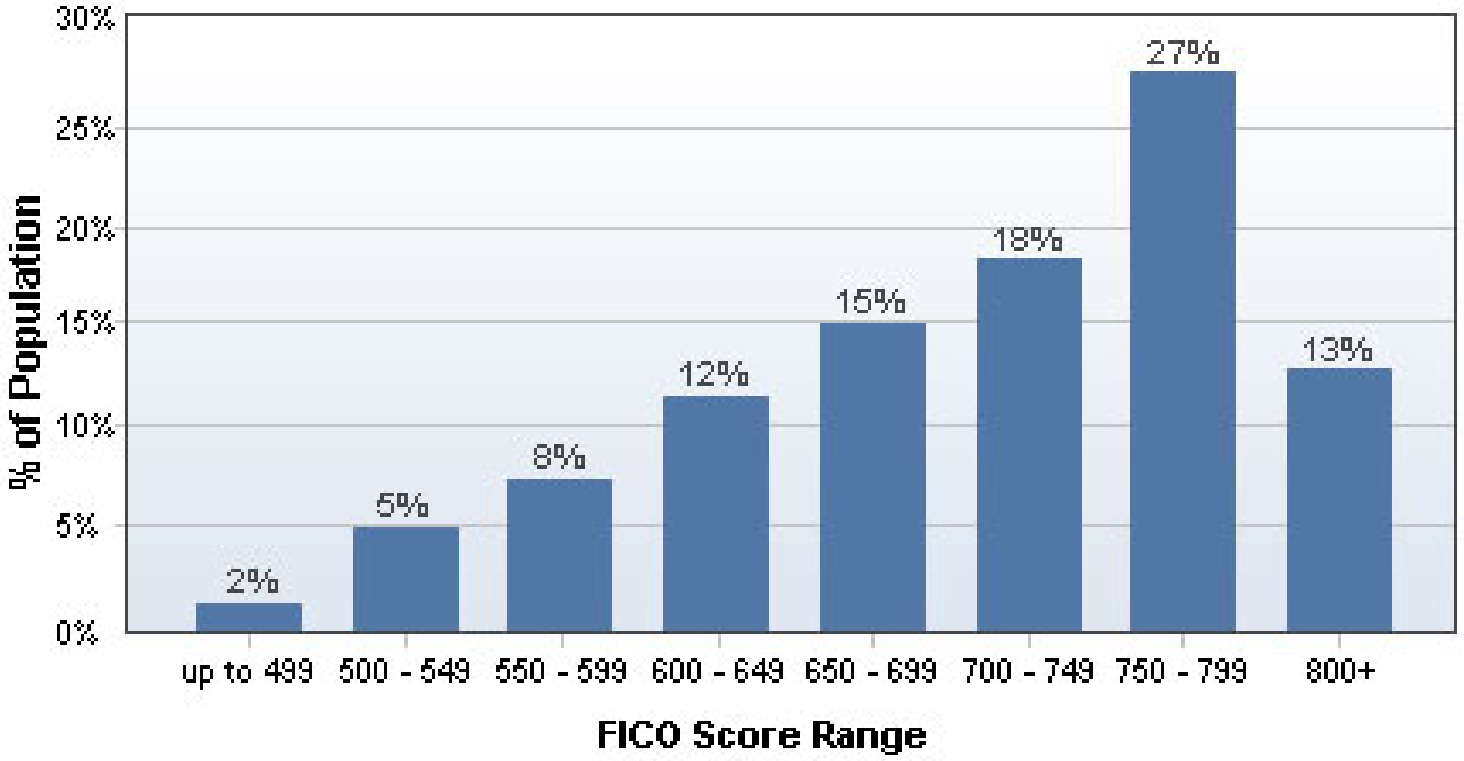
FICO Score Distribution



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Loan Stratification - Cohort

Collateral Type	FICO	CRR%	CDR%	Severity %	Future Loss %
New Vehicle - Direct	746	23.3%	0.5%	30.5%	0.2%
Used Vehicle - Direct	712	22.6%	1.7%	32.6%	0.7%
New Vehicle - Indirect	725	22.9%	1.3%	36.0%	0.8%
Used Vehicle - Indirect	696	22.4%	2.5%	38.5%	1.5%

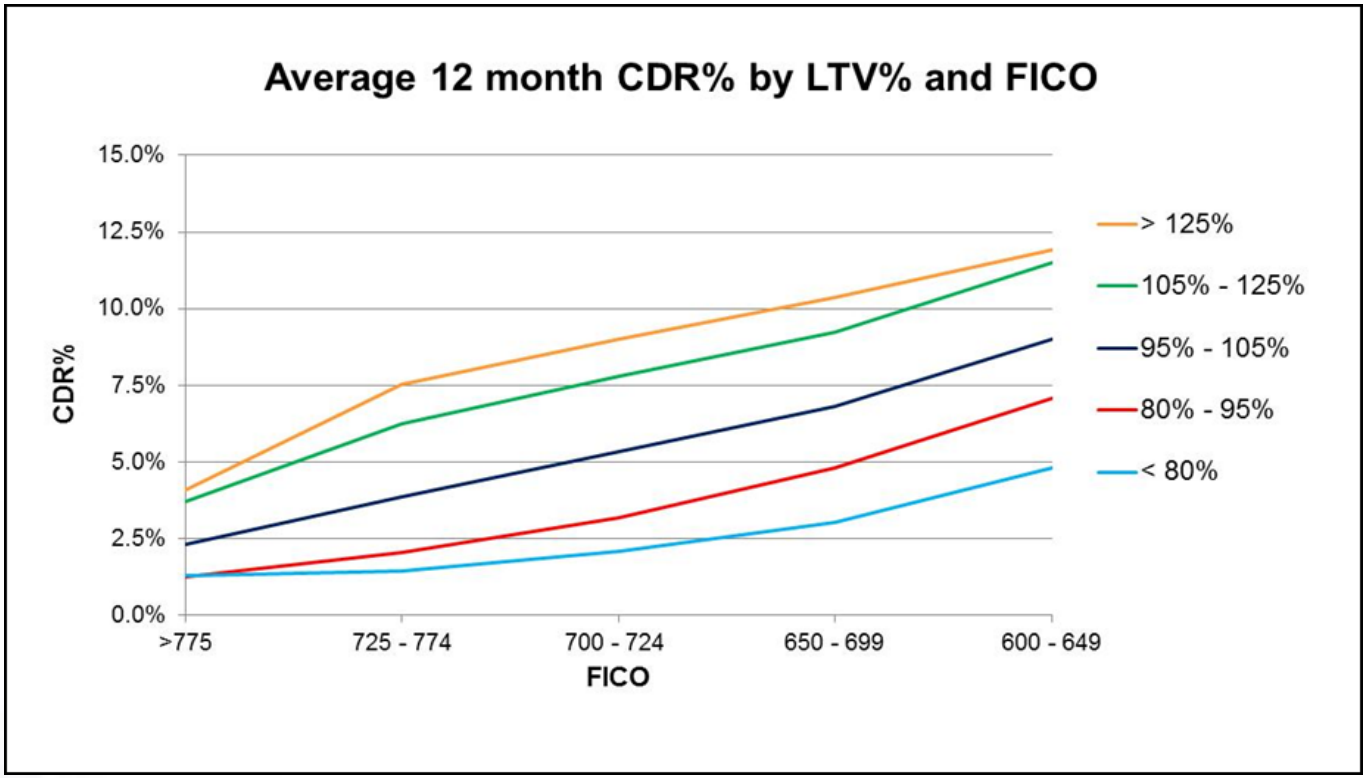
Loan Stratification – Cohort

Collateral Type	CRR	CDR	Severity
Used Vehicle - Direct Current 720 - 779	27.5%	0.1%	36.2%
Used Vehicle - Direct Current 660 - 719	27.2%	0.3%	36.3%
Used Vehicle - Direct Current 620 - 659	26.3%	1.4%	39.9%
Used Vehicle - Direct Current 500 - 619	17.9%	8.7%	37.7%
Used Vehicle - Direct Current under 500	4.0%	36.2%	39.4%
Used Vehicle - Direct Delinquent 30-59	4.0%	45.0%	35.2%

