Draft: 12/06/21

Casualty Actuarial and Statistical (C) Task Force
E-Vote
November 17, 2021

The Casualty Actuarial and Statistical (C) Task Force conducted an e-vote that concluded Nov. 17, 2021. The following Task Force members participated: James J. Donelon, Vice Chair, represented by Nichole Torblaa (LA); Lori K. Wing-Heier represented by Dave Heppen (AK); Evan G. Daniels represented by Tom Zuppan (AZ); Ricardo Lara represented by Lynne Wehmueller (CA); Michael Conway represented by Mitchell Bronson (CO); Andrew N. Mais represented by Wanchin Chou (CT); Karima M. Woods represented by David Christhilf (DC); David Altmaier represented by Christina Huff (FL); Colin M. Hayashida represented by Kathleen H. Nakasone (HI); Doug Ommen represented by Travis Grassel (IA); Dana Popish Severinghaus represented by Judy Mottar (IL); Vicki Schmidt represented by Nicole Boyd (KS); Eric A. Cioppa represented by Sandra Darby (ME); Anita G. Fox represented by Kevin Dyke (MI); Chlora Lindley-Myers and Cynthia Amann (MO); Troy Downing represented by Mari Kindberg (MT); Chris Nicolopoulos represented by Christian Citarella (NH); Marlene Caride represented by Carl Sornson (NJ); Russell Toal and Anna Krylova (NM); Judith L. French represented by Tom Botsko (OH); Glen Mulready represented by Andrew Schallhorn (OK); Andrew R. Stolfi represented by David Dahl (OR); Raymond G. Farmer represented by Will Davis (SC); Doug Slape represented by J'ne Byckovski (TX); Michael S. Pieciak represented by Rosemary Raszka (VT); Mike Kreidler represented by Eric Slavich (WA); and Allan L. McVey and Juanita Wimmer (WV).

1. Adopted the Profitability Report

The Task Force conducted an e-vote to consider adoption of the *Report on Profitability by Line by State* (Profitability Report). The motion passed unanimously.

Having no further business, the Casualty Actuarial and Statistical (C) Task Force adjourned.

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Draft: 11/22/21

Casualty Actuarial and Statistical (C) Task Force
Virtual Meeting
November 9, 2021

The Casualty Actuarial and Statistical (C) Task Force met Nov. 9, 2021. The following Task Force members participated: Grace Arnold, Chair, represented by Phil Vigliaturo (MN); James J. Donelon, Vice Chair, represented by Nichole Torblaa (LA); Lori K. Wing-Heier represented by David Heppen (AK); Jim L. Ridling represented by Daniel J. Davis (AL); Ricardo Lara represented by Lynne Wehmueller (CA); Michael Conway represented by Mitchell Bronson (CO); Andrew N. Mais represented by Wanchin Chou (CT); David Altmaier represented by Greg Jaynes (FL); Colin M. Hayashida represented by Randy Jacobson (HI); Doug Ommen represented by Travis Grassel (IA); Dana Popish Severinghaus represented by Reid McClintock (IL); Vicki Schmidt represented by Nicole Boyd (KS); Kathleen A. Birrane represented by Ron Coleman and Walter Dabrowski (MD); Eric A. Cioppa represented by Sandra Darby (ME); Anita G. Fox represented by Kevin Dyke (MI); Chlora Lindley-Myers represented by Julie Lederer (MO); Troy Downing represented by Mari Kindberg (MT); Mike Causey represented by Arthur Schwartz (NC); Chris Nicolopoulos represented by Christian Citarella (NH); Barbara D. Richardson represented by Gennady Stolyarov (NV); Judith L. French represented by Tom Botsko (OH); Glen Mulready represented by Andrew Schallhorn (OK); Andrew R. Stolfi represented by David Dahl (OR); Jessica K. Altman represented by Kevin Clark (PA); Raymond G. Farmer represented by Ryan Bailey (SC); Cassie Brown represented by J'ne Byckovski (TX); Michael S. Pieciak represented by Mary Richter (VT); and Mike Kreidler represented by Eric Slavich (WA).

1. Received a Report from the Statistical Data (C) Working Group

Ms. Darby said the Statistical Data (C) Working Group will be reviewing the *Competition Database Report*; the *Dwelling Fire, Homeowners Owner-Occupied, and Homeowners Tenant and Condominium/Cooperative Unit Owner's Insurance Report* (Homeowners Report); and the *Auto Insurance Database Report* soon and will consider them for adoption prior to the Fall National Meeting.

Ms. Darby made a motion, seconded by Mr. Chou, to adopt the Statistical Data (C) Working Group's report. The motion passed unanimously.

2. Adopted a Decision Based on the CAS Study on Appointed Actuary CE

Mr. Vigliaturo said the continuing education (CE) charge is to "work with the Casualty Actuarial Society (CAS) and the Society of Actuaries (SOA) to identify: 1) what types of learning property/casualty (P/C) Appointed Actuaries are using to meet CE requirements for specific qualification standards today; and 2) whether more specificity should be added to the P/C Appointed Actuaries' CE requirements to ensure that CE is aligned with the educational needs for a P/C Appointed Actuary. He said this charge resulted from the Executive (EX) Committee's Appointed Actuary Job Analysis project, was a recommendation from the NAIC's consultant, and was adopted by the Property and Casualty Insurance (C) Committee as a charge for the Task Force. The Task Force started work on this charge by asking the CAS and SOA to collect data on Appointed Actuaries' CE and requiring Appointed Actuaries to categorize their CE using specified categories.

Mr. Vigliaturo said the first part of the charge was completed with the CAS' report on Oct. 12. He said what remains of the charge is to determine if there is any reason to believe that Appointed Actuaries are not remaining competent and taking appropriate CE. No one expressed concerns with Appointed Actuaries' CE selections.

Ms. Stolyarov made a motion, seconded by Mr. Schwartz, to discontinue requiring CE categorization and the reporting of CE to the CAS and SOA in the 2022 Statement of Actuarial Opinion instructions. The motion passed unanimously.

3. Adopted its 2022 Proposed Charges

Mr. Vigliaturo said the CE charge is eliminated for 2022 because of the action taken to discontinue CE categorization and reporting. Mr. Vigliaturo presented some proposed additions to the charges regarding predictive analytics work. The Task Force agreed to add two proposed predictive analytics charges with revised wording.

Ms. Lederer made a motion, seconded by Mr. Dyke, to adopt the Task Force's 2022 proposed charges as amended (Attachment ___). The motion passed unanimously.
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Having no further business, the Casualty Actuarial and Statistical (C) Task Force adjourned.

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Draft: 10/29/21

Casualty Actuarial and Statistical (C) Task Force
Virtual Meeting
October 12 and October 19, 2021

The Casualty Actuarial and Statistical (C) Task Force met Oct. 12 and Oct. 19, 2021. The following Task Force members participated: Grace Arnold, Chair, represented by Phil Vigliaturo (MN); James J. Donelon, Vice Chair, represented by Nichole Torblaa (LA); Lori K. Wing-Heier represented by David Heppen (AK); Evan G. Daniels represented by Tom Zuppan (AZ); Ricardo Lara represented by Mitra Sanandajifar and Lynne Wehmueller (CA); Michael Conway represented by Mitchell Bronson (CO); Andrew N. Mais represented by Wanchin Chou (CT); Karima M. Woods represented by David Christhilf (DC); David Altmaier represented by Sandra Starnes (FL); Colin M. Hayashida represented by Randy Jacobson (HI); Doug Ommen represented by Travis Grassel (IA); Dana Popish Severinghaus represented by Reid McClintock and Judy Mottar (IL); Amy L. Beard represented by Stephen Chamblee (IN); Vicki Schmidt represented by Nicole Boyd (KS); Kathleen A. Birrane represented by Ron Coleman and Walter Dabrowski (MD); Eric A. Cioppa represented by Sandra Darby (ME); Anita G. Fox represented by Kevin Dyke (MI); Chlora Lindley-Myers represented by Julie Lederer (MO); Troy Downing represented by Mari Kindberg (MT); Mike Causey represented by Arthur Schwartz (NC); Chris Nicolopoulos represented by Christian Citarella (NH); Russell Toal represented by Anna Krylova (NM); Barbara D. Richardson represented by Gennady Stolyarov (NV); Judith L. French represented by Maureen Motter (OH); Andrew R. Stolfi represented by David Dahl (OR); Jessica K. Altman represented by James DiSanto (PA); Raymond G. Farmer represented by Will Davis (SC); Cassie Brown represented by J'ne Byckovski and Miriam Fisk (TX); Michael S. Pieciak represented by Rosemary Raszka (VT); and Mike Kreidler represented by Eric Slavich (WA). Also participating was: Gordon Hay (NE).

1. Adopted Regulatory Guidance and Received a Report from the Actuarial Opinion (C) Working Group

Ms. Krylova said the Actuarial Opinion (C) Working Group met Sept. 2 and Sept. 8 to finalize the *Regulatory Guidance on Property and Casualty Statutory Statements of Actuarial Opinion, Actuarial Opinion Summaries, and Actuarial Reports for the Year 2021* (Regulatory Guidance). Substantive changes include Schedule P reconciliation and notification about a future expected change to create a deadline of submission of qualification documentation to the Board of Directors. The Working Group adopted the Regulatory Guidance.

Ms. Krylova made a motion, seconded by Ms. Darby, to adopt the Actuarial Opinion (C) Working Group's report, including the 2021 Regulatory Guidance. The motion passed unanimously.

2. Received a Report from the Statistical Data (C) Working Group

Ms. Darby said the Statistical Data (C) Working Group updated its *Report on Profitability by Line by State* (Profitability Report) and will consider it for adoption on Oct. 20. Data for auto and homeowners have been received.

Ms. Darby made a motion, seconded by Mr. Chou, to adopt the Statistical Data (C) Working Group's report. The motion passed unanimously.

3. Adopted a Response to the Blanks (E) Working Group Regarding Proposal 2021-11BWG

Mr. Vigliaturo said proposal 2021-11BWG was submitted by Birny Birnbaum (Center for Economic Justice—CEJ), one of the NAIC consumer representatives, to the Blanks (E) Working Group earlier this year. The Task Force was asked for comments on the original proposal and responded, "CASTF is ready to provide guidance regarding the implementation of the Blanks proposal 2021-11BWG if that proposal moves forward. Furthermore, CASTF requests that Birny Birnbaum submit the most current up-to-date version of the proposal for further consideration and suggestions from CASTF."

