

CASUALTY · LOSS · RESERVE · SEMINAR

CLRS

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Smarter Segmentation for the Lazy Actuary

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Kacie Kiel

Agenda

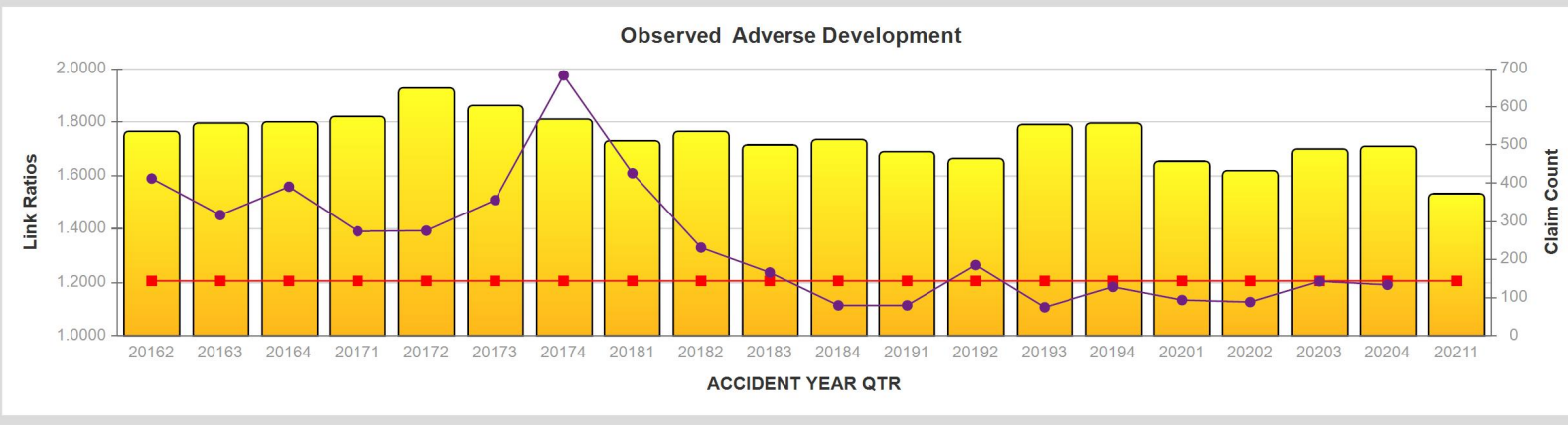
- Questions
- Interact with your data
- Using the machine
- Special considerations
- Conclusion

Questions

- Is there any observed adverse development?
- How homogenous is the data in the triangle?
- What are the key drivers of the observed adverse development?
- Any outliers to be concerned about?