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

Predictive Inputs



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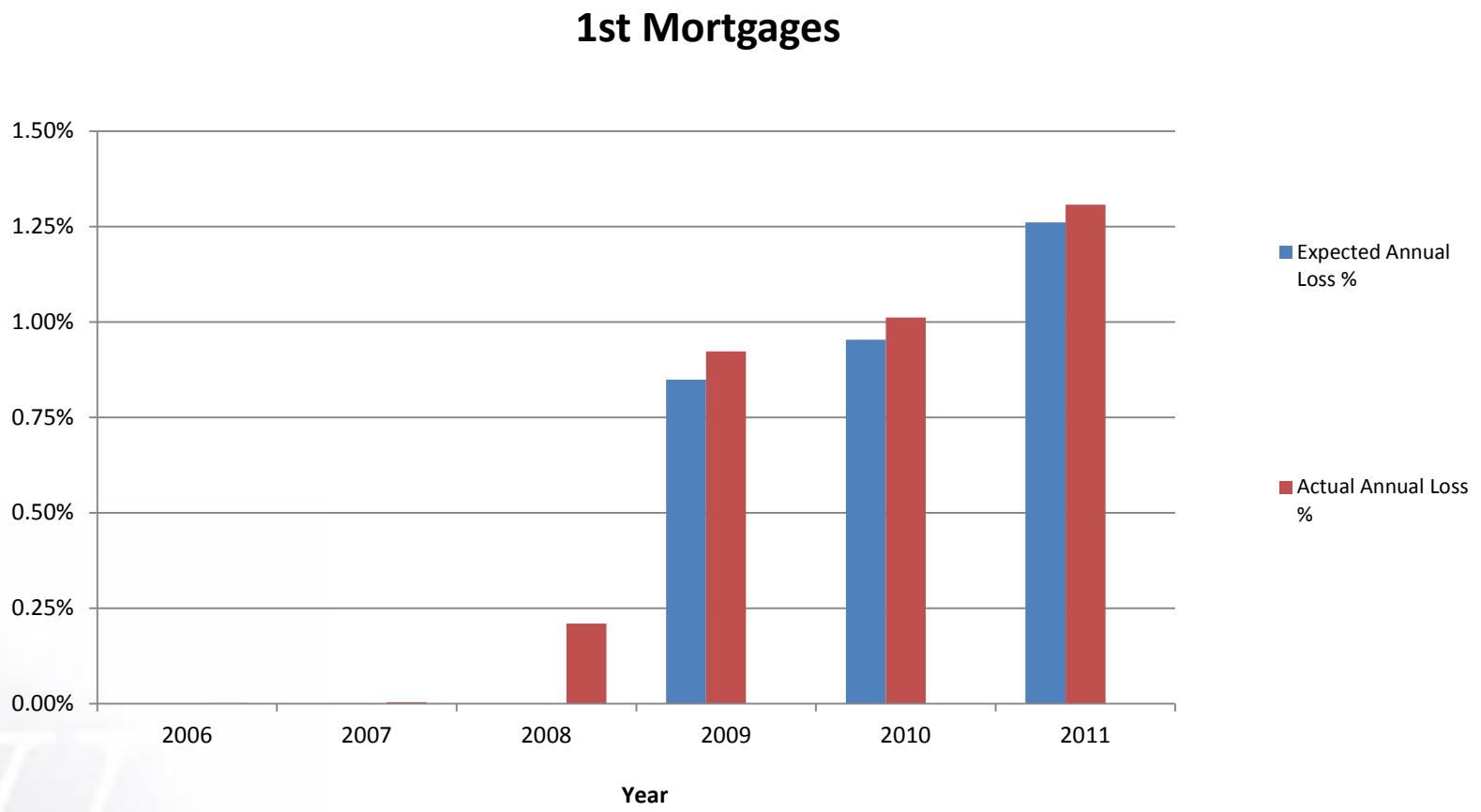
Expected vs. Actual Annual Losses



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Loan Stratification

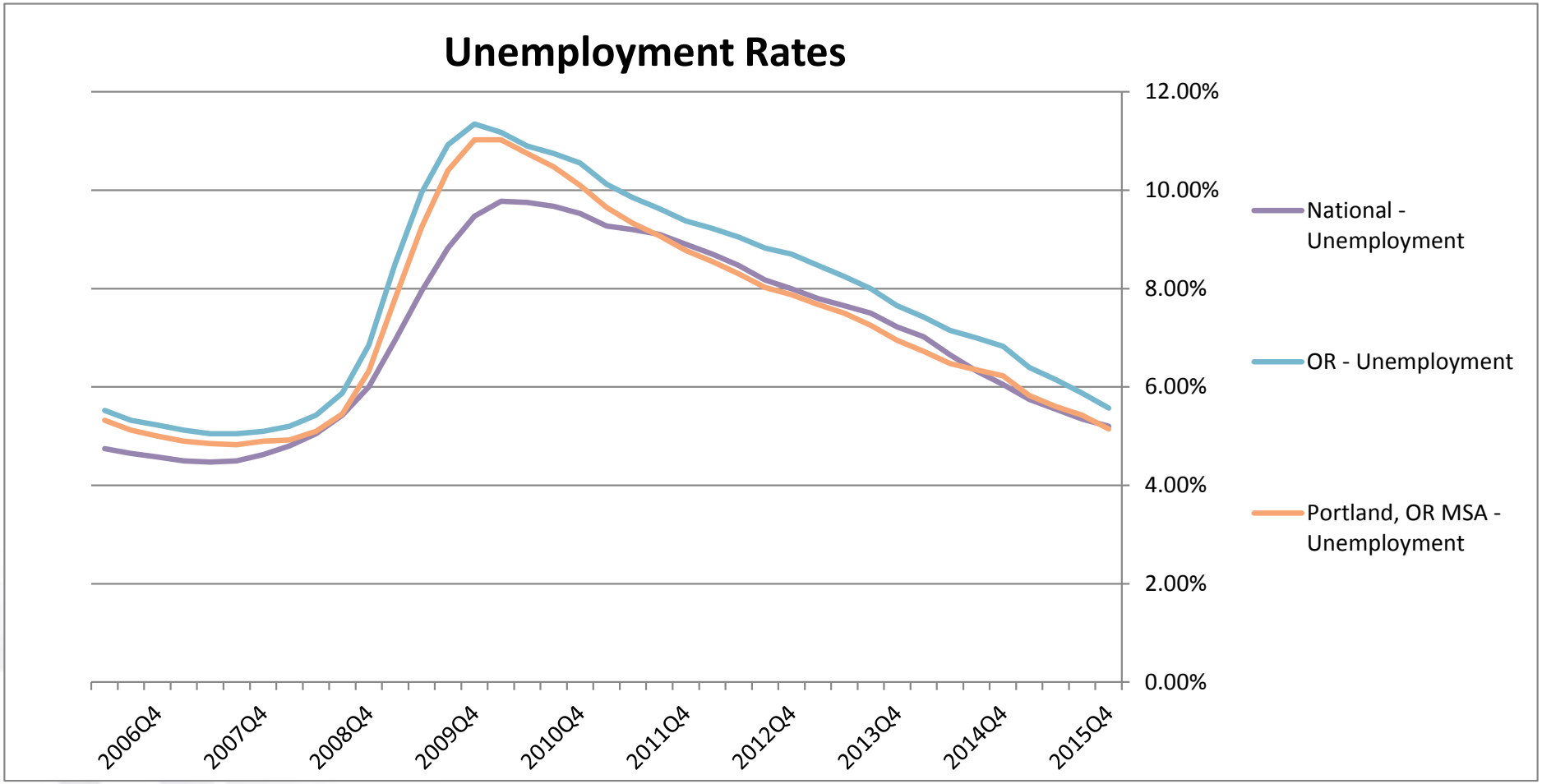
Loan and FICO Category	LTV Range	CRR %	CDR %	Severity%	Future Loss %
Fixed Rate Mortgage Current 720 - 779	under 50%	8.6%	0.0%	0.0%	0.0%
Fixed Rate Mortgage Current 720 - 779	50% - 75%	8.7%	0.0%	10.0%	0.0%
Fixed Rate Mortgage Current 720 - 779	75% - 100%	9.5%	0.0%	15.0%	0.0%
Fixed Rate Mortgage Current 720 - 779	100% - 120%	6.5%	0.1%	16.4%	0.1%
Fixed Rate Mortgage Current 720 - 779	120% - 150%	4.4%	0.1%	21.6%	0.3%
Fixed Rate Mortgage Current 720 - 779	over 150%	4.0%	0.7%	48.5%	1.3%
Fixed Rate Mortgage Current 720 - 779		8.8%	0.0%	12.6%	0.0%
Fixed Rate Mortgage Current 660 - 719	under 50%	6.9%	0.1%	0.0%	0.0%
Fixed Rate Mortgage Current 660 - 719	50% - 75%	6.8%	0.1%	10.0%	0.1%
Fixed Rate Mortgage Current 660 - 719	75% - 100%	6.6%	0.2%	15.0%	0.2%
Fixed Rate Mortgage Current 660 - 719	100% - 120%	6.7%	0.5%	16.7%	0.6%
Fixed Rate Mortgage Current 660 - 719	120% - 150%	4.1%	0.6%	20.9%	1.3%
Fixed Rate Mortgage Current 660 - 719	over 150%	4.0%	1.4%	34.9%	4.7%
Fixed Rate Mortgage Current 660 - 719		6.7%	0.2%	13.2%	0.2%
Fixed Rate Mortgage Delinquent 30-59	under 50%	4.0%	13.4%	0.0%	0.0%
Fixed Rate Mortgage Delinquent 30-59	50% - 75%	4.1%	11.1%	10.0%	5.4%
Fixed Rate Mortgage Delinquent 30-59	75% - 100%	4.0%	30.1%	15.0%	12.5%
Fixed Rate Mortgage Delinquent 30-59	100% - 120%	4.0%	30.7%	15.8%	13.0%
Fixed Rate Mortgage Delinquent 30-59	120% - 150%	4.0%	30.1%	21.9%	18.5%
Fixed Rate Mortgage Delinquent 30-59	over 150%	4.0%	55.8%	38.0%	35.4%
Fixed Rate Mortgage Delinquent 30-59		4.0%	22.1%	13.7%	9.6%