On July 22, the Working Group met and discussed a modified proposal. As noted in the July 22 letter from the Working Group, the Task Force is asked to review the modified proposal and comment. Mr. Vigliaturo said the question of whether the data would be useful for solvency reporting is a question being handled under the Financial Condition (E) Committee, so he suggested that the Task Force focus on three things: 1) whether the Task Force can get some data from statistical agents under similar timing as the annual statement reporting; 2) whether the data elements in the blanks proposal are defined appropriately; and 3) whether the Task Force wishes to support the proposal.

Ms. Darby reported that the Statistical Data (C) Working Group met Sept. 23 and Oct. 7 to discuss the charge from the Task Force to gather information on whether the timeline can be sped up on receipt of premium and exposure information from outside parties. NAIC staff asked submitting statistical agents and residual markets if their current timeline for submitting data could be sped up. NAIC staff also gathered data on what percentage of the total data each party was submitting.

The Working Group received varied responses from the submitting parties. Because statistical agents are not collecting data in the same way, they cannot provide the data to the NAIC on the same timeline. Additionally, statistical agents indicated that not only do they need to wait for company submissions, but they also need time for data quality checks and communication with companies for any data issues.

For the *Dwelling Fire, Homeowners Owner-Occupied, and Homeowners Tenant and Condominium/Cooperative Unit Owner's Insurance Report* (Homeowners Report), in the year following the data year, the Working Group would be able to collect 32% of premium data by the end of May, 60% of premium data by the end of August, and 99% of premium data by the end of November. The Working Group initially believed California would still only be able to provide its data every other year, but it has since indicated that it would be able to use another data set to send in average premium data in June of the year following the data year. All data would still need to be aggregated by NAIC staff, making any output report available in December following the data year, at the earliest.

For the *Auto Insurance Database Report* (Auto Report), in the year following the data year, the Working Group would be able to collect 32% of premium data by the end of May, 49% of premium data by the end of August, and 91% of premium data by the end of November. Texas data, which makes up the remaining 9% of data, would not be provided until January of the next year. Again, all data would have to be aggregated and reviewed by NAIC staff before a report could be produced. The responses for the Auto Report are based only on the collection of premium and exposure data. Loss data cannot be provided on this same timeline.

Ms. Darby said the Working Group has fulfilled its charge as requested by the Task Force. The Working Group is open to continuing the discussion of data collection, including discussion on the data collection and submission process outlined in the *Statistical Handbook*, that may address the need for more timely data.

The Task Force discussion included the following: 1) statistical premium and exposure data would be increased by about 12 months; 2) both the statistical report speed increase and the annual statement proposal could be implemented; 3) an option would be to implement the financial statement proposal in the short term and speed up the statistical data in the longer term; 4) data would be useful to assess the impacts of sudden changes, such as COVID-19; 5) the quarterly part of the proposal would not be broken out by state and would not be useful; 6) a cost benefit analysis should be conducted; 7) 100-year events may be better handled using a data call rather than through annual reporting; 8) average premium could be misleading because the same data could support multiple explanations (e.g., moving policies between legal entities in a group); 9) companies may consider exposures by state to be competitive information and not want it to be in a public filing; 10) the data is company-by-company, whereas the statistical data is aggregated; 11) the exposure data would be useful for rate filings so data can be reconciled; 12) exposure data is an element not currently collected anywhere in the annual statement; 13) the proposal can be expanded to other lines of business over time; and 14) exposure basis by line of business has not been discussed by the Task Force.

Mr. Birnbaum said the Working Group should take a more holistic review of modernizing and re-engineering statistical reporting and not make changes one piece at a time. He said the financial statement approach is a less expensive plan and would be beneficial to consumer representatives, financial analysts, and academics. He submitted his stance in writing (Appendix __). He added that the quarterly reports do not contain by state by line information; thus, this proposal did not include that by quarter. He said the blanks proposal is consistent with the NAIC *State Ahead* initiative to modernize regulatory processes. He reiterated that this data is financial data and completely consistent with the financial statement aim. He said the data would be available in four to five months; statistical data will not be available for at least 12 months.

Continuing the discussion on the Oct. 19 meeting, interested parties Ralph Blanchard (Travelers), Jonathan Rodgers (National Association of Mutual Insurance Companies—NAMIC), Rachel Underwood (Cincinnati Insurance Companies), and Angela Gleason (American Property Casualty Insurance Association—APCIA), voiced opposition to the blanks proposal. Mr. Blanchard said the data is statistical; the three main financial reports are cash flow statements, income statements, and balance sheets. He said financial data has a dollar sign in front of it; calling it statistical data borders on dishonest. The cost of this proposal has not been calculated; it is usually cheaper to speed up an existing process than to create a new one. The financial systems are not set up to collect exposure data. Mr. Blanchard said there is a big difference between financial systems and

statistical systems. He said it is not a trivial exercise for the companies to report this requested information on these financial statements. He added that there has been no specificity with how the data would be used. Mr. Rodgers said the chief concern is that the request is to add statistical-level data to the blanks. There will be several unintended consequences. NAMIC would like a clear explanation of how the data will be used. Mr. Rodgers said the statistical data can be collected a full year earlier through statistical agents, and that should be the way forward. The purpose of the blanks is to communicate financial information in a uniform format; this data is not financial. Mr. Rodgers said this proposal could lead to requesting more statistical data in the financial statements. He said companies share the concern of data reporting errors and the resulting amended financial statements; statistical agents do data quality checks. Audit issues would be material. Currently, reports are aggregated and produced annually; the data is being proposed to be by company and produced quarterly. State insurance regulators can request the information. Ms. Underwood said the proposal is to get industry-level, aggregate premium per exposure by state. The sponsor previously responded that if the data could be available sooner, this proposal would not be needed. The time to publish statistical data can be cut in half, and preliminary results could be published even earlier. She said this data does not change significantly, especially quarter-by-quarter. Statistical agents need two months to perform data quality checks, but this proposal is asking companies to have final reports in less than two months. Ms. Gleason agreed with previous comments, and she looks forward to understanding the reasons for the reporting and desired use. She said everyone likes data, but there are valid data security concerns. She said the Working Group proposed a method that is in line with *State Ahead* because it tried to modernize and propose a way forward.

Mr. Vigliaturo said preliminary state views were gathered by NAIC staff about how Task Force members proposed to respond to the Blanks (E) Working Group, asking whether to voice support, voice opposition, or remain neutral as a Task Force and the reasons each state would use to support their position. His plan was to see if there is a strong majority for any view and then propose a fitting motion. Unfortunately, the strawman vote with 20 Task Force states responding, does not give much direction because the votes are about evenly split between supporting and opposing the proposal. Mr. Vigliaturo suggested that the Task Force submit a state-by-state Task Force member survey response, but with final votes from states that may differ what was submitted on the survey. He asked the states to report to NAIC staff by Oct. 22.

Mr. Vigliaturo said states would be identified, and any comments made in the survey will be forwarded. Mr. Birnbaum said the statistical report is not a direct comparison to the blanks proposal because it is not company-by-company.

Mr. Chou made a motion, seconded by Ms. Darby, to respond to the Blanks (E) Working Group on Oct. 22 with the results of individual states' survey responses and the Statistical Data (C) Working Group report about the potential to speed up premium and exposure statistical data collection and reporting. The motion passed unanimously.

4. Received a Report from the CAS on Appointed Actuary CE

Mr. Vigliaturo said the Executive (EX) Committee hired a consultant a few years ago to conduct a job analysis on the property/casualty (P/C) Appointed Actuary. One of the recommendations in the consultant's report was to evaluate the continued competence of Appointed Actuaries after obtainment of credentials. With that charge given to the Task Force, the Task Force asked the Casualty Actuarial Society (CAS) and the Society of Actuaries (SOA) to collect data on Appointed Actuaries' continuing education (CE) and required Appointed Actuaries to categorize their CE using the Task Force's adopted categories. With those actions taken, what remains of the continued competence charge is to work with the CAS and the SOA to identify: 1) what types of learning P/C Appointed Actuaries are using to meet CE requirements for "Specific Qualification Standards" today; and 2) whether more specificity should be added to the P/C Appointed Actuaries' CE requirements to ensure that CE is aligned with the educational needs for a P/C Appointed Actuary.

Ken Williams (CAS) described the written report submitted by the CAS (Attachment ___) in fulfillment of the Task Force's first charge. He said the CAS reviewed over 100 members to evaluate CE compliance. A higher percentage of appointed actuaries participate in the process. There were 41 Appointed Actuaries and 37 used the required categorization. Mr. Williams said reserves and requirements were the highest number of hours, and reinsurance was the lowest; there were a lot of "other," which is mostly COVID-19-related. He said the report shows the number of Appointed Actuaries who reported learning in a category and provided the average number of hours.

Mr. Vigliaturo said the aim is for the Task Force to: 1) discuss any concerns with the types of CE being taken by Appointed Actuaries; 2) decide whether there is a need to take any action to require that specific CE be taken by Appointed Actuaries; and 3) decide whether to continue to require the CE categorization or end this reporting requirement in the SAO instructions.

On its Oct. 19 call, the Task Force began discussion of the second part of the Task Force's charge. Mr. Vigliaturo asked: 1) whether anyone has any concerns with the types of CE being taken by Appointed Actuaries; 2) whether it appears that Appointed Actuaries are taking relevant CE to continue to update skills; and 3) whether the Task Force has concerns that there is a need to take any further action, such as creating requirements for certain types of CE. He said if the Task Force has no concerns, then the question becomes whether to continue to require the CE categorization or end this reporting requirement in the 2022 SAO instructions. Mr. Schwartz said the categories originally adopted by the Task Force are excessive. He said he would want to make the categories fewer, the reporting simpler, and the process streamlined.

Ms. Lederer said before implementation of the CE categorization, she submitted a comment letter on this proposal and stated that she did not know what she would do with the resulting information. She said the reserving category is well represented, so perhaps actuaries find this topic to be important, or perhaps Appointed Actuaries are spending too much time on this category. She said it might be worth discussing not requiring the categorization in the future. Alternatively, she said state insurance regulators should discuss the findings and metrics that could lead to the decision to remove categorization requirements. Mr. Vigliaturo said he agrees that it was difficult to classify presentations because one presentation could contain multiple categories.

The Task Force will continue this discussion on its Nov. 9 call.