Start with the Answer

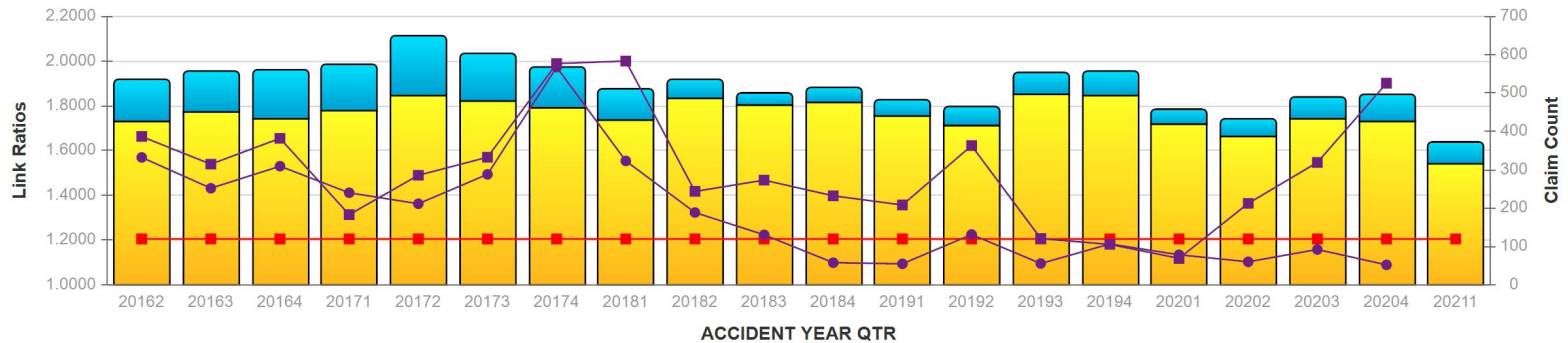
CLAIM COU.	03	06	09	12	15	18	21	24	27	30	33	36	39	42	45	48	51	54	57	60	
20162	535	2,327,474	3,699,972	4,394,808	4,616,549	4,823,582	4,986,506	5,015,591	5,220,597	5,406,942	5,432,719	5,501,020	5,561,920	5,604,941	5,624,513	5,619,513	5,630,413	5,649,913	5,649,913	5,660,413	5,660,413
20163	557	2,702,837	3,925,283	4,381,951	4,826,793	5,223,121	5,364,607	5,438,035	5,475,679	5,703,102	5,775,214	5,834,353	5,866,353	5,885,750	5,891,250	5,913,773	5,916,449	5,916,449	5,941,749	5,938,491	0
20164	563	2,740,834	4,273,061	4,888,205	5,298,394	5,586,741	5,618,999	5,652,998	5,700,019	5,822,322	5,773,621	5,862,042	5,896,924	5,993,955	5,982,225	5,979,725	5,965,197	5,960,197	5,954,697	0	0
20171	574	2,596,745	3,612,760	4,225,010	4,891,168	5,142,347	5,344,914	5,490,319	5,637,067	5,645,962	5,641,753	5,647,377	5,628,862	5,665,737	5,674,737	5,622,386	5,668,536	5,694,636	0	0	0
20172	649	2,764,686	3,852,961	4,598,081	5,239,623	5,396,692	5,678,484	5,726,888	5,767,263	5,894,114	5,856,008	5,879,726	5,908,837	5,912,537	5,943,037	5,952,337	5,955,436	0	0	0	0
20173	605	1,919,315	2,895,515	3,693,255	4,101,142	4,514,373	4,612,324	4,726,945	4,876,257	4,974,772	5,106,373	5,136,642	5,179,051	5,190,551	5,198,551	5,182,051	0	0	0	0	0
20174	570	1,598,005	3,158,121	3,879,654	4,242,000	4,457,188	4,789,919	4,913,756	5,054,212	5,149,619	5,168,860	5,169,135	5,186,035	5,188,535	5,181,535	0	0	0	0	0	0
20181	512	2,006,271	3,229,274	3,731,110	4,061,237	4,122,868	4,264,282	4,313,153	4,471,720	4,611,612	4,586,695	4,573,695	4,596,308	4,556,995	0	0	0	0	0	0	0
20182	535	2,554,457	3,397,686	3,984,864	4,337,121	4,541,039	4,759,784	4,866,467	5,047,967	5,156,875	5,216,289	5,219,123	5,228,623	0	0	0	0	0	0	0	0
20183	501	3,044,484	3,765,190	4,391,575	4,848,241	5,184,242	5,251,622	5,487,211	5,601,961	5,713,761	5,832,561	5,812,561	0	0	0	0	0	0	0	0	0
20184	514	2,876,823	3,203,635	3,396,672	3,920,643	4,092,172	4,275,142	4,344,182	4,360,958	4,472,480	4,475,528	0	0	0	0	0	0	0	0	0	0
20191	483	2,545,273	2,834,478	3,353,084	3,811,691	4,183,002	4,256,130	4,359,490	4,893,031	4,655,180	0	0	0	0	0	0	0	0	0	0	0
20192	465	2,526,399	3,195,121	3,591,269	4,098,359	4,493,697	4,526,291	4,640,392	4,720,815	0	0	0	0	0	0	0	0	0	0	0	0
20193	554	2,990,629	3,308,981	3,812,083	4,286,663	4,566,412	4,803,691	4,915,415	0	0	0	0	0	0	0	0	0	0	0	0	0
20194	559	3,570,098	4,223,673	5,067,843	5,786,389	6,314,632	6,597,695	0	0	0	0	0	0	0	0	0	0	0	0	0	0
20201	457	2,910,688	3,299,494	3,554,465	3,964,296	4,348,986	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
20202	432	2,804,449	3,157,967	3,570,173	3,824,605	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
20203	492	3,176,968	3,825,280	4,152,920	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
20204	496	3,628,388	4,320,890	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
20211	374	2,873,850	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0