Base CECL Results

		Base		
Loan Category	Balance	Credit Losses $	Credit Losses %	Decrease in NW Ratio
New Vehicle - Direct	50,000,000	100,601	0.20%	0.01%
Used Vehicle - Direct	50,000,000	341,920	0.68%	0.03%
New Vehicle - Indirect	75,000,000	504,161	0.67%	0.04%
Used Vehicle - Indirect	75,000,000	1,008,952	1.35%	0.08%
Total Vehicles	250,000,000	1,955,635	0.78%	0.16%
Fixed Rate Mortgage	300,000,000	1,835,005	0.61%	0.14%
ARM	150,000,000	480,000	0.32%	0.04%
Home Equity	50,000,000	310,423	0.62%	0.02%
HELOC	50,000,000	109,838	0.22%	0.01%
Total Residential Real Estate	550,000,000	2,735,266	0.50%	0.22%
Credit Card	100,000,000	3,046,598	3.05%	0.23%
Member Business Loans	50,000,000	407,492	0.81%	0.03%
Other Consumer	50,000,000	1,031,567	2.06%	0.08%
Total Loans	1,000,000,000	9,176,558	0.92%	0.69%

Net Worth Ratio After Credit Losses	8.37%
Current Net Worth Ratio at December 31, 2015	8.50%
Change in Net Worth to Account for Lifetime Losses / Estimated CECL Effect on Net Worth	-0.13%

Predictive Inputs



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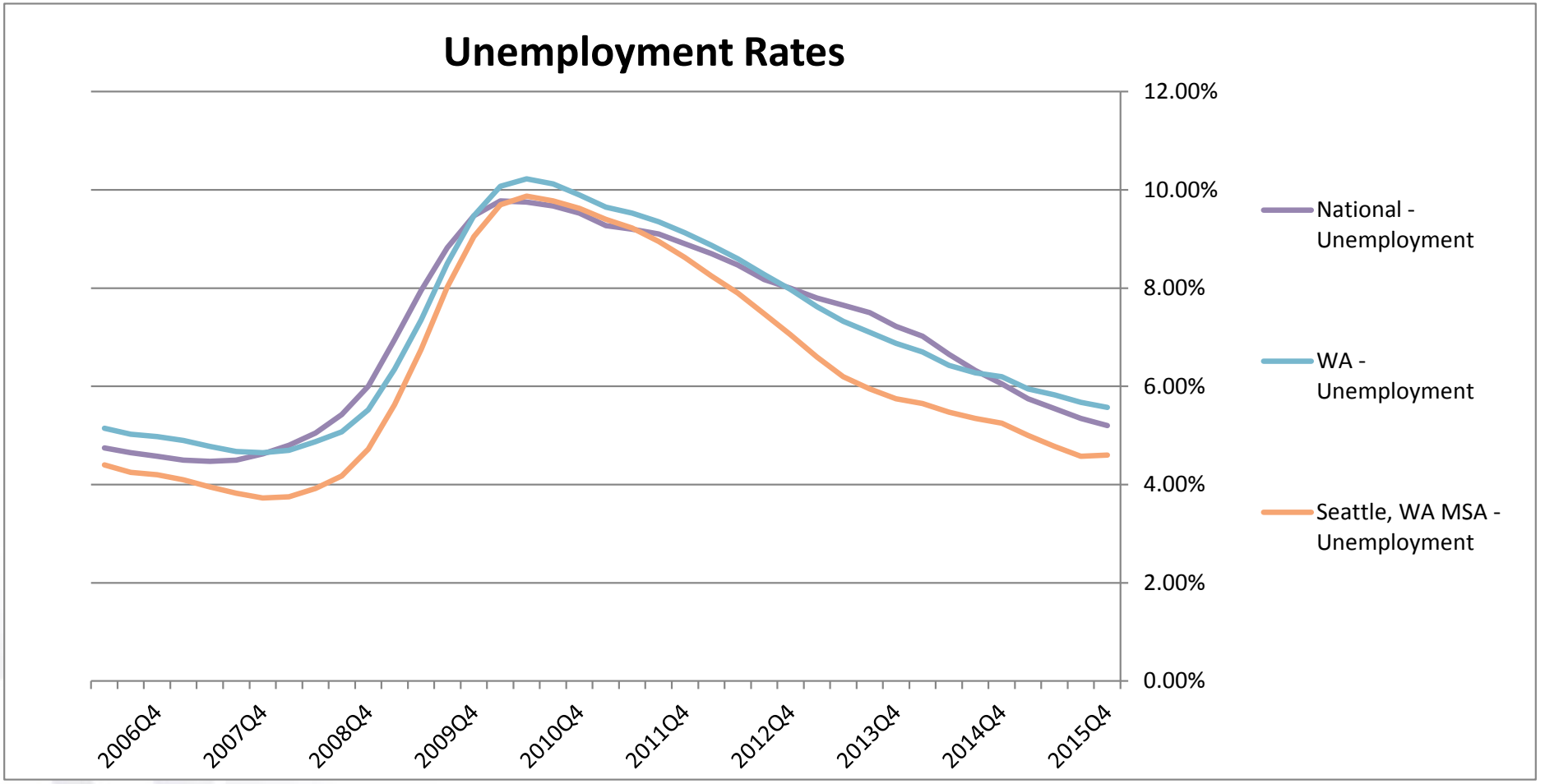
Predictive Inputs



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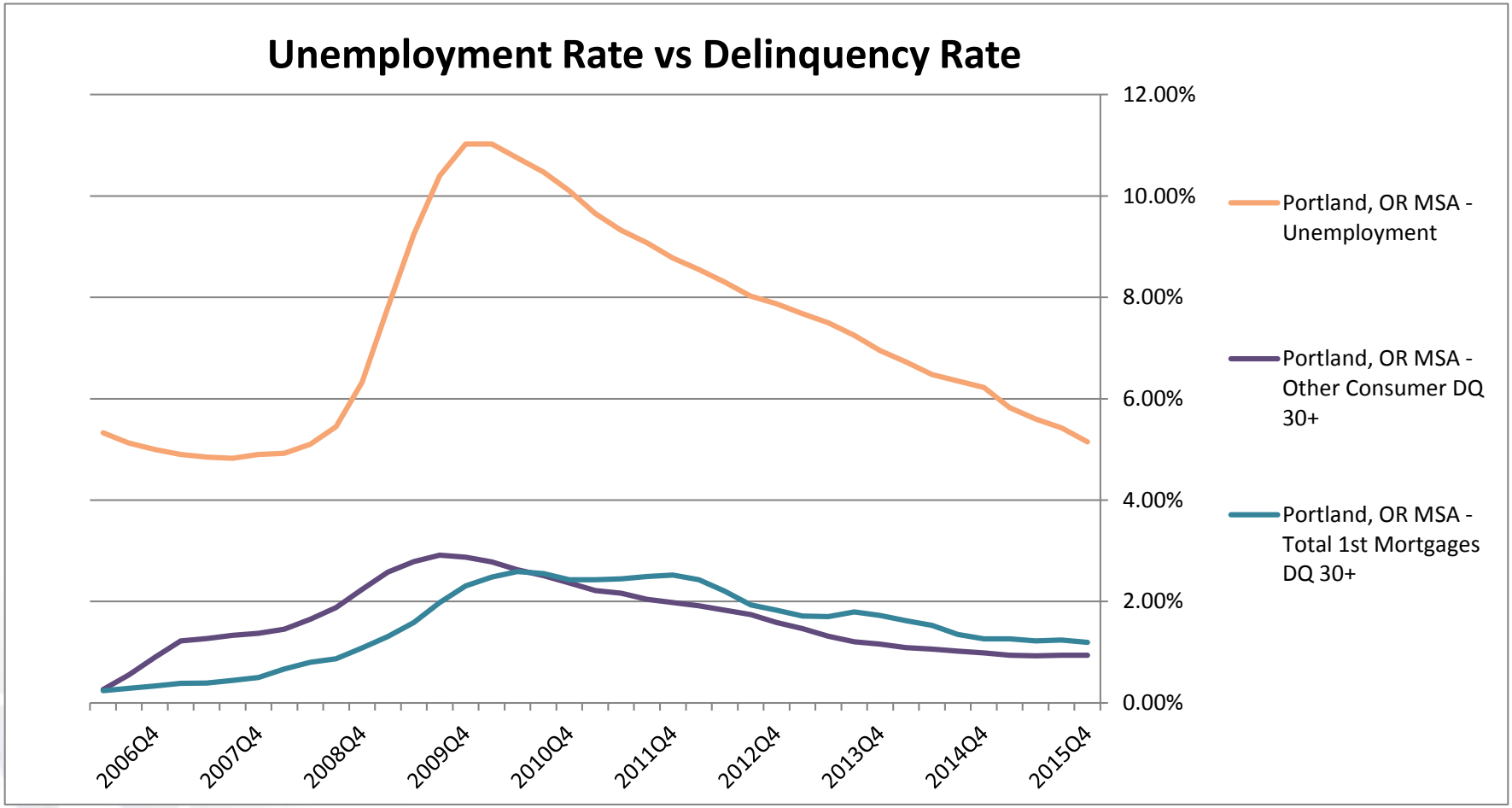