5. Received a Report on Project #2019-49

Mr. Hay said he drafted a response to the referral of Project #2019-49—Retroactive Reinsurance Exception, and he will have a final proposal for the Task Force for the meeting in December. His draft response includes two proposals regarding *Statement of Statutory Accounting Principles (SSAP) No. 62R—Property and Casualty Reinsurance* paragraph 36. First, add intercompany pooling agreements to the exceptions in SSAP No. 62R; second, modify the Schedule P instructions to require explanation for each of the steps in SSAP No. 62R paragraph 36 exceptions. Mr. Hay said the issues involve structured settlements, reinsurance commutations, innovations, runoff agreements, and affiliated reinsurance that qualify for prospective reinsurance accounting treatment.

Mr. Hay said he does not have proposed resolutions for at least two issues raised in the Statutory Accounting Principles (E) Working Group. Except for intercompany reporting, he does not see anything confusing in SSAP No. 62R for Schedule P presentations for members of the same group versus not in the same group. Also, the American Academy of Actuaries' (Academy's) Committee on Property and Liability Financial Reporting (COPLFR) observed variations in presentation to ambiguity in SSAP No. 62R. He said case studies did not validate this. Also, COPLFR thought better instructions and clarity would prevent distortions in the industry risk-based capital (RBC), but Mr. Hay also saw affiliated deals that on Schedule P would produce material sessions to entities outside the NAIC system. Therefore, improving instructions and adding clarity alone will not solve the problems.

Mr. Hay said he will seek input from Nebraska and the Catastrophe Risk (E) Subgroup, and he will collaborate with the Statutory Accounting Principles (E) Working Group.

6. Heard a Report on the NAIC Rate Model Reviews

Kris DeFrain (NAIC) presented three issues concerning rate model reviews by states and the NAIC. First, is a request for Task Force assistance about the regulatory review of tree-based models. The second issue is a professional and ethical question about how states should handle rate filings submitted by non-actuaries who are not subject to any professional standards. The third issue is to explain the NAIC tools available if states sign the NAIC Rate Review Support Services Agreement yet do not plan to ask the NAIC for a model review.

Most of the model reviews contain Generalized Linear Models (GLMs), and they are aligned with the Task Force's *Regulatory Review of Predictive Models* white paper. Sam Kloese (NAIC) is taking the GLM information items and rankings of importance from the white paper's appendix and modifying them via tracked changes for differences when reviewing a tree-based model. The Task Force will have to decide whether it wants to take the product forward for adoption or only use it as a reference for discussion with the NAIC to ensure the NAIC is conducting reviews the way state insurance regulators need. Mr. Kloese will present the product on the Task Force's Nov. 12 call.

Next is a professionalism issue. Some rate filings are being submitted by non-actuaries; thus, while still subject to law and regulation, the filings are most likely not subject to professional or ethical standards. Most states do not have any type of

requirement for an actuary to prepare the filing or provide an expert opinion about the model. Ms. DeFrain said state insurance regulators are used to working with actuarial standards in place, and some requirements may need to be put in place to ensure the models are built in accordance with documentation, communication, ethical, and other requirements.

Last on the list is to discuss the Agreement, which 31 states have signed, and one more state is in the pipeline. While not all states need the NAIC rate review service, the Agreement also allows states access to the NAIC's Shared Model Database and case studies. If one state finds that a company's rate model has been reviewed by another state, the NAIC will conduct what is called a Comparison Report. NAIC staff will compare the filings between the two states, document any differences, track the objections made by the first state and answers received, and document the conclusions reached. If desired, the NAIC can also review any new issues. Ms. DeFrain added that the Agreement will place no burdens on the state, but if put in place now, it might be useful if state insurance regulators want to use the other NAIC services or have a short-term need to use the NAIC for model reviews after the loss of a key employee.

Having no further business, the Casualty Actuarial and Statistical (C) Task Force adjourned.

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Draft: 8/26/21

Casualty Actuarial and Statistical (C) Task Force
E-Vote
August 20, 2021

The Casualty Actuarial and Statistical (C) Task Force conducted an e-vote that concluded Aug. 20, 2021. The following Task Force members participated: Grace Arnold, Chair, represented by Phil Vigliaturo (MN); James J. Donelon, Vice Chair, represented by Nichole Torblaa (LA); Jim L. Ridling represented by Daniel Davis (AL); Evan G. Daniels represented by Tom Zuppan (AZ); Ricardo Lara represented by Lynne Wehmueller (CA); Michael Conway represented by Mitchell Bronson (CO); Andrew N. Mais represented by Wanchin Chou (CT); Karima M. Woods represented by David Christhilf (DC); David Altmaier represented by Sandra Starnes (FL); Colin M. Hayashida represented by Randy Jacobson (HI); Doug Ommen represented by Travis Grassel (IA); Dana Popish Severinghaus represented by Judy Mottar (IL); Vicki Schmidt represented by Nicole Boyd (KS); Kathleen A. Birrane represented by Robert Baron (MD); Chlora Lindley-Myers and Cynthia Amann (MO); Mike Causey represented by Arthur Schwartz (NC); Barbara D. Richardson represented by Gennady Stolyarov (NV); Glen Mulready represented by Andrew Schallhorn (OK); Andrew R. Stolfi represented by David Dahl (OR); Doug Slape represented by Miriam Fisk (TX); Michael S. Pieciak represented by Rosemary Raszka (VT); and James A. Dodrill represented by Juanita Wimmer (WV).

1. Adopted a Comment Letter on the *U.S. Qualification Standards*

The Task Force conducted an e-vote to consider adoption of a comment letter on the second exposure draft of the American Academy of Actuaries' (Academy's) *U.S. Qualification Standards* (Attachment XX) and send it to the Academy. The motion passed unanimously.

Having no further business, the Casualty Actuarial and Statistical (C) Task Force adjourned.

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Draft: 9/21/21

Casualty Actuarial and Statistical (C) Task Force
Virtual Meeting (*in lieu of meeting at the 2021 Spring National Meeting*)
August 10, 2021

The Casualty Actuarial and Statistical (C) Task Force met August 10, 2021. The following Task Force members participated: Grace Arnold, Chair, represented by Phil Vigliaturo (MN); James J. Donelon, Vice Chair, represented by Nichole Torblaa (LA); Lori K. Wing-Heier represented by Katie Hegland (AK); Jim L. Ridling represented by Daniel Davis (AL); Evan G. Daniels represented by Tom Zuppan (AZ); Ricardo Lara represented by Mitra Sanandajifar and Lynne Wehmueller (CA); Michael Conway represented by Mitchell Bronson (CO); Andrew N. Mais represented by Wanchin Chou (CT); Karima M. Woods represented by David Christhilf (DC); David Altmaier represented by Sandra Starnes (FL); Colin M. Hayashida represented by Randy Jacobson (HI); Doug Ommen represented by Travis Grassel (IA); Dana Popish Severinghaus represented by Reid McClintock (IL); Vicki Schmidt represented by Nicole Boyd (KS); Kathleen A. Birrane represented by Walter Dabrowski (MD); Eric A. Cioppa represented by Sandra Darby (ME); Anita G. Fox represented by Kevin Dyke (MI); Chlora Lindley-Myers represented by Cynthia Amann (MO); Troy Downing (MT); Mike Causey represented by Arthur Schwartz (NC); Chris Nicolopoulos represented by Christian Citarella (NH); Russell Toal represented by Anna Krylova (NM); Barbara D. Richardson represented by Gennady Stolyarov (NV); Judith L. French represented by Tom Botsko (OH); Glen Mulready represented by Andrew Schallhorn (OK); Andrew R. Stolfi represented by David Dahl (OR); Jessica K. Altman represented by James DiSanto (PA); Raymond G. Farmer represented by Will Davis (SC); Doug Slape represented by Miriam Fisk (TX); Michael S. Pieciak represented by Rosemary Raszka (VT); Mike Kreidler represented by Eric Slavich (WA); James A. Dodrill represented by Juanita Wimmer (WV); and Jeff Rude represented by Tana Howard (WY). Also participating was: Gordon Hay (NE).

1. Adopted its July 13, June 8, May 11, and March 9 Minutes

Mr. Vigliaturo said the Task Force met July 13, June 8, and May 11. During these meetings, the Task Force adopted responses to the Blanks (E) Working Group and a request for NAIC staff to gather information about statistical reports.

The Task Force also met May 20 and April 20 in regulator-to-regulator session, pursuant to paragraph 3 (specific companies, entities or individuals) of the NAIC Policy Statement on Open Meetings, to discuss rate filing issues.

The Task Force held the following Predictive Analytics Book Club meetings: Sam Madden (Cambridge Mobile Telematics) presented on telematics in March and Radost Wenman (Pinnacle Actuarial Resources) presented on generalized linear models (GLMs) to generalized additive models (GAMs) in April. In June, the American Academy of Actuaries (Academy) arranged presentations for the NAIC's Insurance Summit. Dorothy Andrews (Academy) and Hao Li (Verisk) presented on big data and modeling; Howard Kunst (CoreLogic) and Matt Chamberlain (Milliman) presented on catastrophe modeling; James Guszcza (Center for Advanced Study in Behavioral Sciences—CASBS at Stanford University), Dani Bauer (University of Wisconsin-Madison), and Birny Birnbaum (Center for Economic Justice—CEJ) presented on ethics in analytics, Ms. Andrews and Sam Kloese (NAIC) presented on GAMs; Michael Regier (Verisk) and Tim Hagan (Verisk) presented on regularization methods; Jonathan Fesenmeyer (Allstate) and Evan Petzoldt (Allstate) presented on geographic rating in personal lines insurance pricing; and Caolan Kovach-Orr (Verisk) and Vahid Meimand (Verisk) presented on tree-based models. In July, Larry Baeder (Milliman) presented on interpretable machine learning for insurance.

Ms. Darby made a motion, seconded by Mr. Grassel, to adopt the Task Force's July 13 (Attachment One), June 8 (Attachment Two), May 11 (Attachment Three), and March 9 (*see NAIC Proceedings – Spring 2021, Casualty Actuarial and Statistical (C) Task Force*) minutes. The motion passed unanimously.

2. Adopted the Report of the Actuarial Opinion (C) Working Group

Ms. Krylova said the Actuarial Opinion (C) Working Group generally agreed that 2020 Statement of Actuarial Opinion submissions were fine but that some additional regulatory guidance would be helpful. Topics under discussion include reconciliation to Schedule P and a Board of Director's review of qualification documentation. The actuarial opinion instructions will be revised to eliminate reference to the Casualty Actuarial Society's (CAS) principles due to the CAS' rescission of the reserving principles.