Start with the Answer

CLAIM COU.	03	06	09	12	15	18	21	24	27	30	33	36	39	42	45	48	51	54	57	60
20162. N	425	1,845,470	2,898,071	3,480,367	3,641,916	3,800,069	3,957,339	3,958,929	4,116,122	4,272,282	4,301,060	4,348,361	4,390,261	4,383,282	4,400,761	4,391,281	4,402,181	4,425,181	4,425,181	4,441,181
20163. N	451	2,205,683	3,159,611	3,486,077	3,847,085	4,131,368	4,235,005	4,283,683	4,294,077	4,450,005	4,524,717	4,568,856	4,599,356	4,618,754	4,618,754	4,631,777	4,634,453	4,634,453	4,631,453	4,628,195
20164. N	432	2,124,353	3,252,377	3,634,764	3,982,134	4,181,082	4,223,537	4,256,036	4,321,186	4,399,311	4,309,811	4,393,203	4,433,085	4,495,116	4,499,886	4,499,386	4,495,858	4,490,858	4,485,358	0
20171. N	485	2,041,990	2,883,579	3,371,152	3,942,159	4,157,565	4,348,717	4,462,837	4,576,085	4,554,215	4,522,086	4,500,346	4,500,513	4,500,513	4,508,012	4,458,012	4,482,512	4,482,512	4,508,612	0
20172. N	494	2,103,520	2,864,609	3,442,410	3,945,022	4,040,820	4,249,792	4,281,926	4,343,843	4,139,024	4,188,073	4,190,573	4,232,884	4,206,184	4,236,684	4,242,484	4,245,583	0	0	0
20173. N	478	1,568,440	2,344,261	3,044,029	3,216,515	3,547,272	3,628,604	3,714,905	3,841,313	3,912,768	3,997,472	4,037,741	4,057,376	4,068,876	4,076,876	4,073,376	0	0	0	0
20174. N	461	1,354,300	2,673,155	3,140,741	3,307,667	3,505,696	3,719,818	3,832,327	3,972,782	4,052,191	4,050,155	4,040,776	4,029,776	4,035,276	4,028,276	0	0	0	0	0
20181. N	429	1,759,356	2,735,149	3,029,717	3,155,097	3,190,546	3,284,077	3,326,449	3,475,016	3,589,907	3,570,490	3,557,490	3,564,835	3,525,521	0	0	0	0	0	0
20182. N	488	2,387,527	3,160,951	3,678,275	3,907,017	4,095,016	4,303,409	4,376,667	4,558,167	4,653,104	4,690,118	4,682,451	4,687,451	0	0	0	0	0	0	0
20183. N	469	2,888,084	3,535,490	3,936,455	4,235,921	4,558,722	4,594,797	4,829,386	4,957,245	5,044,045	5,162,845	5,142,845	0	0	0	0	0	0	0	0
20184. N	476	2,743,198	3,016,746	3,095,072	3,461,692	3,637,474	3,810,443	3,882,944	3,886,221	3,950,242	3,953,290	0	0	0	0	0	0	0	0	0
20191. N	439	2,360,632	2,583,803	2,956,817	3,247,884	3,533,295	3,656,422	3,705,782	3,941,934	4,084,332	0	0	0	0	0	0	0	0	0	0
20192. N	416	2,277,604	2,791,360	3,093,967	3,435,911	3,787,249	3,795,344	3,913,232	3,993,655	0	0	0	0	0	0	0	0	0	0	0
20193. N	499	2,706,650	2,966,086	3,412,035	3,689,649	3,925,898	4,129,427	4,148,151	0	0	0	0	0	0	0	0	0	0	0	0