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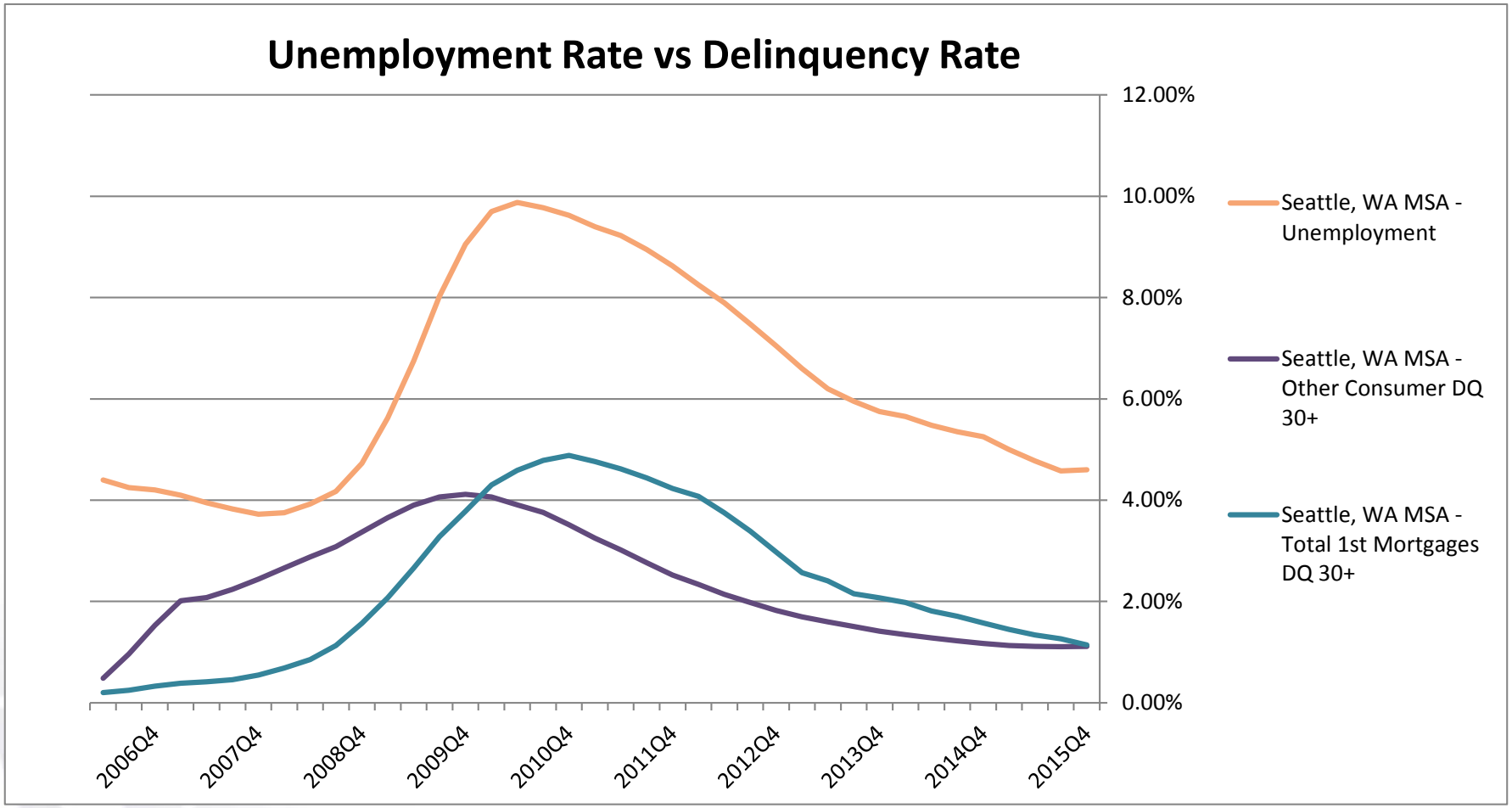
Predictive Inputs



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Predictive Inputs

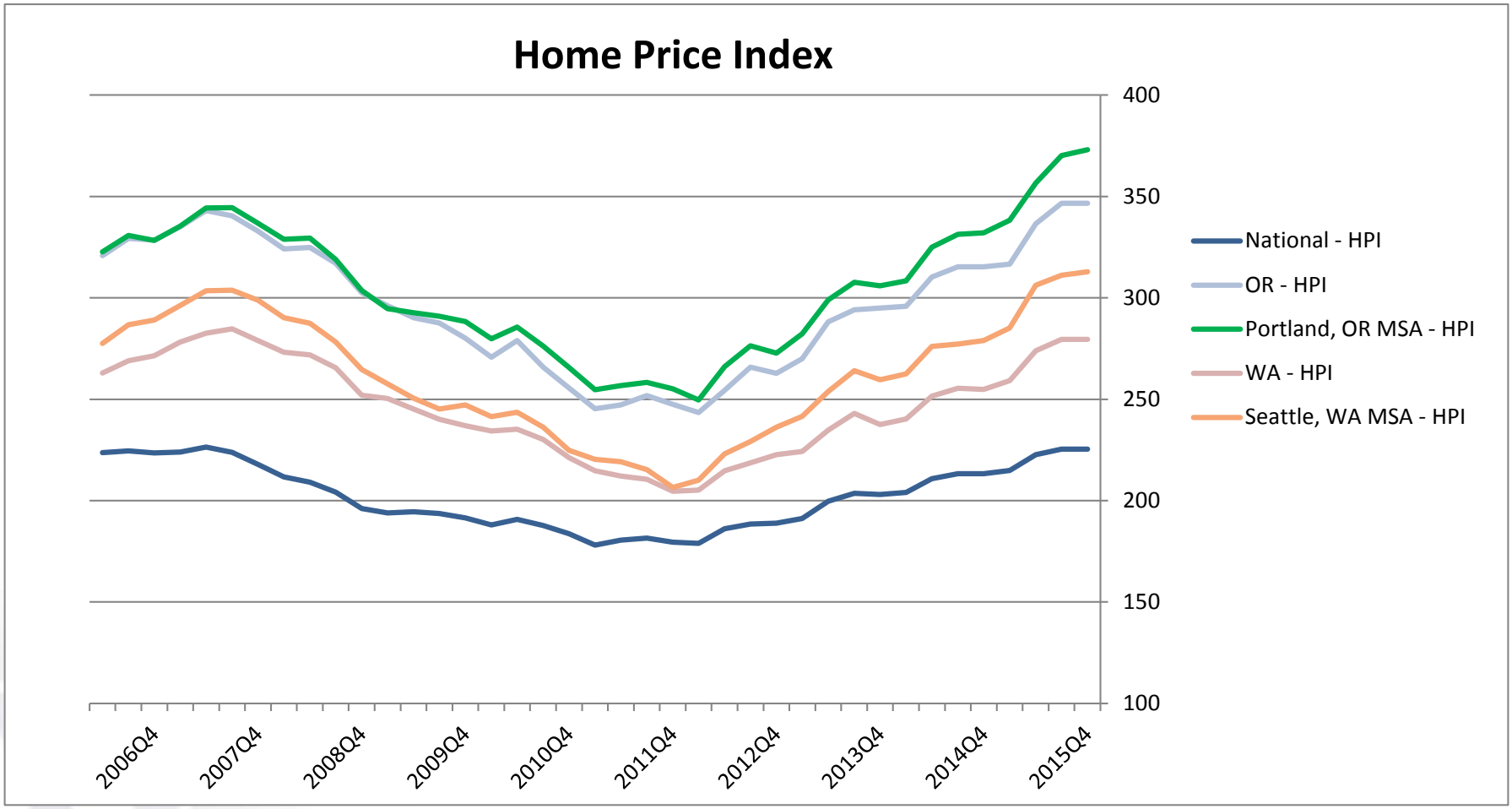
Quantifying the relationship between unemployment and defaults

- 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

Performance Through Last 10 Year Economic Cycle											
		Regression	Unemployment Rates			Estimated Default Rates			Estimated Default Factors		
Market	Loan Category	R-Squared	Current	Mid-Point	Max	Current	Mid-Point	Max	Base	Mid-point	Max
National	First Mortgage	0.89	4.80%	7.50%	10.20%	0.55%	1.24%	1.92%	100%	225%	350%
Portland, OR MSA	First Mortgage	0.79	4.70%	8.05%	11.40%	0.37%	0.97%	1.58%	100%	267%	433%
Seattle, WA MSA	First Mortgage	0.94	5.00%	7.60%	10.20%	0.74%	1.75%	2.75%	100%	235%	370%
National	Other RE	0.92	4.80%	7.50%	10.20%	0.56%	0.98%	1.41%	100%	175%	251%
Portland, OR MSA	Other RE	0.70	4.70%	8.05%	11.40%	0.42%	1.07%	1.71%	100%	254%	408%
Seattle, WA MSA	Other RE	0.94	5.00%	7.60%	10.20%	0.58%	1.03%	1.48%	100%	177%	254%
National	Credit Card	0.34	4.80%	7.50%	10.20%	1.17%	1.44%	1.71%	100%	123%	146%
Portland, OR MSA	Credit Card	0.55	4.70%	8.05%	11.40%	0.69%	1.00%	1.32%	100%	145%	190%
Seattle, WA MSA	Credit Card	0.38	5.00%	7.60%	10.20%	1.23%	1.71%	2.19%	100%	139%	178%
National	Other Consumer	0.21	4.80%	7.50%	10.20%	1.17%	1.38%	1.58%	100%	117%	135%
Portland, OR MSA	Other Consumer	0.71	4.70%	8.05%	11.40%	0.56%	1.08%	1.59%	100%	191%	281%
Seattle, WA MSA	Other Consumer	0.31	5.00%	7.60%	10.20%	1.10%	1.50%	1.89%	100%	136%	172%

Predictive Inputs



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Predictive Inputs

Performance Through Last 10 Year Economic Cycle							
		Peak-to-Trough HPI			Depreciation for Stress		
Market	Current HPI	Max	Mid-Point	Min	Base	Mid-Point	Max
National	225	226	202	178	0.00%	-10.70%	-21.41%
Portland, OR MSA	373	345	297	250	0.00%	-13.77%	-27.55%
Seattle, WA MSA	313	304	255	206	0.00%	-16.03%	-32.05%