Ms. Krylova made a motion, seconded by Mr. Dyke, to adopt the report of the Actuarial Opinion (C) Working Group, including its July 22 (Attachment Four) and July 1 (Attachment Five) minutes. The motion passed unanimously.

3. Adopted the Report of the Statistical Data (C) Working Group

Mr. Vigliaturo said he appointed Ms. Darby as chair of the Statistical Data (C) Working Group. Ms. Darby said the Working Group has not met recently, but NAIC staff are reviewing auto and home data submissions.

4. Discussed the U.S. Qualification Standard

Mr. Vigliaturo said the Academy's Committee on Qualifications released the second exposure draft of the U.S. Qualification Standards with a comment deadline of Aug. 20. Mr. Stolyarov said the changes made by the Academy were responsive to the comments the Task Force submitted on the first draft. He said he had preliminary discussions with NAIC staff about the second exposure draft, and some issues need discussion in regulator-to-regulator session. He said he is not sure another comment letter needs to be submitted, but state insurance regulators should discuss the issues and see if they can come to any agreement. Mr. Schwartz said he has some additional comments for discussion during the regulator-to-regulator session. He said one issue is that a new requirement was added in the second draft to require one hour of continuing education (CE) on bias topics.

Mr. Vigliaturo asked if anyone objected to a plan to meet in regulator-to-regulator session followed by an e-vote of any comment letter the following week. No objections were voiced. Mr. Vigliaturo said the deadline for comments is Aug. 20.

5. Received a Report on Project #2019-49: Retroactive Reinsurance Exception

Mr. Hay said he would present a proposal for discussion at the Fall National Meeting.

6. Adopted a Charge for the Statistical Data (C) Working Group and Discussed Proposal 2021-11BWG

Mr. Vigliaturo said the Task Force unanimously adopted a motion during its July 13 meeting to inform the Blanks (E) Working Group the Task Force is ready to provide guidance regarding the implementation of proposal 2021-11BWG if that proposal moves forward. The Blanks (E) Working Group met July 22 and took the following action: 1) deferred the revised proposal for comment until Oct. 22; 2) decided to send the revised proposal to the Task Force for review and comment; and 3) decided to send a referral to the Financial Analysis Solvency Tools (E) Working Group and the Financial Analysis (E) Working Group for review and comment about whether the information in the proposal would be useful for regulating for solvency purposes.

Mr. Birnbaum presented the changes made to the proposal (Attachment Six) since the Task Force's July 13 meeting. He said the proposed additions would provide timely and useful information for financial and market analysis, the proposed additions are financial and not statistical data, and the proposed additions do not conflict with nor replace the Task Force's statistical reporting. He asked the Task Force to support the proposal in its response to the Blanks (E) Working Group.

Mr. Chou asked whether an alternative option to speed up the statistical report of premium and exposure information would have a similar impact as the proposal. Mr. Birnbaum said then the blanks proposal would not be necessary. Currently, the statistical reporting machine does not provide that data until a year and a half after the end of the experience period. He said reinventing the statistical reporting system is not a short-term project. Ralph Blanchard (Travelers) said the premium and loss information at the policy form level is statistical information because it is not captured in financial reporting systems today.

Ms. Starnes asked whether the quarterly reporting would include data by state or only nationwide. Mr. Birnbaum said it would be nationwide only on the quarterly statements. He said the information is still useful although it would be helpful to have by state information. Mr. Davis asked how the data would be used. Mr. Birnbaum replied that it might not be as useful to actuaries, but could be quite valuable to financial and market analysts.

Ms. Darby said NAIC staff gathered information in response to the request adopted by the Task Force on July 13 to provide the data and normal reporting times for the *Auto Insurance Database Report* and the *Dwelling, Fire, Homeowners Owner-Occupied, and Homeowners Tenant and Condominium/Cooperative Unit Owner's Insurance Report* (Homeowners Report).

Ms. Darby said data for the *Auto Insurance Database Report* is obtained from four statistical agents—American Association of Insurance Services (AAIS), Insurance Services Office (ISO), Independent Statistical Services (ISS), and National

Independent Statistical Service (NISS)—and four state entities—the California Department of Insurance (DOI), Massachusetts Commonwealth Automobile Reinsurers, Maryland Automobile Insurance Fund (MAIF), and the Texas DOI. Data received in 2021 would be for 2018/2019. The two years refer to written and earned premiums. For instance, in 2021, written exposures would be reported for 2019, and earned exposures would be reported for 2018. There are additional caveats, like earned exposures, and incurred claims for Texas are not available at all. Therefore, the Texas pure premium, frequency, and severity cannot be calculated. The NAIC currently receives two separate files from each entity—one for premiums and exposures and a second file for claims and losses. Currently, the timing for which each file is received is substantially the same.

Ms. Darby said data for the Homeowners Report is received from four statistical agents: the AAIS, the ISO, the NISS, and the American Property Casualty Insurance Association (APCIA); the California DOI; the Texas DOI; and multiple residual market programs. The reported data is two years behind the current calendar year. For example, 2019 data is reported in 2021. This report only includes premium and exposure data, all of which is included in one file.

For both publications, Ms. Darby said requests for data are sent to statistical agents, states, and residual market organizations in late January, with final data due from all entities in July. If all goes well, the data is clean and states are responsive regarding the state law section of the publication. Then the report can be completed in early fall. In recent years, there have been data concerns that needed to be addressed prior to release of the publications. There are fluctuations in the data due to different companies reporting to statistical agents from one year to the next, which can result in significant year-over-year (YOY) changes to premium and exposure data provided.

Ms. Darby said the information contained in both the *Auto Insurance Database Report* and Homeowners Report is voluntarily reported to the NAIC and not required through a data-sharing agreement. If the timeline were to be revised, all reporting entities would need to voluntarily agree to the change. Otherwise, there may need to be a formal agreement in place to get everyone on the same timeline going forward. Additionally, the Statistical Data (C) Working Group members would need to sign off on the changes, as they oversee the publications and any amendments would need to be considered for adoption. In terms of next steps, the Working Group can draft a letter, requesting that all of the organizations providing content for each report provide input and participate in a meeting to discuss the feasibility of an expedited timeline for reporting. Ms. Darby said the Task Force could additionally consider producing the reports in different formats or at different timelines, such as the earlier suggestion to consider reporting premium and loss data separately, along separate timelines. Again, the Task Force would need to confirm that each entity can abide by the expedited timeline and that they continue to be willing to do so under the voluntary nature of the reporting agreement.

Mr. Dyke said he is concerned about the quality checks that might be lost by receiving this data directly from companies. He said there is a robust data quality process that statistical reporting agents use. He is also concerned about potential misuse of the data. He said use of the data at a company level to identify trends could be misleading. For example, he said if there is more premium written in downtown Detroit, MI, then the average statewide premium would be higher but would not be a premium trend.

Mr. Chou made a motion, seconded by Mr. Dahl, to ask the Statistical Data (C) Working Group to gather information about whether the timeline can be sped up on receipt of premium and exposure information from outside parties. The Working Group should report back to the Task Force before Oct. 12. The motion passed unanimously. Mr. Birnbaum expressed concern whether the statistical reporting study can be completed prior to the deadline to respond to the Blanks (E) Working Group.

7. Received a Report on the NAIC Rate Model Reviews

Mr. Vigliaturo asked for a shortened report on rate model reviews due to time constraints during the meeting. Kris DeFrain (NAIC) said there are 30 states contracted with the NAIC using a Rate Review Support Services Agreement. She said the NAIC rate review team has produced 60 technical reports, with 47 standard GLMs, six regularized GLMs, 11 tree-based models (which includes random forests and GBMs), and five GAMs. She said there are sometimes more than one model in a filing. NAIC staff asked the Task Force if it would review the issues being evaluated for non-GLM models and provide guidance.

8. Heard Reports from Professional Actuarial Associations

Lauren Cavanaugh (Academy) said the Academy's Casualty Practice Council formed a racial equity task force to address racial equity in the context of property/casualty (P/C) insurance. Comment letters were submitted to the NAIC and Colorado. Two issue briefs were published by the auto committee: 1) COVID-19; and 2) consumer cost of auto insurance. The Federal

Insurance Office (FIO) asked for information on the availability and affordability of auto insurance. Derek Freihaut (Academy) said the Committee on Property and Liability Financial Reporting (COPLFR) is conducting its opinion seminar in December and is working on the law manual and practice note. He said COPLFR is seeking a regulatory member(s).

Brian Fannin (CAS) provided the CAS' research report (Attachment Seven). Dale Hall (Society of Actuaries—SOA) provided the SOA's research report (Attachment Eight).

Having no further business, the Casualty Actuarial and Statistical (C) Task Force adjourned.

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Schedule P Reporting for Retroactive Reinsurance Accounting Exceptions

CASTF response to SAPWG Ref 2019-49

December 7, 2021, Draft

- CASTF Subgroup
  - Gordon Hay, FCAS, MAAA, CPCU – Nebraska
  - Miriam Fisk, FCAS, FCAS, MAAA, ASA – Texas
  - Tom Botsko, ACAS – Ohio
- NAIC Staff
  - Robin Marcotte
  - Kris DeFrain, FCAS, MAAA, CPCU

COPLFR's May 2019 Letter to CASTF and SAPWG

- Asserted ambiguity in the accounting/reporting requirements for affiliated retroactive reinsurance agreements that meet the requirements for "Prospective Reinsurance Accounting" treatment
- Attributed materially different presentations in Schedule P by different companies to that ambiguity
- Recommended that this asserted ambiguity be addressed by improved clarity in SSAP 62R and the Annual Statement Instructions, "given that industry Schedule P is utilized for risk-based capital (RBC) purposes as well as other purposes"

SSAP 62R

P&C Reinsurance Accounting (SSAP 62R)

Deposit Accounting (paragraphs 40-41)

- Used when the agreement does not transfer risk
- Paragraph 37 requires harsher version of deposit accounting to be used for affiliated retroactive reinsurance involving a gain in surplus to the cedant – does not allow the deposit asset to be admitted

Prospective Reinsurance Accounting (paragraphs 30-32)

- **Net premium = Gross premium – Ceded premium**
- **Net loss and LAE = Gross loss and LAE – Ceded loss and LAE**

Retroactive Reinsurance Accounting (paragraphs 33-39)