20194. N	493	3,185,297	3,769,097	4,363,847	4,746,160	5,107,786	5,365,848	0	0	0	0	0	0	0	0	0	0	0	0	0
20201. N	420	2,672,425	3,032,896	3,176,000	3,413,177	3,738,320	0	0	0	0	0	0	0	0	0	0	0	0	0	0
20202. N	387	2,563,312	2,828,880	3,190,216	3,215,673	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
20203. N	433	2,806,790	3,252,273	3,284,912	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
20204. N	426	3,177,488	3,463,195	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
20211. N	316	2,276,226	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
20162. Y	110	482,004	801,901	914,441	974,633	1,023,513	1,029,167	1,056,662	1,102,476	1,134,659	1,131,659	1,152,659	1,171,659	1,221,659	1,223,732	1,228,232	1,228,232	1,224,732	1,224,732	1,219,232
20163. Y	106	497,154	765,672	895,873	979,707	1,091,752	1,129,602	1,154,352	1,181,602	1,253,096	1,250,496	1,265,496	1,266,996	1,266,996	1,272,496	1,281,996	1,281,996	1,281,996	1,310,296	1,310,296
20164. Y	131	616,481	1,020,683	1,253,441	1,316,259	1,405,659	1,395,462	1,396,962	1,378,833	1,423,011	1,463,810	1,468,839	1,468,839	1,482,339	1,480,339	1,469,339	1,469,339	1,469,339	1,469,339	0
20171. Y	119	554,755	729,181	853,859	949,009	984,782	996,197	1,027,482	1,061,982	1,091,747	1,119,747	1,121,016	1,128,516	1,166,224	1,166,224	1,164,374	1,186,024	1,186,024	0	0
20172. Y	155	663,166	988,352	1,155,672	1,294,621	1,355,864	1,428,691	1,444,962	1,623,420	1,665,090	1,667,935	1,689,153	1,693,953	1,706,353	1,706,353	1,709,853	1,709,853	0	0	0
20173. Y	127	350,875	551,255	649,225	684,627	967,101	983,720	1,012,940	1,034,944	1,062,004	1,108,901	1,098,901	1,121,675	1,121,675	1,121,675	0	0	0	0	0
20174. Y	109	243,305	484,965	738,913	934,332	951,491	1,070,101	1,081,429	1,081,429	1,097,438	1,118,704	1,128,359	1,156,259	1,153,259	1,153,259	0	0	0	0	0
20181. Y	83	246,915	494,125	701,394	906,140	932,322	980,205	996,704	1,021,704	1,016,204	1,016,204	1,031,473	1,031,473	0	0	0	0	0	0	0
20182. Y	47	166,930	236,735	306,589	430,104	446,023	456,375	489,800	489,800	503,772	526,172	536,672	541,172	0	0	0	0	0	0	0
20183. Y	32	156,400	229,700	455,120	612,320	625,520	656,825	657,825	644,715	669,715	669,715	669,715	0	0	0	0	0	0	0	0
20184. Y	38	133,625	186,890	301,600	468,951	454,698	464,699	461,238	474,738	522,238	522,238	0	0	0	0	0	0	0	0	0