Concentration Risk

Concentration Risk Stress Testing

- Through the last economic cycle markets experienced both an increase in unemployment and a decrease in housing values
- Both macroeconomic indicators are highly correlated to loan performance
- To stress modeling inputs we utilized the combined effect
  - Adjust default assumptions for changes in unemployment
  - Adjust real estate severity assumptions for changed in housing values

Concentration Risk

Concentration Risk Stress Testing

		Base			Mid-Stress			Max-Stress		
Loan Category	Balance	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%	0.03%
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%	0.16%	2,239,622	0.90%	0.17%	2,490,212	1.00%	0.19%
Fixed Rate Mortgage	300,000,000	1,835,005	0.61%	0.14%	5,457,824	1.82%	0.41%	9,161,662	3.05%	0.69%
ARM	150,000,000	480,000	0.32%	0.04%	1,656,062	1.10%	0.12%	5,352,943	3.57%	0.40%
Home Equity	50,000,000	310,423	0.62%	0.02%	599,056	1.20%	0.04%	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 Residential Real Estate	550,000,000	2,735,266	0.50%	0.22%	7,925,444	1.44%	0.59%	16,352,993	2.97%	1.23%
Credit Card	100,000,000	3,046,598	3.05%	0.23%	3,516,541	3.52%	0.26%	4,030,767	4.03%	0.30%
Member Business Loans	50,000,000	407,492	0.81%	0.03%	642,816	1.29%	0.05%	839,108	1.68%	0.06%
Other Consumer	50,000,000	1,031,567	2.06%	0.08%	1,212,913	2.43%	0.09%	1,391,954	2.78%	0.10%
Total Loans	1,000,000,000	9,176,558	0.92%	0.69%	15,537,335	1.55%	1.17%	25,105,034	2.51%	1.88%
Net Worth Ratio After Credit Losses				8.37%			7.90%			7.18%
Current Net Worth Ratio at December 31, 2015				8.50%			8.50%			8.50%
Change in Net Worth to Account for Lifetime Losses / Estimated CECL Effect on Net Worth				-0.13%			-0.60%			-1.32%

Concentration Risk

Concentration Risk Stress Testing

Used Vehicle - Indirect										
FICO Cohort Characteristics					Base	Mid-Stress	Max-Stress	Base	Mid-Stress	Max-Stress
FICO	Balance	Conc. %	30+ DQ %	60+ DQ %	CDR%	CDR%	CDR%	CECL Loss %	CECL Loss %	CECL Loss %
775+	26,464,845	23.52%	0.00%	0.00%	0.03%	0.05%	0.07%	0.01%	0.02%	0.02%
750 - 774	17,807,984	15.83%	0.00%	0.00%	0.04%	0.08%	0.11%	0.01%	0.02%	0.03%
730 - 749	12,351,646	10.98%	0.07%	0.00%	0.12%	0.21%	0.30%	0.05%	0.09%	0.12%
700 - 729	19,841,641	17.64%	0.28%	0.08%	0.30%	0.52%	0.69%	0.12%	0.21%	0.28%
680 - 699	10,478,344	9.31%	0.16%	0.01%	0.33%	0.59%	0.83%	0.13%	0.23%	0.33%
660 - 679	7,777,855	6.91%	0.23%	0.02%	0.56%	1.00%	1.40%	0.24%	0.42%	0.58%
640 - 659	5,469,111	4.86%	1.00%	0.54%	1.16%	1.99%	2.65%	0.48%	0.81%	1.06%
620 - 639	3,570,696	3.17%	1.56%	0.63%	1.77%	3.14%	4.38%	0.76%	1.35%	1.87%
500 - 619	7,343,201	6.53%	14.42%	2.98%	13.68%	23.13%	29.85%	5.67%	9.23%	11.65%
under 500	644,864	0.57%	42.73%	13.82%	33.94%	55.43%	65.64%	11.90%	18.46%	21.30%
unknown	749,162	0.67%	1.25%	0.88%	1.76%	2.81%	3.58%	0.70%	1.13%	1.44%
Total	**112,499,349**	**100.00%**	**1.38%**	**0.34%**	**1.36%**	**2.30%**	**2.98%**	**0.55%**	**0.90%**	**1.15%**

Concentration Risk

Creating Concentration Sub-limits by Risk Tier on Consumer Loans

FICO	Credit Tier	Risk Tier
775+	A1	Prime
750 - 774	A2	Prime
730 - 749	A3	Prime
700 - 729	B	Prime
680 - 699	C	Near Prime
660 - 679	D	Near Prime
640 - 659	E	Near Prime
620 - 639	F	Sub Prime
500 - 619	F	Sub Prime
under 500	F	Sub Prime

Concentration Risk

Creating Concentration Sub-limits by Risk Tier on Real Estate Loans

Categorized Risk Level										
FICO/LTV	775+	750 - 774	730 - 749	700 - 729	680 - 699	660 - 679	640 - 659	620 - 639	500 - 619	under 500
under 50%	Low	Low	Low	Low	Low	Low	Low	Low	Low	Low
50% - 75%	Low	Low	Low	Low	Low	Low	Medium	Medium	Medium	Medium
75% - 100%	Low	Low	Low	Low	Medium	Medium	Medium	High	High	High
100% - 120%	Medium	Medium	Medium	Medium	Medium	High	High	High	High	High
120% - 150%	High	High	High	High	High	High	High	High	High	High
over 150%	High	High	High	High	High	High	High	High	High	High

Concentration Risk

Loan Category	Current Balance	Concentration % of Net Worth	Proposed Limit	Balance at Proposed Limit	Base Credit Losses $	Base Credit Losses %	Decrease in NW Ratio
Example #1 - Current Concentration							
Used Vehicle - Indirect	**141,008,293**	**85.85%**	**85.85%**	**141,008,293**	**1,896,942**	**1.35%**	**0.09%**
Prime	*71,146,078*	*43.32%*	*43.32%*	*71,146,078*	*46,059*	*0.06%*	*0.002%*
Near Prime	*44,899,140*	*27.34%*	*27.34%*	*44,899,140*	*155,464*	*0.35%*	*0.007%*
Subprime	*24,963,074*	*15.20%*	*15.20%*	*24,963,074*	*1,695,418*	*6.79%*	*0.079%*
Example #2 - Prime Focused Lending							
Used Vehicle - Indirect	**141,008,293**	**85.85%**	**150.00%**	**246,373,970**	**1,356,875**	**0.55%**	**0.06%**
Prime	*71,146,078*	*43.32%*	*120.00%*	*197,099,176*	*127,599*	*0.06%*	*0.006%*
Near Prime	*44,899,140*	*27.34%*	*20.00%*	*32,849,863*	*113,743*	*0.35%*	*0.005%*
Subprime	*24,963,074*	*15.20%*	*10.00%*	*16,424,931*	*1,115,533*	*6.79%*	*0.052%*
Example #3 - Non Credit Selective Lending							
Used Vehicle - Indirect	**141,008,293**	**85.85%**	**150.00%**	**246,373,970**	**5,915,189**	**2.40%**	**0.28%**
Prime	*71,146,078*	*43.32%*	*50.00%*	*82,124,657*	*53,166*	*0.06%*	*0.002%*
Near Prime	*44,899,140*	*27.34%*	*50.00%*	*82,124,657*	*284,359*	*0.35%*	*0.013%*
Subprime	*24,963,074*	*15.20%*	*50.00%*	*82,124,657*	*5,577,664*	*6.79%*	*0.259%*

Concentration Risk

Determining Potential 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	**55,565,234**	**33.83%**	**65.00%**	**106,762,053**	**51,196,819**
Prime	*45,862,185*	*27.92%*	*50.00%*	*82,124,657*	*36,262,471*
Near Prime	*7,485,203*	*4.56%*	*10.00%*	*16,424,931*	*8,939,728*
Subprime	*2,217,846*	*1.35%*	*5.00%*	*8,212,466*	*5,994,620*
Used Vehicle - Direct	**148,750,114**	**90.56%**	**115.00%**	**188,886,710**	**40,136,596**
Prime	*93,913,994*	*57.18%*	*75.00%*	*123,186,985*	*29,272,990*
Near Prime	*35,953,795*	*21.89%*	*25.00%*	*41,062,328*	*5,108,533*
Subprime	*18,882,324*	*11.50%*	*15.00%*	*24,637,397*	*5,755,073*
New Vehicle - Indirect	**191,740,652**	**116.74%**	**140.00%**	**229,949,038**	**38,208,387**
Prime	*134,954,420*	*82.16%*	*100.00%*	*164,249,313*	*29,294,893*
Near Prime	*39,011,461*	*23.75%*	*25.00%*	*41,062,328*	*2,050,867*
Subprime	*17,774,771*	*10.82%*	*15.00%*	*24,637,397*	*6,862,626*
Used Vehicle - Indirect	**141,008,293**	**85.85%**	**115.00%**	**188,886,710**	**47,878,417**
Prime	*71,146,078*	*43.32%*	*75.00%*	*123,186,985*	*52,040,906*
Near Prime	*44,899,140*	*27.34%*	*25.00%*	*41,062,328*	*(3,836,812)*
Subprime	*24,963,074*	*15.20%*	*15.00%*	*24,637,397*	*(325,677)*