- **Ceding entity:** loss and LAE reserves Exhibits & Schedules do not take credit for retroactive reinsurance
- **Assuming entity:** loss and LAE reserves Exhibits & Schedules exclude assumed retroactive reinsurance
- **Balance sheet write-in amounts:**
  Amount of retroactive reinsurance ceded (contra-liability) or assumed (liability)
  Special surplus from retroactive reinsurance
- **Income statement write-in:** Retroactive reinsurance gain/loss included under Other Income

Retroactive Reinsurance Accounting Exceptions (paragraph 36)

Exceptions "accounted for as prospective reinsurance agreements unless otherwise provided" in SSAP 62R

a. Structured settlement annuities
b. Novations
c. Commutations
d. Intercompany reinsurance agreements with no surplus gain
e. Property/casualty run-off agreements

36.a: Structured settlement annuities

Definition & Requirements

- Annuities for individual claims purchased to implement settlements of policy obligations

Accounting

- Accounting guidance is provided in SSAP 21R (Other Admitted Assets) and SSAP 65 (P&C Contracts)
- Not specified in SSAP 62R, other than being an exception to retroactive reinsurance accounting

36.b: Novations

Definition & Requirements

- Original insurer's obligations are completely extinguished, resulting in no further exposure to loss arising on the business novated
- Parties are not affiliates (or if affiliates, that the transaction has the prior approval of the domiciliary regulators of the parties)
- The accounting for the original reinsurance agreement will not be altered from retroactive to prospective

Prospective Reinsurance Accounting

SSAP 62R, paragraph 39

- Original insurer reports amounts paid as reduction of written and earned premiums, and unearned premiums to the extent that premiums have not been earned
- Novated loss and LAE reserves are written off through accounts, exhibits, and schedules in which they were originally recorded
- Assuming insurer reports amounts received as written and earned premiums, and obligations assumed as incurred losses

36.c: Commutations

Definition & Requirements

- Complete and final settlement and discharge of all present and future obligations between the parties arising out of the (commuted portion of the) original agreement

Accounting

SSAP 62R, paragraphs 94-97

- Commuted balances are written off through accounts, exhibits, and schedules in which they were originally recorded
- Any net gain or loss (to either party) is reported as underwriting income
- Cedant in the commuted agreement records cash received as negative paid loss

36.d: Intercompany reinsurance, without surplus gain

Definition & Requirements

- Companies are 100% owned by a common parent or ultimate controlling person.
- There is <u>no</u> surplus gain to the ceding entity as a result of the transaction.

Prospective Reinsurance Accounting

Note: This exception is the focus of the COPLFR letter.

- Explicitly "shall be accounted for as prospective reinsurance agreements"

37: Cession to an affiliate, with surplus gain

Definition & Requirements

- Companies are affiliated or under common control (as defined in Appendix A-440)
- Retroactive reinsurance results in surplus gain to the ceding entity (with or without risk transfer)

Accounting

SSAP 62R, paragraph 37

- Requires harsher version of deposit accounting
- Consideration paid is recorded as a deposit and reported as a non-admitted asset
- No deduction made from ceding entity's loss and LAE reserves

36.e: Property/casualty run-off agreements

Definition & Requirements

- Can only cover liabilities relating to line(s) of business or specific market segments no longer actively marketed by the transferring entity
- Transferring entity remains primarily liable to the policyholder under the original contracts
- Agreements between affiliates or insurers under common control are <u>not</u> eligible for this exception
- Accounting treatment must be approved by the domiciliary regulators of the transferring entity and the assuming entity
- Cannot be cancelable by either party for any reason

Accounting

SSAP 62R, paragraphs 102-105

- Transferring entity records consideration paid to the assuming entity as a paid loss
- Assuming entity records consideration received as negative paid loss
- Transferring entity records increase to ceded reinsurance recoverable for the amount of the transferred reserve
- Assuming entity reports the business in the same lines of business and same level of detail as reported by the original insurer

Schedule P Instructions

Premium and Losses

Earned premium is on a calendar-year basis. Losses incurred should be assigned to the year in which the event occurred that triggered coverage under the contract. This may be a date of accident (occurrence policies), a date of report (claims-made policies), a policy issue date (tail policies), or a date of discovery (fidelity and surety).

Retroactive Reinsurance

Retroactive reinsurance should not be reflected in Schedule P. The transferor in such an agreement must record, without recognition of the retroactive reinsurance, its loss and loss adjustment expense reserves on a gross basis on its balance sheet and in all schedules and exhibits. The transferee in such an agreement must exclude the retroactive reinsurance from its loss and loss expense reserves and from its schedules and exhibits.

Note: This is consistent with SSAP 62R, paragraph 34.

Intercompany Pooling

If the reporting entity participates in a pooling agreement, show only its share of the business, not the total for all participants.

When changes to pooling agreements impact prior accident years, historical data values in Schedule P Parts, 1 through 6 should be restated based on the new pooling percentage. This should be done to present meaningful development patterns in Schedule P. When pooling changes only impact future accident years, no restatement of historical values should be made.

Note: This differs from SSAP 62R, paragraphs 36d and 37.

CASTF Discussion

Disconnect between Schedule P Pooling Instructions and SSAP 62R

- Intercompany pooling agreements with a retroactive component generally reallocate surplus among the members.
- SSAP 62R, paragraph 36d only allows prospective accounting if there is no gain in surplus to the ceding entity.
- To prevent surplus manipulation amongst the group and/or backdoor dividends, SSAP 62R, paragraph 37 requires harsher method of deposit accounting if there is a gain in surplus to the ceding entity.

CASTF Discussion

- Do we want to address this disconnect? If so, how?

One Potential Proposal

- Add intercompany pooling agreements to the exceptions listed in SSAP 62R, paragraph 36.

Applying Retroactive Reinsurance Exception in Schedule P

- Schedule P Instructions are explicit for Intercompany Pooling Agreements, including when the agreement has a retroactive component
  - "When changes to pooling agreements impact prior accident years, historical data values in Schedule P Parts, 1 through 6 should be restated based on the new pooling percentage."
- Schedule P Instructions provide no explicit guidance for any of the SSAP 62R, paragraph 36 exceptions
- Esp., paragraph 36.d. LPT's create Schedule P distortions
  - LPT ceded losses are reported by accident year
  - Schedule P Instructions note premium should be calendar year earned premium (not allocated to prior years)
    - Agree with COPLFR that 6 GEICO companies did allocate Cal Year 2014 ceded LPT premium to prior years on Schedule P. 100% ceded loss ratios, with largest ceded balances in most recent Acc Years, produced a very favorable-looking net loss ratio trend.
    - Most have recorded LPT premium in current calendar year on Schedule P. Cedant's result is abrupt favorable prior years' development offset by high current Acc Year net loss ratio. Reinsurer's result is abrupt adverse prior years' development offset by low current Acc Year net loss ratio.

Proposal: Clarify Schedule P Instructions for "prospective reporting exceptions"

- The Schedule P Instructions are silent regarding novations and paragraph 36d agreements, which both receive prospective accounting treatment.
- Schedule P Instructions should provide explicit guidance for the SSAP 62R, paragraph 36c and 36d exceptions.
- There will be distortions in Schedule P when applying prospective accounting to retroactive reinsurance.

Proposal

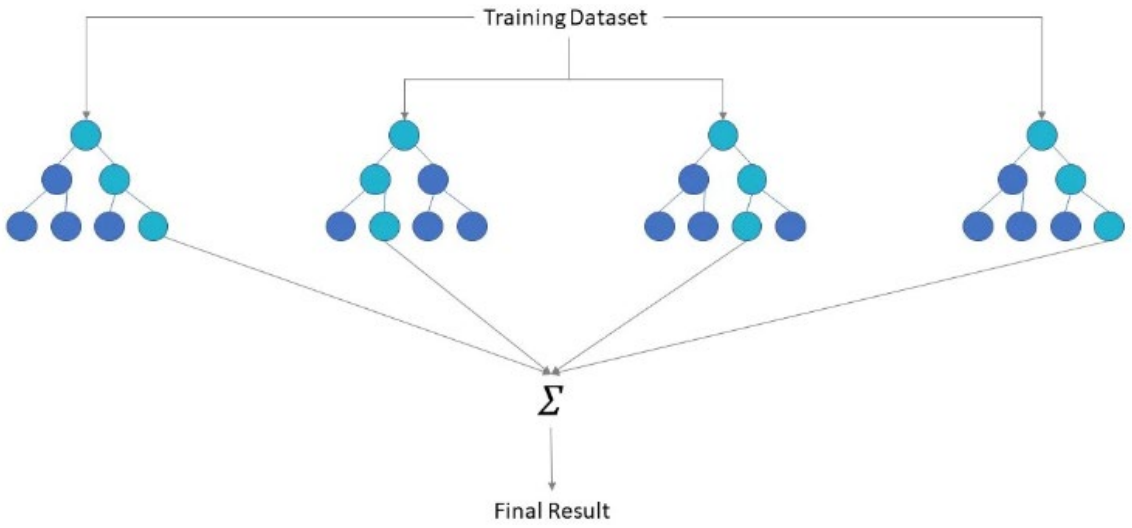
Add Schedule P reporting instructions for the exceptions listed in SSAP 62R, paragraph 36c and 36d.