Observed Adverse Development

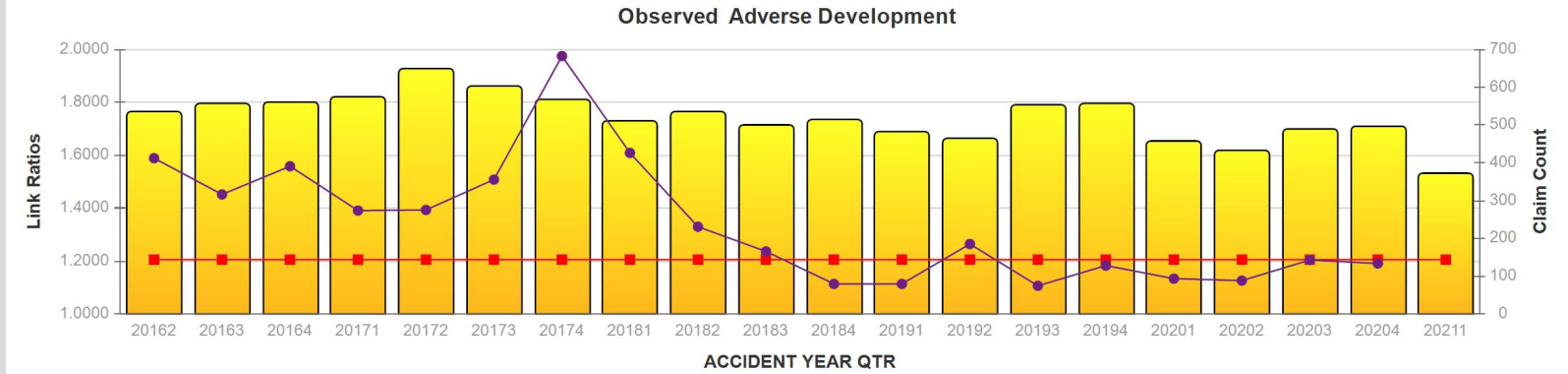


Interact with your data

- Is there any observed adverse development?
- How homogenous is the data in the triangle?
- What are the key drivers of the observed adverse development?
- Any outliers to be concerned about?

Interact with your data: "Find the pattern"

	CLAM COUNT	03	06	09	12	15	18	21	24	27	30	33	36	39	42	45	48	51	54	57	60
20162	535	2,327,474	3,699,972	4,394,808	4,616,549	4,823,582	4,986,506	5,015,591	5,220,597	5,406,942	5,432,719	5,501,020	5,561,920	5,604,941	5,624,513	5,619,513	5,630,413	5,649,913	5,649,913	5,660,413	5,660,413
20163	557	2,702,837	3,925,283	4,381,951	4,826,793	5,223,121	5,364,607	5,438,035	5,475,679	5,703,102	5,775,214	5,834,353	5,866,353	5,885,950	5,891,250	5,913,773	5,916,449	5,916,449	5,941,749	5,938,491	0
20164	563	2,740,834	4,273,061	4,888,205	5,296,394	5,586,741	5,618,999	5,652,998	5,700,019	5,822,322	5,773,621	5,862,042	5,896,924	5,993,955	5,982,225	5,979,725	5,965,197	5,960,197	5,954,697	0	0
20171	574	2,596,745	3,612,760	4,225,010	4,891,166	5,142,347	5,344,914	5,490,319	5,637,067	5,646,962	5,641,753	5,647,377	5,628,862	5,666,737	5,674,737	5,622,386	5,668,536	5,694,636	0	0	0
20172	649	2,764,686	3,852,961	4,598,081	5,239,623	5,396,692	5,678,484	5,726,888	5,767,263	5,804,114	5,856,008	5,879,726	5,926,837	5,912,537	5,943,037	5,952,337	5,955,436	0	0	0	0
20173	605	1,919,315	2,895,515	3,693,255	4,101,142	4,514,373	4,612,324	4,726,945	4,876,257	4,974,772	5,106,373	5,136,642	5,179,051	5,190,551	5,198,551	5,182,051	0	0	0	0	0
20174	570	1,598,005	3,158,121	3,879,654	4,242,000	4,457,188	4,789,919	4,913,756	5,054,212	5,149,619	5,168,860	5,169,135	5,186,035	5,188,535	5,181,535	0	0	0	0	0	0
20181	512	2,006,271	3,229,274	3,731,110	4,061,237	4,122,868	4,264,282	4,313,153	4,471,720	4,611,612	4,586,695	4,573,695	4,596,308	4,566,995	0	0	0	0	0	0	0
20182	535	2,554,457	3,397,686	3,984,864	4,337,121	4,541,039	4,759,784	4,866,467	5,047,967	5,156,675	5,216,289	5,228,623	0	0	0	0	0	0	0	0	0
20183	501	3,044,484	3,785,190	4,391,575	4,848,241	5,188,242	5,251,622	5,487,211	5,601,961	5,713,761	5,832,561	5,812,561	0	0	0	0	0	0	0	0	0
20184	514	2,876,823	3,203,635	3,396,672	3,920,643	4,092,172	4,275,142	4,344,182	4,360,958	4,472,480	4,475,528	0	0	0	0	0	0	0	0	0	0
20191	483	2,545,273	2,834,478	3,353,084	3,811,691	4,183,002	4,256,130	4,389,490	4,593,031	4,655,190	0	0	0	0	0	0	0	0	0	0	0
20192	465	2,526,399	3,195,121	3,591,269	4,098,359	4,493,697	4,526,291	4,640,392	4,720,815	0	0	0	0	0	0	0	0	0	0	0	0
20193	554	2,990,629	3,308,981	3,812,083	4,286,663	4,566,412	4,803,691	4,915,415	0	0	0	0	0	0	0	0	0	0	0	0	0
20194	559	3,570,098	4,223,673	5,067,843	5,786,389	6,314,632	6,597,696	0	0	0	0	0	0	0	0	0	0	0	0	0	0
20201	457	2,910,688	3,299,494	3,554,465	3,964,296	4,348,986	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
20202	432	2,804,449	3,157,967	3,570,173	3,824,605	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
20203	492	3,176,958	3,825,280	4,152,920	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
20204	498	3,628,388	4,320,890	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
20211	374	2,873,850	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0