Concentration Risk

Testing Concentration Limits

		Base			Mid-Stress			Max-Stress		
Loan Category	Balance at proposed limit	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	57,500,000	115,691	0.20%	0.01%	130,766	0.23%	0.01%	144,492	0.25%	0.01%
Used Vehicle - Direct	57,500,000	393,208	0.68%	0.03%	466,295	0.81%	0.03%	526,265	0.92%	0.04%
New Vehicle - Indirect	86,250,000	579,786	0.67%	0.04%	646,062	0.75%	0.05%	708,062	0.82%	0.05%
Used Vehicle - Indirect	86,250,000	1,160,295	1.35%	0.09%	1,332,441	1.54%	0.10%	1,484,925	1.72%	0.11%
Total Vehicles	287,500,000	2,248,980	0.90%	0.18%	2,575,565	1.03%	0.19%	2,863,744	1.15%	0.21%
Fixed Rate Mortgage	345,000,000	2,110,256	0.61%	0.16%	6,276,498	1.82%	0.47%	10,535,911	3.05%	0.79%
ARM	172,500,000	552,000	0.32%	0.04%	1,904,472	1.10%	0.14%	6,155,885	3.57%	0.46%
Home Equity	57,500,000	356,987	0.62%	0.03%	688,915	1.20%	0.05%	1,480,333	2.57%	0.11%
HELOC	57,500,000	126,314	0.22%	0.01%	244,376	0.43%	0.02%	633,813	1.10%	0.05%
Total Residential Real Estate	632,500,000	3,145,556	0.57%	0.25%	9,114,260	1.66%	0.68%	18,805,942	3.42%	1.41%
Credit Card	115,000,000	3,503,588	3.05%	0.26%	4,044,022	3.52%	0.30%	4,635,382	4.03%	0.35%
Member Business Loans	57,500,000	468,616	0.81%	0.04%	739,238	1.29%	0.06%	964,975	1.68%	0.07%
Other Consumer	57,500,000	1,186,302	2.06%	0.09%	1,394,850	2.43%	0.10%	1,600,747	2.78%	0.12%
Total Loans	1,150,000,000	10,553,042	1.06%	0.79%	17,867,935	1.79%	1.34%	28,870,790	2.89%	2.17%
Net Worth Ratio After Credit Losses				8.27%			7.72%			6.90%
Net Worth Ratio Target				7.00%			7.00%			7.00%
Net Worth Ratio Cushion				1.27%			0.72%			-0.10%
Pass/Fail				Pass			Pass			Fail

Risk-Based Pricing

Interest Rate by Current FICO											
Summary Loan Category	775+	750 - 774	730 - 749	700 - 729	680 - 699	660 - 679	640 - 659	620 - 639	500 - 619	under 500	Total
Vehicles Loans	2.84%	3.09%	3.32%	3.62%	4.05%	4.38%	4.64%	4.93%	5.11%	5.65%	**3.66%**
Residential Real Estate	4.10%	4.44%	4.65%	5.19%	5.22%	5.51%	5.52%	5.86%	5.75%	5.98%	**4.67%**
Credit Card	9.12%	9.40%	9.58%	10.03%	10.39%	10.83%	10.95%	11.32%	11.07%	11.59%	**10.02%**
Member Business Loans	0.00%	0.00%	5.17%	4.91%	5.20%	6.15%	6.26%	4.63%	5.86%	5.56%	**5.26%**
Other Consumer Loans	6.23%	7.02%	7.43%	7.68%	8.02%	8.50%	8.86%	9.37%	8.59%	9.63%	**7.86%**
Total Loans	**3.67%**	**4.19%**	**4.42%**	**4.73%**	**5.04%**	**5.35%**	**5.53%**	**5.74%**	**5.86%**	**6.14%**	**4.55%**

Estimated Real Return by Current FICO											
Summary Loan Category	775+	750 - 774	730 - 749	700 - 729	680 - 699	660 - 679	640 - 659	620 - 639	500 - 619	under 500	Total
Vehicles Loans	2.83%	3.07%	3.26%	3.53%	3.89%	4.09%	4.14%	3.92%	0.36%	-6.50%	**3.01%**
Residential Real Estate	4.14%	4.53%	4.74%	5.24%	5.10%	5.41%	5.18%	5.34%	2.93%	-2.14%	**4.41%**
Credit Card	9.02%	9.19%	9.31%	9.69%	10.01%	10.08%	9.69%	8.27%	-12.63%	-52.44%	**7.38%**
Member Business Loans	0.00%	0.00%	2.79%	4.78%	4.78%	4.90%	4.69%	5.42%	4.16%	-24.73%	**4.51%**
Other Consumer Loans	6.20%	6.98%	7.32%	7.46%	7.75%	7.85%	7.87%	7.65%	-2.52%	-22.38%	**5.83%**
Total Loans	**3.68%**	**4.19%**	**4.36%**	**4.64%**	**4.83%**	**5.03%**	**4.93%**	**4.73%**	**0.01%**	**-8.32%**	**3.82%**

Why The Change to CECL?

- GAAP did not properly reflect risk pre-financial crisis because of the delayed recognition of credit losses

- Departs from the incurred loss model which means the probable threshold is removed
  - Removes the prohibition on recording day one losses

FASB Proposed Accounting Standards Update (ASU)

- Second CECL ASU was issued on December 20, 2012
- Comment time period ended May 31, 2013
- Final rule was expected end of 2014
- Now final rule is expected 2Q 2016 with implementation required for credit unions in 2021
- Rule will *significantly* change the allowance for loan and lease losses and other approaches to impairment
- Not just the ALLL, applies to all financial assets not classified at fair value

  e.g. AFS securities not included in scope

Amortized Cost Should be Based on the Present Value of 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
- Cash flows **not** expected to be collected are also discounted at the effective interest rate

Measuring Expected Credit Losses

- Begin with historical loss rates for similar assets (grouped approach)
- Adjust for current conditions
- Adjust for reasonable and supportable forecasts
- Life of loan estimate - can assume economic conditions after the end of the reasonable forecast time period remain the same or can revert to historical loss rates
  - Final guidance is expected to state that the entity should revert to historical loss experience