Caveats

- Clarity in SSAP 62R and Schedule P Instructions should <u>reduce but will not eliminate</u> variations in Schedule P presentation or distortions to (industry) RBC.
  - Intentional variations observed in Schedule P presentation for paragraph 36d exceptions were due to states' direction, not ambiguity in SSAP 62R.
  - Variations may be unintentional, particularly when the cedant and its domicile are not accustomed to prescribed accounting treatment for exceptions.
  - Paragraph 36d agreements have been used to cede material portfolios to an affiliate with the same ultimate owner, but outside the NAIC financial reporting system, where:
    - Subsequent development is omitted from the Industry Schedule P data
    - Retrocession may proceed without deferred surplus recognition

Other Possible Actions

- Related to SSAP 62R, paragraph 36d exceptions:
  - Stop prescribing prospective reinsurance accounting
  - Specify a method for allocation of premium to prior years instead of being reported in the current calendar year
  - Expand Schedule P interrogatories or Note 23 disclosures to provide more information about these agreements
  - Add a Schedule P line of business
  - *Unacceptable option:* Specify that the consideration paid is reported as loss (positive paid loss by cedant, negative paid loss by assuming entity) instead of premium
    - This is commutation accounting and is not consistent with prospective accounting, although it has been advocated by some companies.
- Add Schedule P reporting instructions for the SSAP 62R, paragraph 36 exceptions that don't receive prospective accounting treatment (Structured Settlements, Commutations, and qualifying Run-off agreements)
- Discuss whether SSAP 62R, paragraph 37 is overly punitive



Random Forest Models

Sam Kloese, ACAS, CSPA
P/C Rate Modeling Actuary
December 7, 2021

NAIC NATIONAL ASSOCIATION OF INSURANCE COMMISSIONERS

Introduction

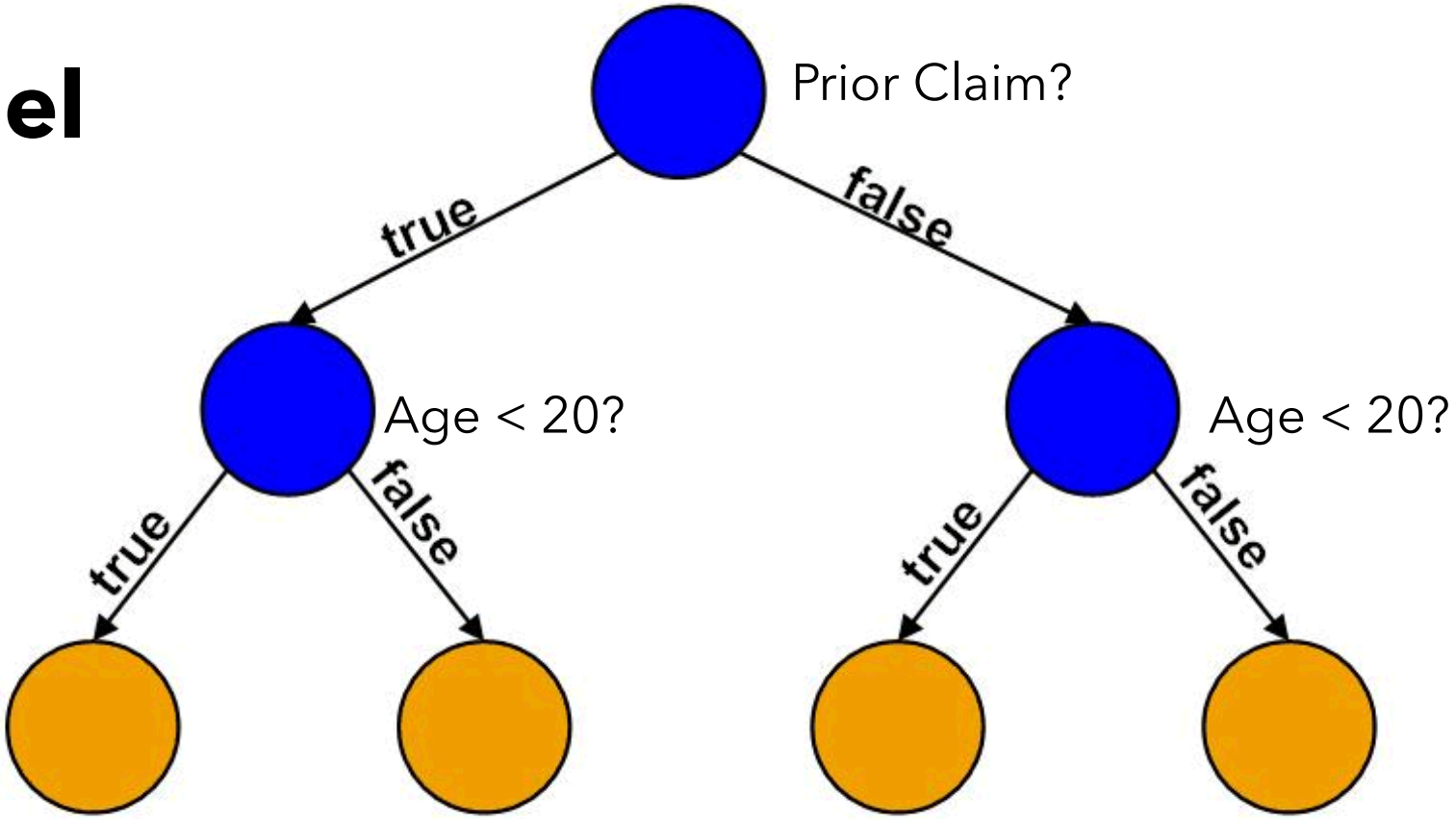
- GLM's are industry standard
- The CASTF White Paper for Predictive Models is focused primarily on GLM's
- Some companies are experimenting with more sophisticated models
  - GAM – Similar to GLM's, but with non-parametric "smoothed" terms
  - Tree Based Models – Based on a collection of multiple decision trees
  - Neural Networks – Mostly for generating scores based on images
- The NAIC model review team has reviewed the above model types without CASTF guidance
- The NAIC model review team would like to discuss how reviews should vary for these differing model types
- Today's focus is on Random Forests (a type of Tree Based Model)

Tree Based Models

- Models that can be represented as a decision tree or a collection of decision trees
- Types of Tree Based Models
  - Single decision Tree
  - “Bagged” Trees
  - Random Forest
  - Gradient Boosting Machine (XGBoost)
- Supervised Model
  - There is still a target variable
    - Classification: Renew/Non-renew, Claim/No Claim, Fraud/No Fraud
    - Regression: Frequency, Severity, Pure Premium
- Today’s focus will be on Random Forest Models

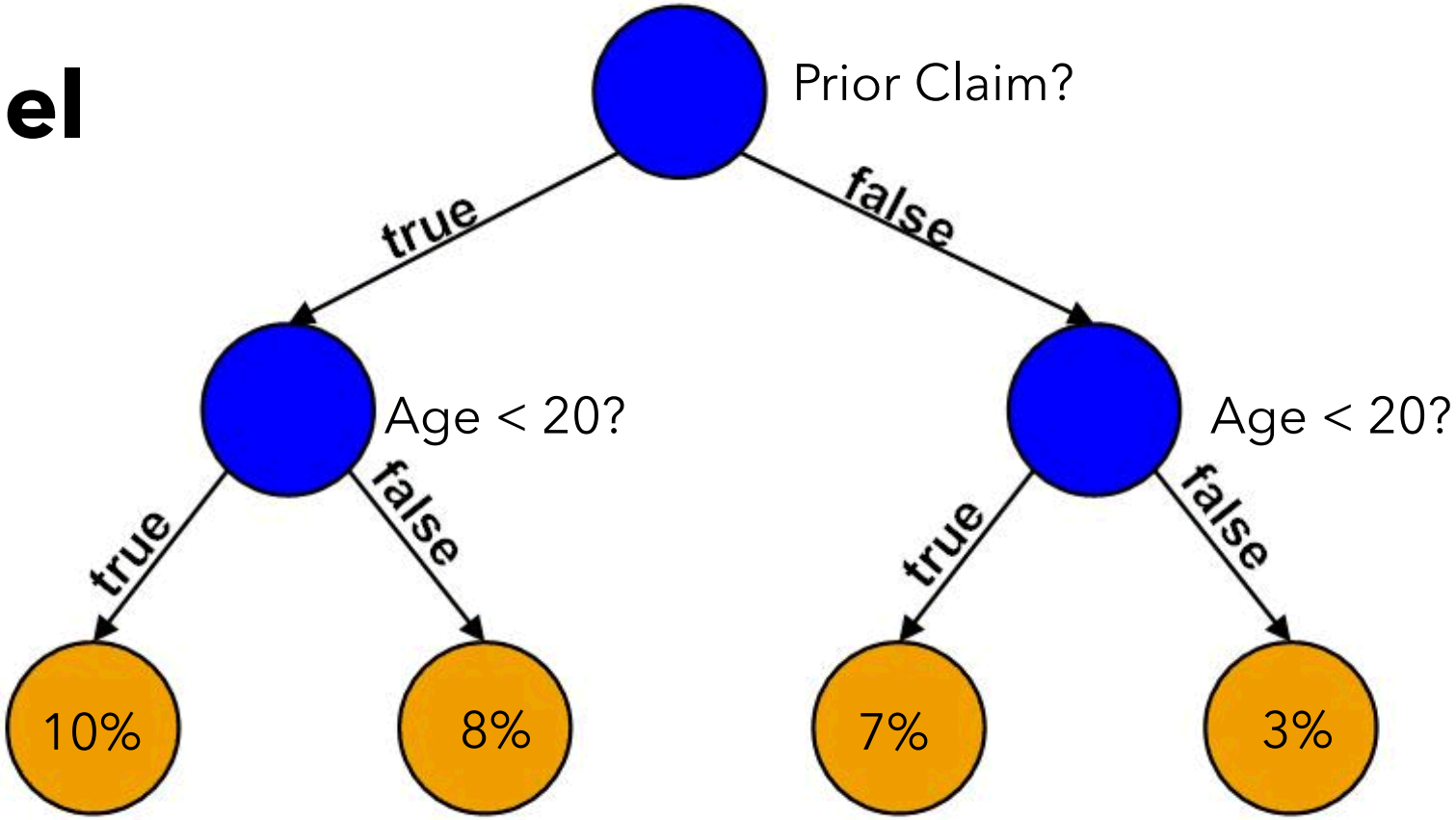
Tree Based Model

- Single Decision Tree
  - Easy to Understand
  - Mimics how people make decisions
  - Easily interpreted



Tree Based Model

- Single Decision Tree
  - Easy to Understand
  - Mimics how people make decisions
  - Easily interpreted
- Classification returns a likelihood