Using the Machine

- Standard interactions has the analyst slice and dice data to find permutations of characteristics that create the pattern of observed adverse development
- Machine based approaches specify the pattern to look for and has the algorithm search the claim features and find the claim characteristics that drive the results

Using the Machine: "Identify the pattern"



Using the Machine: "Identify the pattern"

SEGMENT FILTER

- BAND 03 06
- BAND 06 09
- BAND 09 12

First term: BAND 03 06 Second term: None Third term: None

Adverse Development
Claim Count by First vs Second Term

BI SELECTIONS

Name	Value
SELECT 03...	5
SELECT 06...	6
SELECT 09...	7

TREE FITTER

Response Variable: SELECTION_RESPONSE

Weight: SELECTION_WEIGHT

Objective: Regression Logistic

Tweedie Variance Power: 1.5

Start Value: AGG_AVG 0.5

Row Sampling: 100 %

Column Sampling (Tree Based): 100 %

Column Sampling (Level Based): 100 %

Seed: 0

TREE FITTER

Factor Selection

Name	Include	Override factor type	Resolved factor type
ACCIDE...	True	None applied	Ordered
ArbFlag	True	None applied	Categorical
BILIMIT	True	None applied	Ordered
CLDED...	True	None applied	Ordered
COMPA...	False	None applied	Categorical
ExclDriv...	True	None applied	Categorical
FClag	True	None applied	Categorical
HODiscr...	True	None applied	Categorical
NumOf...	True	None applied	Ordered
PDLIMIT	True	None applied	Ordered
PIFdisc	True	None applied	Categorical
PolicyT...	True	None applied	Ordered
PROGR...	True	None applied	Categorical
STATE	False	None applied	Categorical
SuitFlag	True	None applied	Categorical
SuitState	True	None applied	Categorical
SuitYear	True	None applied	Categorical
UBLIMIT	True	None applied	Ordered