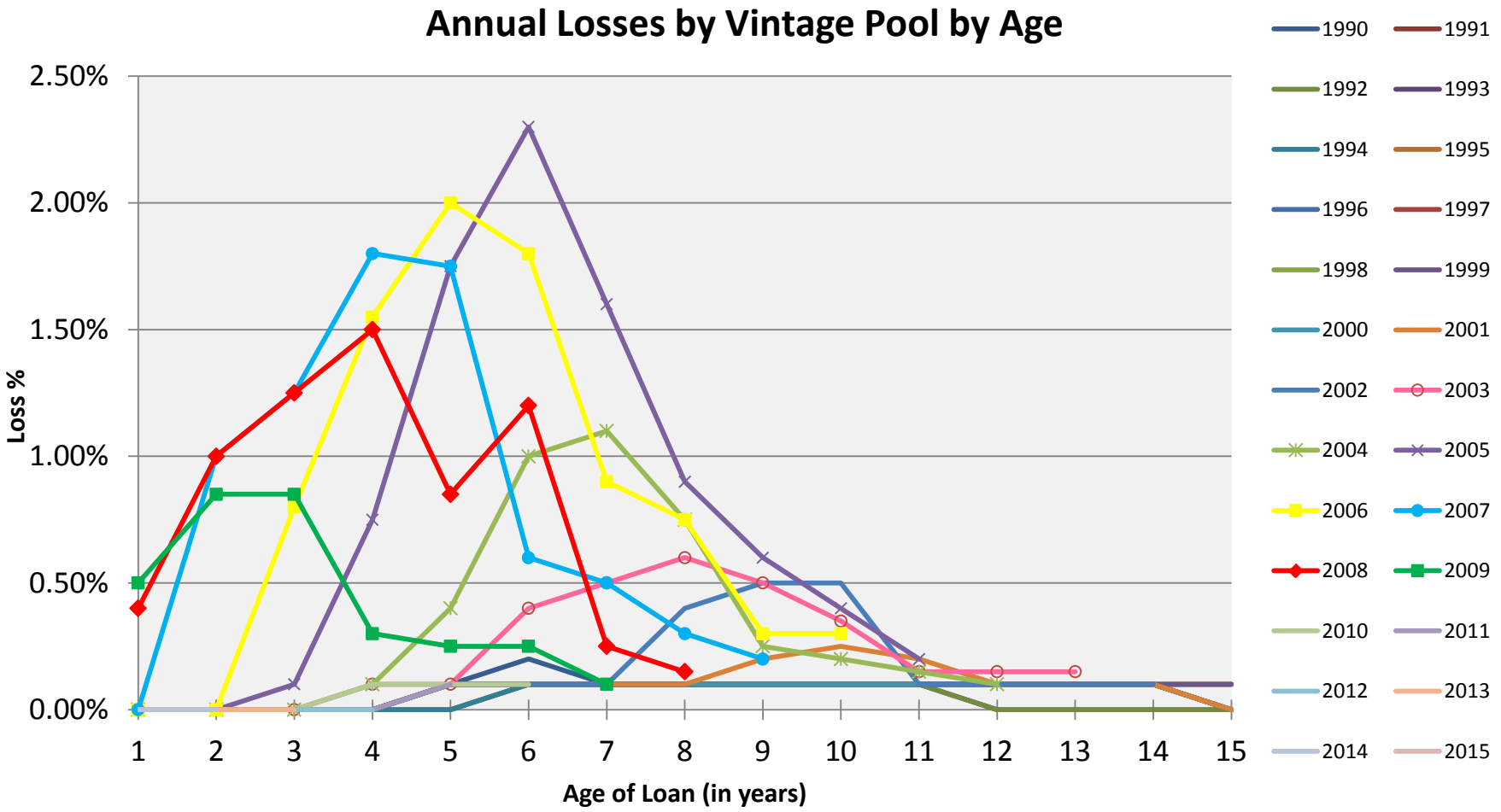
Technical Considerations

- 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

Static Pools – Annual Loss

15 yr mortgage, 660-719 FICO, 80% LTV					Actual Annual 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
1	1990	1,000,000	8,000	0.8%	0.0%	0.0%	0.0%	0.0%	0.1%	0.2%	0.1%	0.1%	0.1%	0.1%	0.1%	0.0%	0.0%	0.0%	0.0%
2	1991	1,000,000	9,000	0.9%	0.0%	0.0%	0.0%	0.0%	0.0%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.0%
3	1992	1,000,000	7,000	0.7%	0.0%	0.0%	0.0%	0.0%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.0%	0.0%	0.0%	0.0%
4	1993	1,000,000	10,000	1.0%	0.0%	0.0%	0.0%	0.0%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.0%
5	1994	1,000,000	9,000	0.9%	0.0%	0.0%	0.0%	0.0%	0.0%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.0%
6	1995	1,000,000	10,000	1.0%	0.0%	0.0%	0.0%	0.0%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	**0.0%**
7	1996	1,000,000	10,000	1.0%	0.0%	0.0%	0.0%	0.0%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	**0.1%**	0.0%
8	1997	1,000,000	11,000	1.1%	0.0%	0.0%	0.0%	0.0%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	**0.1%**	0.1%	0.1%
9	1998	1,000,000	11,000	1.1%	0.0%	0.0%	0.0%	0.0%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	**0.1%**	0.1%	0.1%	0.1%
10	1999	1,000,000	11,000	1.1%	0.0%	0.0%	0.0%	0.0%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	**0.1%**	0.1%	0.1%	0.1%	0.1%
11	2000	1,000,000	10,000	1.0%	0.0%	0.0%	0.0%	0.0%	0.1%	0.1%	0.1%	0.1%	0.1%	**0.1%**	0.1%	0.1%	0.1%	0.1%	0.0%
12	2001	1,000,000	13,500	1.4%	0.0%	0.0%	0.0%	0.0%	0.1%	0.1%	0.1%	0.1%	**0.2%**	0.3%	0.2%	0.1%	0.1%	0.1%	0.0%
13	2002	1,000,000	21,000	2.1%	0.0%	0.0%	0.0%	0.0%	0.1%	0.1%	0.1%	**0.4%**	0.5%	0.5%	0.1%	0.1%	0.1%	0.1%	
14	2003	1,000,000	30,000	3.0%	0.0%	0.0%	0.0%	0.1%	0.1%	0.4%	**0.5%**	0.6%	0.5%	0.4%	0.2%	0.2%	0.2%		
15	2004	1,000,000	40,500	4.1%	0.0%	0.0%	0.0%	0.1%	0.4%	**1.0%**	1.1%	0.8%	0.3%	0.2%	0.2%	0.1%			
16	2005	1,000,000	86,000	8.6%	0.0%	0.0%	0.1%	0.8%	**1.8%**	2.3%	1.6%	0.9%	0.6%	0.4%	0.2%				
17	2006	1,000,000	84,000	8.4%	0.0%	0.0%	0.8%	**1.6%**	2.0%	1.8%	0.9%	0.8%	0.3%	0.3%					
18	2007	1,000,000	74,000	7.4%	0.0%	1.0%	**1.3%**	1.8%	1.8%	0.6%	0.5%	0.3%	0.2%						
19	2008	1,000,000	66,000	6.6%	0.4%	**1.0%**	1.3%	1.5%	0.9%	1.2%	0.3%	0.2%							
20	2009	1,000,000	31,000	3.1%	**0.5%**	0.9%	0.9%	0.3%	0.3%	0.3%	0.1%								
21	2010	1,000,000	3,000	0.3%	0.0%	0.0%	0.0%	0.1%	0.1%	0.1%									
22	2011	1,000,000	1,000	0.1%	0.0%	0.0%	0.0%	0.0%	0.1%										
23	2012	1,000,000	-	0.0%	0.0%	0.0%	0.0%	0.0%											
24	2013	1,000,000	-	0.0%	0.0%	0.0%	0.0%												
25	2014	1,000,000	-	0.0%	0.0%	0.0%													
26	2015	1,000,000	-	0.0%	0.0%														
	Average				0.0%	0.1%	0.2%	0.3%	0.4%	0.4%	0.3%	0.3%	0.2%	0.2%	0.1%	0.1%	0.1%	0.1%	0.0%

Static Pools – Annual Loss

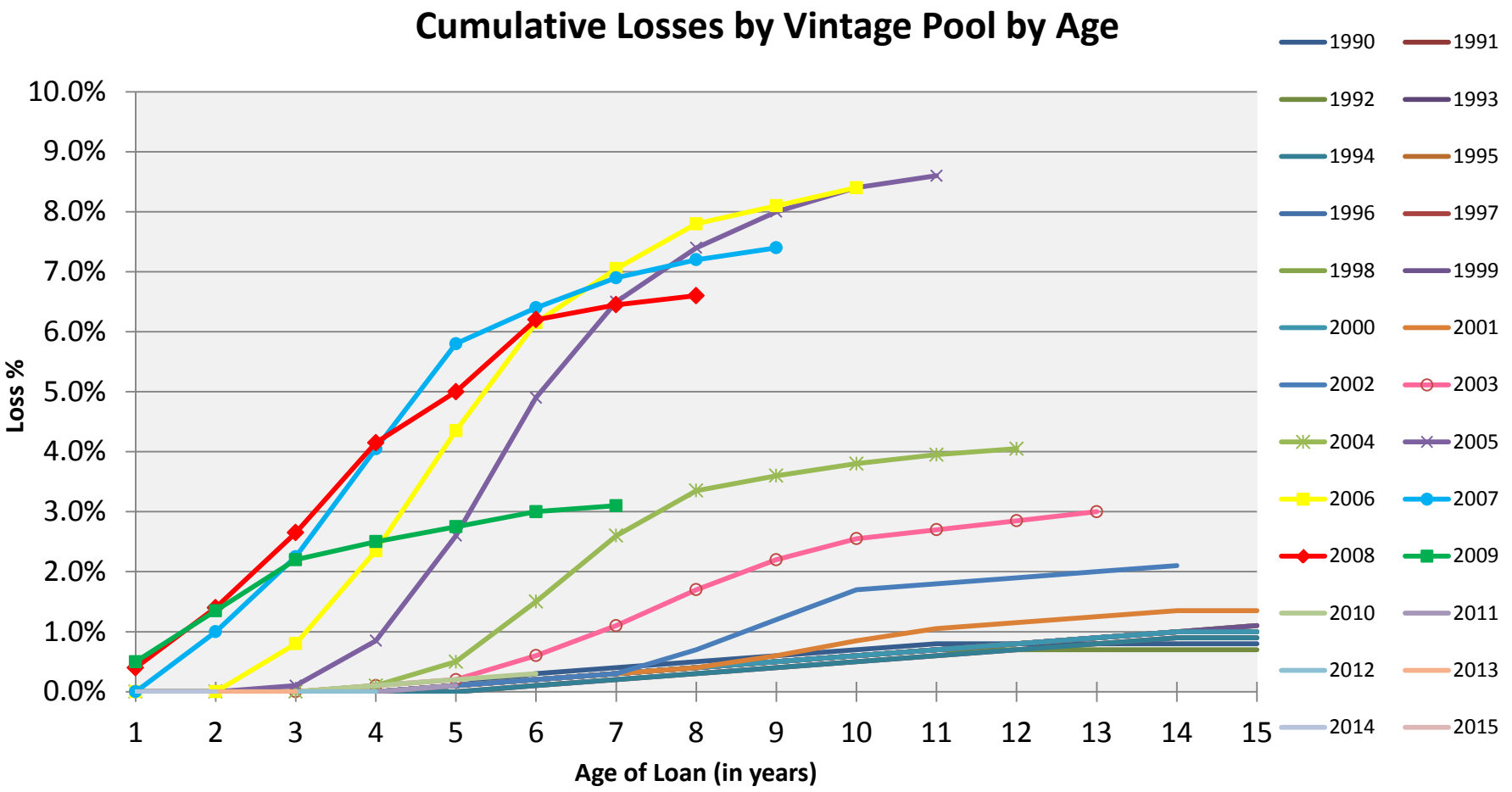


Wilary Winn LLC

Static Pools – Cumulative Loss

15 yr 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
1	1990	1,000,000	8,000	0.8%	0.0%	0.0%	0.0%	0.0%	0.1%	0.3%	0.4%	0.5%	0.6%	0.7%	0.8%	0.8%	0.8%	0.8%	0.8%
2	1991	1,000,000	9,000	0.9%	0.0%	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%	0.9%
3	1992	1,000,000	7,000	0.7%	0.0%	0.0%	0.0%	0.0%	0.1%	0.2%	0.3%	0.4%	0.5%	0.6%	0.7%	0.7%	0.7%	0.7%	0.7%
4	1993	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%
5	1994	1,000,000	9,000	0.9%	0.0%	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%	0.9%
6	1995	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%**
7	1996	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%
8	1997	1,000,000	11,000	1.1%	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%	1.1%
9	1998	1,000,000	11,000	1.1%	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%	1.1%
10	1999	1,000,000	11,000	1.1%	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%	1.1%
11	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%
12	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%
13	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%	
14	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%		
15	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%			
16	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%				
17	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%					
18	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%						
19	2008	1,000,000	66,000	6.6%	0.4%	**1.4%**	2.7%	4.2%	5.0%	6.2%	6.5%	6.6%							
20	2009	1,000,000	31,000	3.1%	**0.5%**	1.4%	2.2%	2.5%	2.8%	3.0%	3.1%								
21	2010	1,000,000	3,000	0.3%	0.0%	0.0%	0.0%	0.1%	0.2%	0.3%									
22	2011	1,000,000	1,000	0.1%	0.0%	0.0%	0.0%	0.0%	0.1%										
23	2012	1,000,000	-	0.0%	0.0%	0.0%	0.0%	0.0%											
24	2013	1,000,000	-	0.0%	0.0%	0.0%	0.0%												
25	2014	1,000,000	-	0.0%	0.0%	0.0%													
26	2015	1,000,000	-	0.0%	0.0%														
	Average		556,000		0.0%	0.2%	0.3%	0.6%	1.0%	1.5%	1.9%	2.1%	2.0%	1.9%	1.6%	1.2%	1.1%	1.1%	1.0%