Tree Based Model

- Single Decision Tree
  - Easy to Understand
  - Mimics how people make decisions
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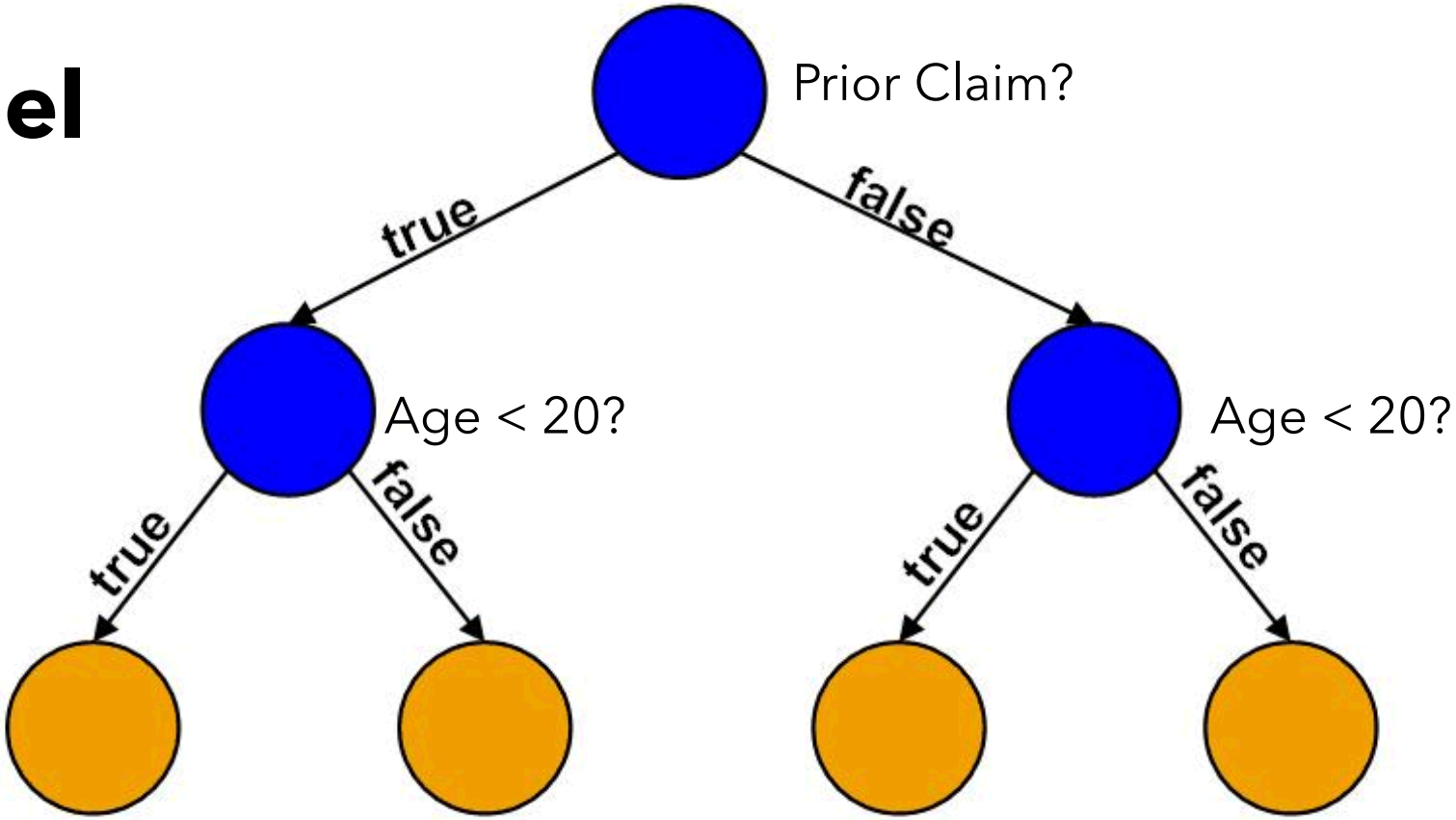
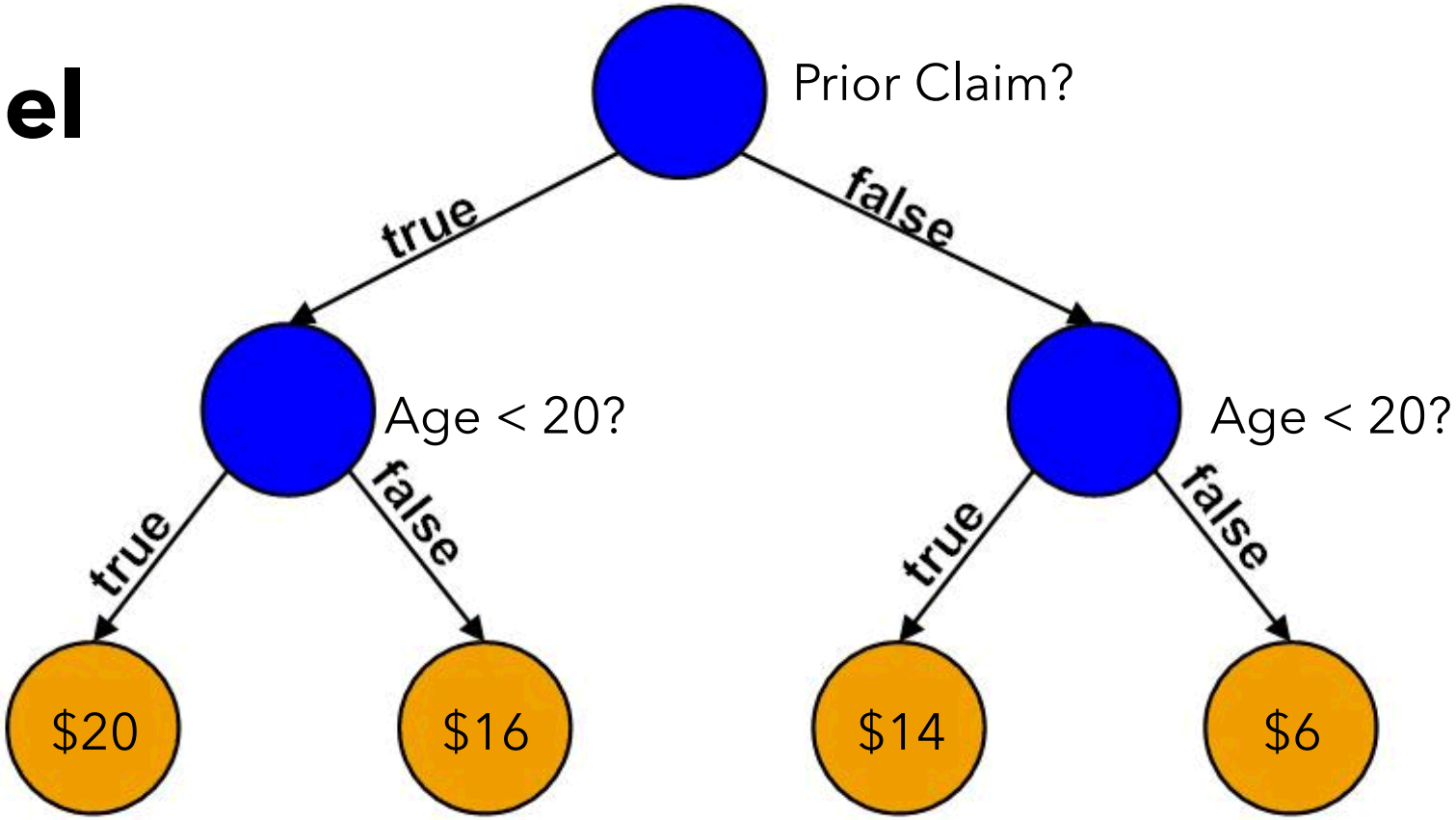
- Classification returns a likelihood



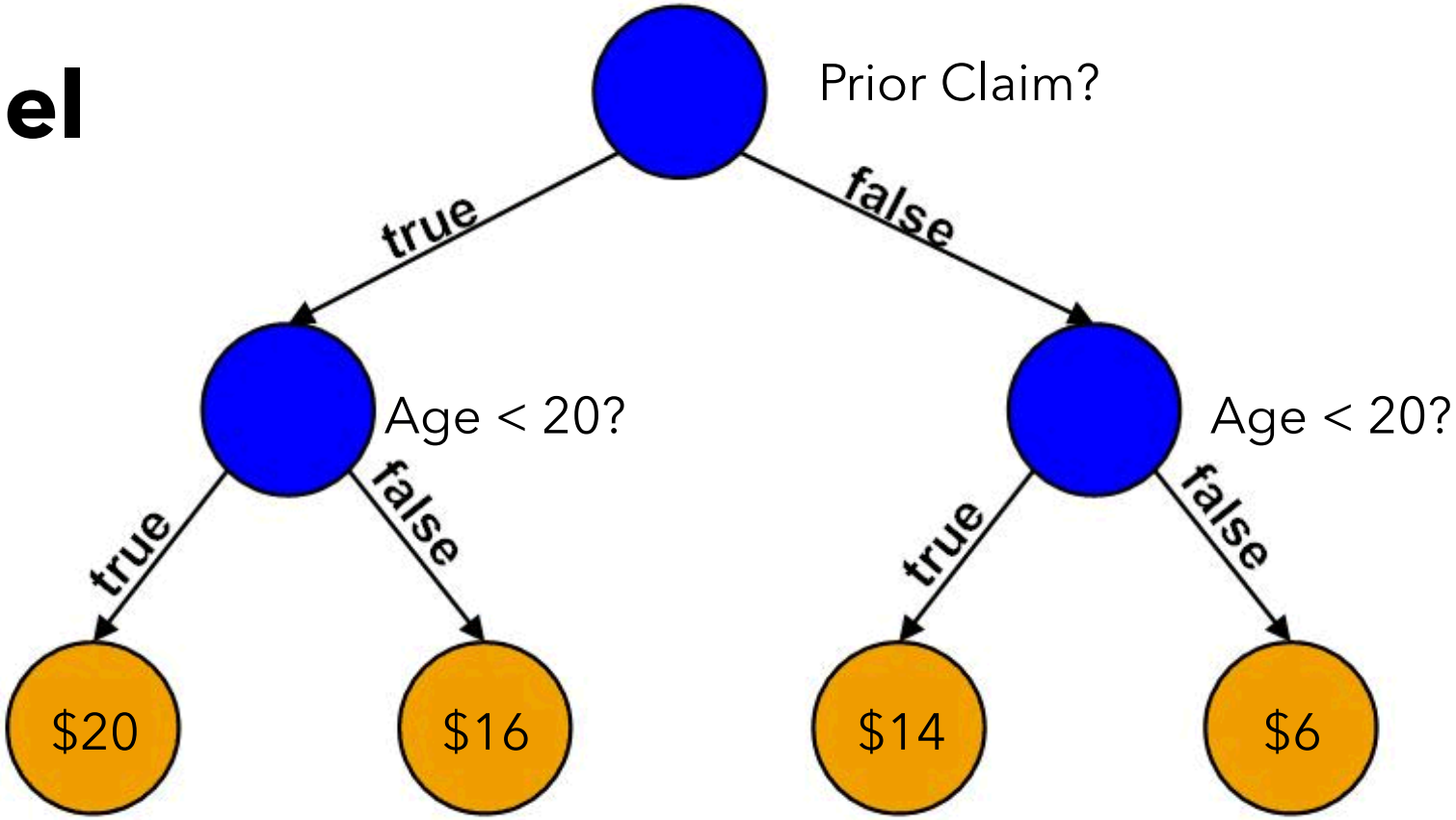
Tree Based Model

- Single Decision Tree
  - Easy to Understand
  - Mimics how people make decisions
  - Easily interpreted
- Classification returns a likelihood
- Regression returns a predicted amount