TREE FITTER

Display all factors

Factor Importance

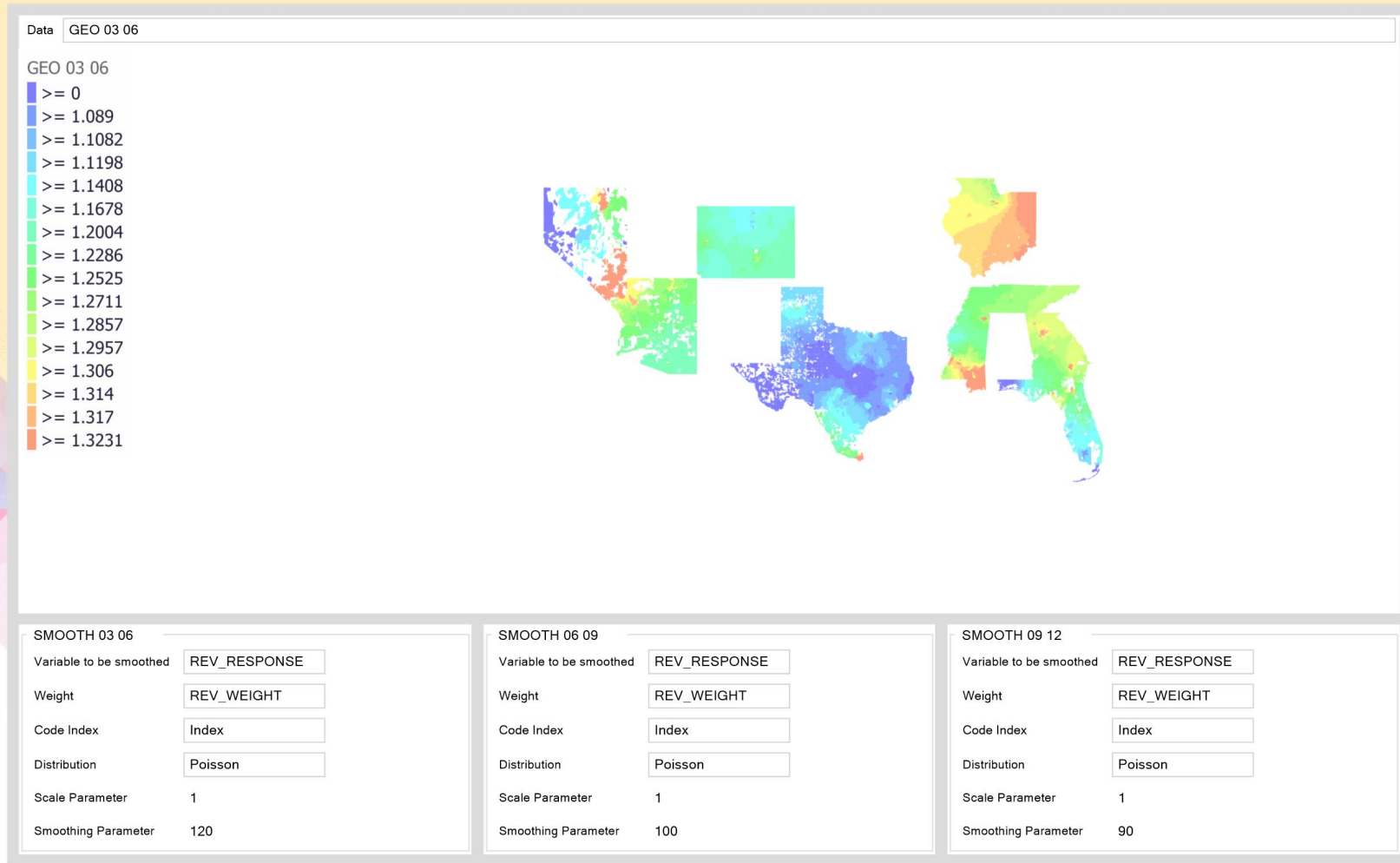
Special Considerations: Back to Questions..

- Is there any observed adverse development?
- How homogenous is the data in the triangle?
- What are the key drivers of the observed adverse development?
- Any outliers to be concerned about?

Special Considerations

- Geography: adjacency smoothing gives the analyst more control and is not limited to distance
- Outliers: what should you do about specific claims that share common characteristics with claims that are developing adversely
- Describing the cohort: what are other ways to effectively describe the claim groups

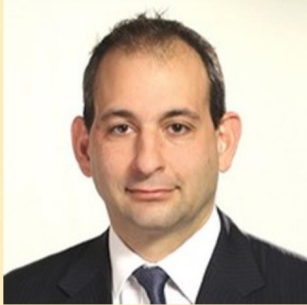
Special Considerations



Conclusions

- Segmentation is already a common practice with assessing company reserves
- Machines can help identify segments but require a clear statement of scope
- As with any method – additional consideration and care is required during development and interpretation

Thank you



- Serhat Guven



- Kacie Kiel