RMS® CCRA® Training Program

Earthquake Modeling Course Exercise: Comparing Earthquake Severity and Frequency

Learning Objectives:

The purpose of this exercise is to compare and contrast the exposure, losses, and events that underlie the EP curves for two portfolios; one in California (CA EQ Commercial) and one in the Pacific Northwest covering the states of Washington and Oregon (PNW EQ Commercial). At the end of the exercise you will have learned:

- How to assess the distribution of average annual loss (pure premium) based on earthquake magnitude and source types within the event set.
- How to characterize sources driving excess losses at the tail of the EP curve.
- How differences in the frequency and severity of seismic activity in different regions affects EP results.

You have been provided with the following files:

- RiskLink® Post-Import Summary Report for each portfolio
- Excel workbook (Earthquake Modeling Exercise.xls)
- The Excel workbook includes mean losses for all events in the Event Loss Table for each portfolio (see Results tabs), and tables showing losses by magnitude range and source type (see Analysis tabs).

Exposure Data Summary

	CA EQ Commercial Book	PNW EQ Commercial Book
# Accts/ locations	81 accounts 320 locations	87 accounts 1614 locations
Total Value	$1,643,367,400	$8,880,155,600
Geocoding level(s) as % of TIV	89.4% Street 5.9% ZIP Code 4.8% County	63.4% Street 36.6% ZIP Code
Line(s) of business	Commercial	Commercial
Primary characteristics modeled	Construction Occupancy Number of Stories (17% unknown; 76% 1-story) Year Built (80% unknown)	Construction Occupancy Number of Stories (99.8% known; 85% 1-story) Year Built (65% unknown)
Typical deductibles or attachment points	Primary and XS policies Avg. site deductible = 5% Various policy deductibles	Excess policies Avg. site deductible = 3% Various policy deductibles

Insured Limits: Top 5 Counties

County, State	Insured Limits ($)	% Total Portfolio Limits
1. King, WA	656,624,582	48% PNW Portfolio
2. Multnomah, OR	157,114,115	11% PNW Portfolio
3. Washington, OR	92,143,748	7% PNW Portfolio
4. Snohomish, WA	83,979,949	6% PNW Portfolio
5. Los Angeles, CA	83,405,822	29% CA Portfolio

Summary Gross AEP Loss Results

Critical Probability	Return Period	California Book $	Pacific NW Book $	Total Group $
0.02%	5,000	31,805,577	182,933,155	188,446,731
0.10%	1,000	22,100,838	47,557,234	50,642,695
0.20%	500	17,989,396	19,263,191	27,614,074
0.40%	250	14,060,842	7,098,386	18,499,462
1.00%	100	9,288,252	1,004,437	11,127,824
2.00%	50	6,047,558	34,447	7,026,289
Pure Premium		412,215	196,761	608,976
Standard Deviation		1,858,886	4,584,601	5,102,993
CV		4.5095	23.0035	8.3796

Gross AAL: Top 5 Counties

County, State	Gross AAL ($)
1. Los Angeles, CA	123,314
2. Santa Clara, CA	96,233
3. King, WA	73,690
4. Sonoma, CA	53,066
5. Multnomah, OR	45,583

1. Use the Excel workbook to compare the risk of the CA EQ Commercial book with the PNW EQ Commercial book. This information was compiled using the following data sources:

    - The event table of the RMS_EVENTINFO database
    - The rdm_anlsevent and rdm_port tables from the RDM for each portfolio
    - Source types based on Event ID number; check with RMS for more information

a. What is the distribution of Gross AAL by magnitude and source type? Use the tables in the Analysis tabs of the spreadsheet to compile your results.

Table 1

Gross AAL Distribution by Magnitude and Source Type								
	California Book (%)				Pacific NW Book (%)			
Source Type	Fault	Back-ground	Interface	Intraslab	Fault	Back-ground	Interface	Intraslab
5.0-5.9								
6.0-6.9								
7.0-7.9								
8.0-8.9								
9.0+								

Table 2

Gross AAL Distribution by Magnitude and Source Type					
	CA and PNW Grouped Results (%)				Total Group (%)
Source Type	Fault	Background	Interface	Intraslab	All source types
5.0-5.9					
6.0-6.9					
7.0-7.9					
8.0-8.9					
9.0+					

b. For the California portfolio, what magnitude range in the table above dominates the portfolio loss as measured by percent contribution to the gross average annual losses (pure premium)?

As a comparison, which magnitude range dominates for the Pacific NW portfolio?

c. For the California book, what source types in Table 1 dominate the portfolio loss as measured by percent contribution to the gross average annual losses (pure premium) by magnitude range?

As a comparison, which source types dominate for the Pacific NW book?

2. Now, consider events that contribute to losses in excess of the 250-year loss level for the entire group. Note that losses shown in the ELT are mean losses for each event and do not include secondary uncertainty. The XSAAL has been calculated for you and listed in the table below. To account for secondary uncertainty, we used the XSAAL calculation described in the Modeling Applications course.

   Note: Please refer to the RMS CCRA Training Program Study Topic Supplement: Incorporating Secondary Uncertainty into XSAAL Calculations document from the Modeling Applications course on this topic.

Portfolio	250-Year AEP Gross Loss	Gross XSAAL
CA EQ Commercial	$ 14,060,842	$ 73,110
Pacific NW EQ Commercial	$ 7,098,386	$ 175,804
Group (CA and Pacific NW)	$ 18,499,462	$ 201,437

a. Which earthquake region dominates the risk in excess of the 250-year EP return period (excluding secondary uncertainty) for the entire group? This can be assessed by reviewing events in the ELT with losses greater than the 250-year gross loss.

b. What types of earthquake sources make up the bulk of the risk in this range of losses?

c. List at least three earthquake source names that are prominent drivers of risk in excess of the 250-year EP return period.

d. Based on your analysis, which portfolio is at higher risk to earthquake losses and why?

e. What additional information would you want to obtain before making any decisions or recommendations regarding these portfolios?