Static Pools – Cumulative Loss



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Miscellaneous Items

- Final rule is expected to state that on collateral-dependent assets, the reserve is measured as the difference between the collateral's fair value (less selling costs) and the amortized cost basis of the asset.
- Final guidance is expected to clarify that an entity is not required to recognize a loss on a financial asset for which the risk of nonpayment is greater than zero, yet the amount of the loss would be zero
  - Example – have a CDR, but have a zero loss severity

Incorporating Your Credit Union's Loss Experience

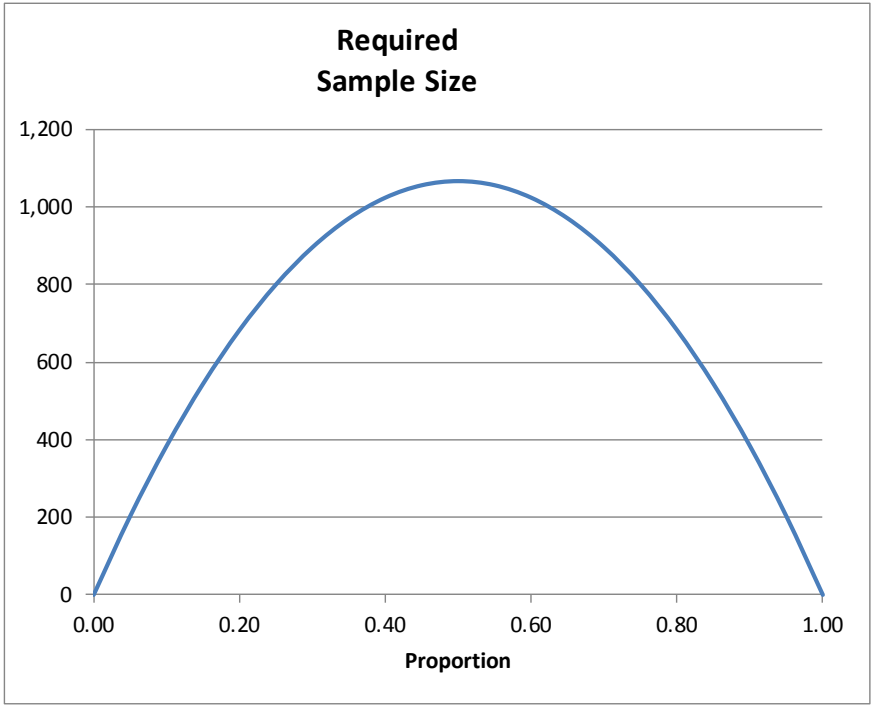
Data to collect:

- Unemployment rate
- Change in housing prices
- Change in used auto prices
- Delinquency rates by loan cohort by quarter
- Balance of defaulted loan and date of default
- Proceeds from liquidation of defaulted loan
- FICO and combined LTV at time of default
- Balance of prepaid loan and date of prepayment

Statistical Significance and Creditability

Margin for Error (M)	3%
Confidence Level (1-α)	95%

Proportion	Required Sample Size
0.00	0
0.05	203
0.10	384
0.15	544
0.20	683
0.25	800
0.30	896
0.35	971
0.40	1,024
0.45	1,056
0.50	1,067
0.55	1,056
0.60	1,024
0.65	971
0.70	896
0.75	800
0.80	683
0.85	544
0.90	384
0.95	203
1.00	0



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

Statistical Significance and Creditability

Materiality Example

500,000,000	Asset Size
200,000,000	Fixed Rate Mortgages
250,000	Average Loan Size
800	Number of Loans in Portfolio
140,000	Materiality Threshold

FICO	Balance	Balance %	Number of Loans	Proportion / CDR%	Severity	Estimated Loss Amount	Materiality Threshold	Confidence Level (1-α)	Margin for Error as a Proportion (M/π)	Margin for Error (M)	Required Sample Size	Estimated # of defaulted loans
780+	99,397,279	49.70%	398	0.03%	23%	6,858	13,717	0.95	2.00	0.06%	3,200	1
720 - 779	63,208,279	31.60%	253	0.10%	23%	14,685	22,027	0.95	1.50	0.15%	1,689	2
660 - 719	24,670,661	12.34%	99	0.64%	23%	36,587	18,294	0.95	0.50	0.32%	2,368	15
620 - 659	5,852,054	2.93%	23	4.51%	23%	60,687	27,309	0.95	0.45	2.03%	402	18
500 - 619	6,541,771	3.27%	26	13.73%	23%	206,648	51,662	0.95	0.25	3.43%	386	53
under 500	329,957	0.16%	1	23.06%	23%	17,498	4,375	0.95	0.25	5.76%	205	47
	200,000,000	100.00%	800	0.75%	23%	342,964	137,383	0.95		0.30%	8,249	136

250,000	Estimated Average Balance	140,000	Materiality Threshold
800	Estimated Count of Loans	Pass	
8,249	Required Sample Size		
Fail			

Creditability Estimator

New Estimator = Z × Company Estimator + (1 − Z) × Prior (Industry) Estimator

K = n/(n+k) where for some quantity k and company sample size n

k = 4/(L^2 * Prior Estimator)

Here, "L" is the proportion desired (margin for error as a proportion or M/π per the previous slide).

Creditability Estimator Results

620 to 659 FICO Band – Industry CDR is 4.51% and Credit Union's 3.20%

We want to be 95% confident our sample is within 45% of true default probability

k= 4/(L^2 * Prior Estimator) = 4/(0.45^2 * 0.0451) = 197.09.

Thus the credibility factor Z = 23/(23 + 197.09) = 0.1045.

Our final CDR estimate for the 620 to 659 FICO band is equal to our company input (10.45% * 3.20%) + (1 – 10.45%) * 4.51% or 4.37%.

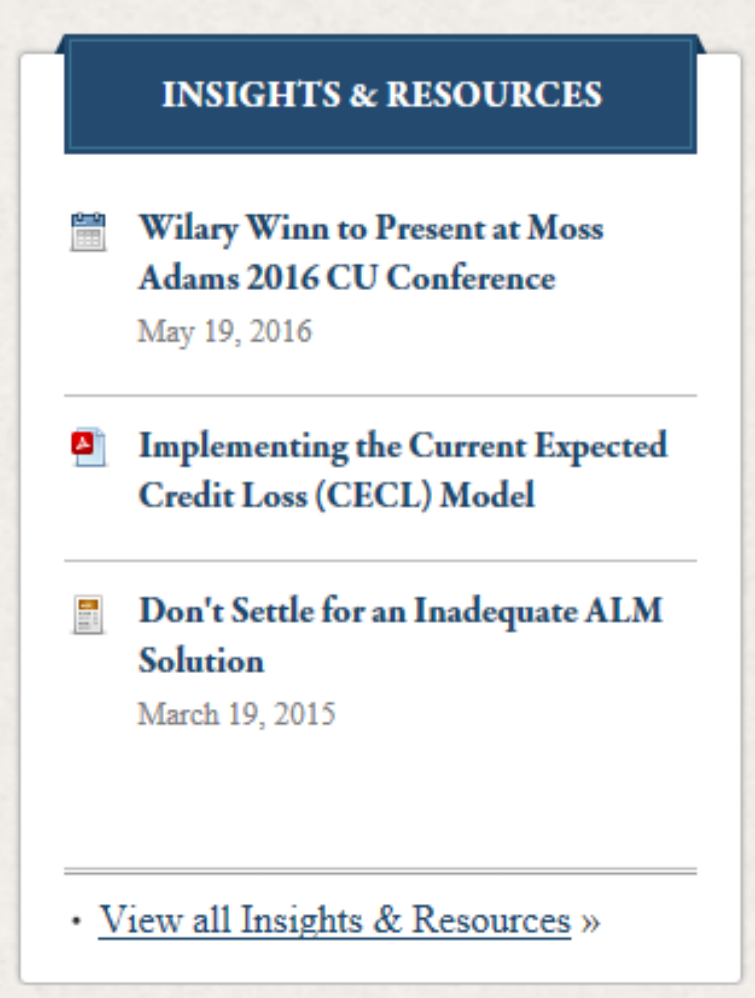
DCF Modeling Advantages

- Uses key credit indicators that credit union uses to make loans
- 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
- Reversion to historic trends can be implemented by reverting to national forecasts
- Technique explicitly discounts modified contractual cash flows

Other Uses of DCF Modeling

- Technique can be used for capital stress testing
- Results of capital stress testing can be used to set 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

Resources



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