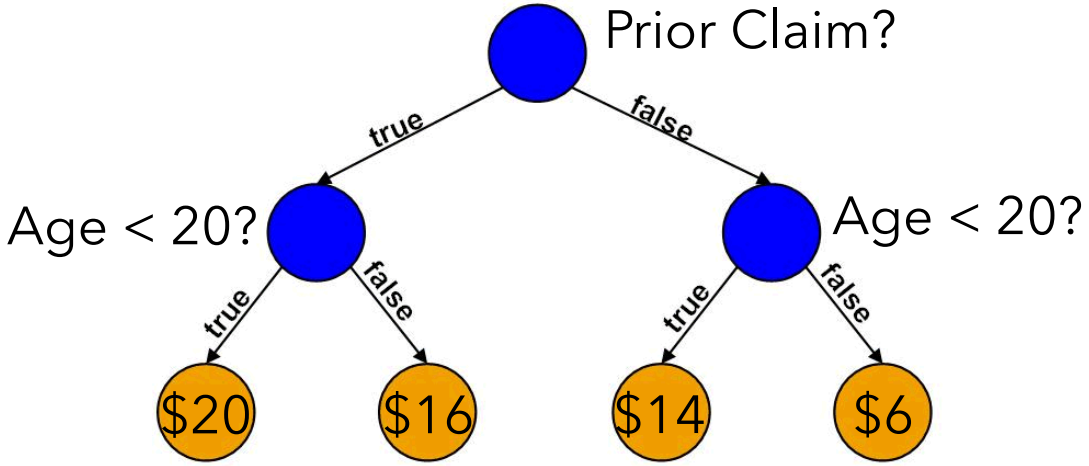
Tree Based Model

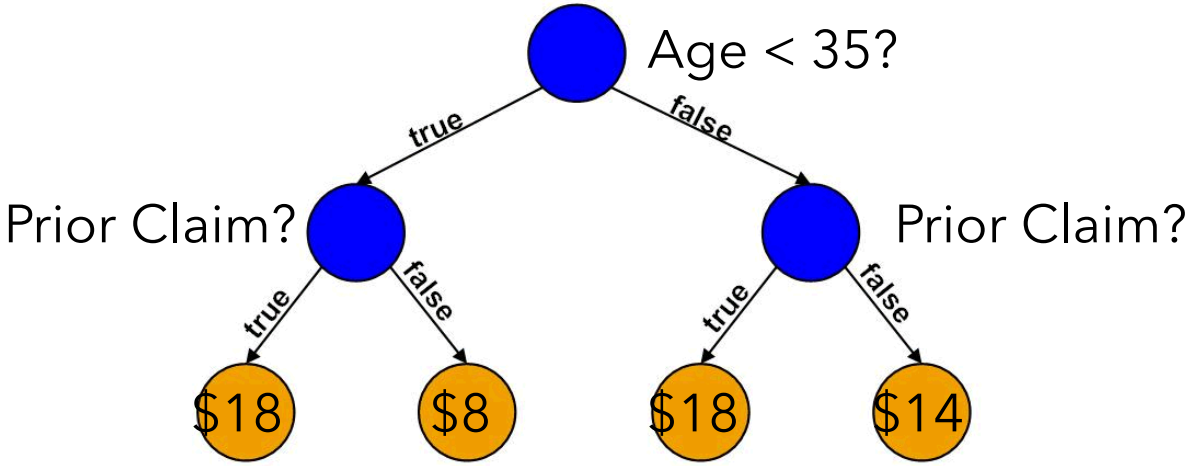
- Terminology
  - Nodes
    - Root
    - Sub-Node
    - Parent/Child
  - Splitting
    - Branch
    - Sub-Tree



Bagged Trees

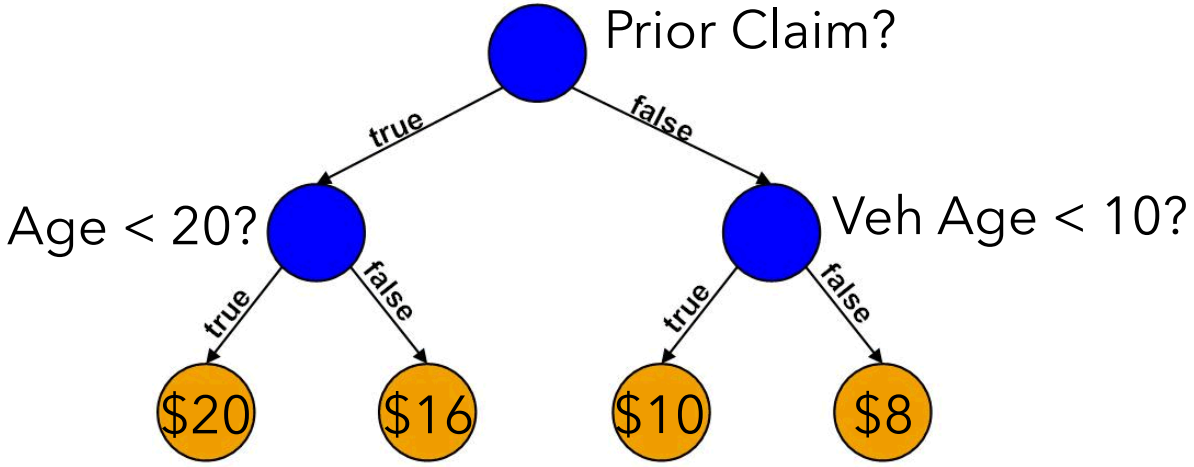
- Most Tree-Based Models are an "ensemble" of models
- "Bagged" Trees are based on multiple trees
  - "Bagged" comes from "bootstrap aggregated"
  - Each tree is grown the same way
  - The difference is each tree is based on a different bootstrap sample
  - The same variables are considered in each tree
  - Final prediction is the average of each tree's prediction

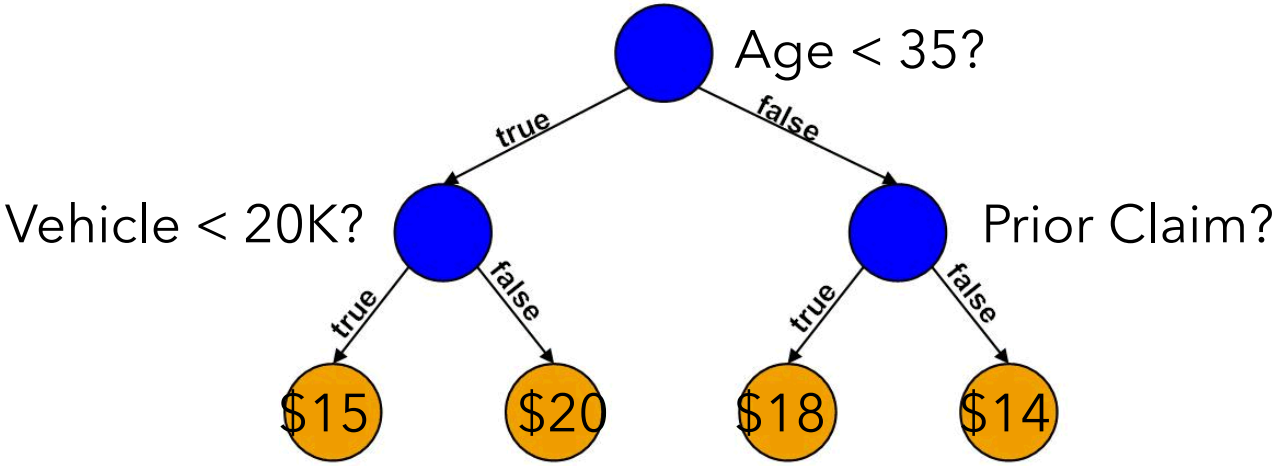




Random Forest

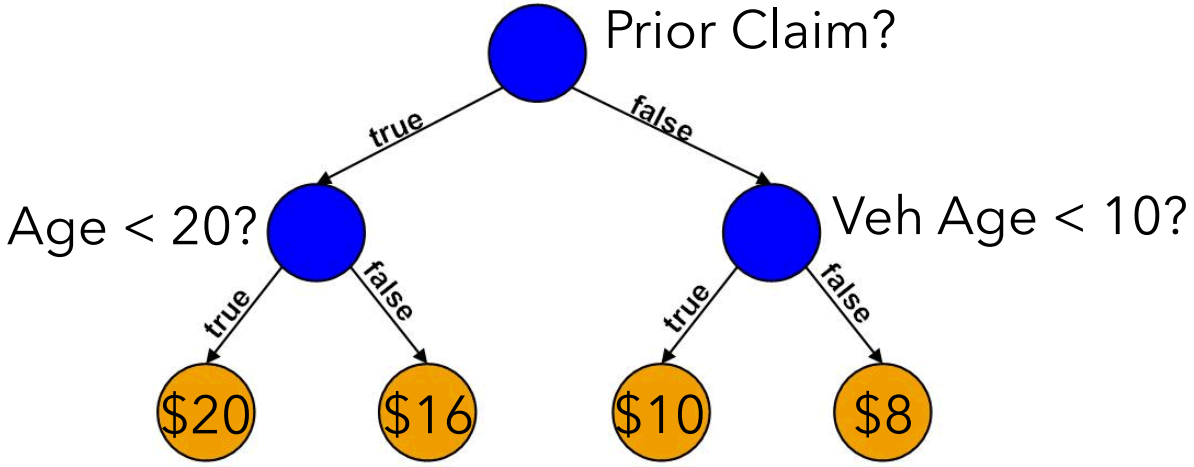
- Random Forest
  - Each each tree is based on a different bootstrap sample (still)
  - Additionally: Randomly chosen variables considered at each split
  - Each tree is grown the same way
  - Final prediction is the average of each trees prediction
- Advantages
  - Trees are substantially different
    - Each tree not based on the same sample
    - Each split not based on the same variables

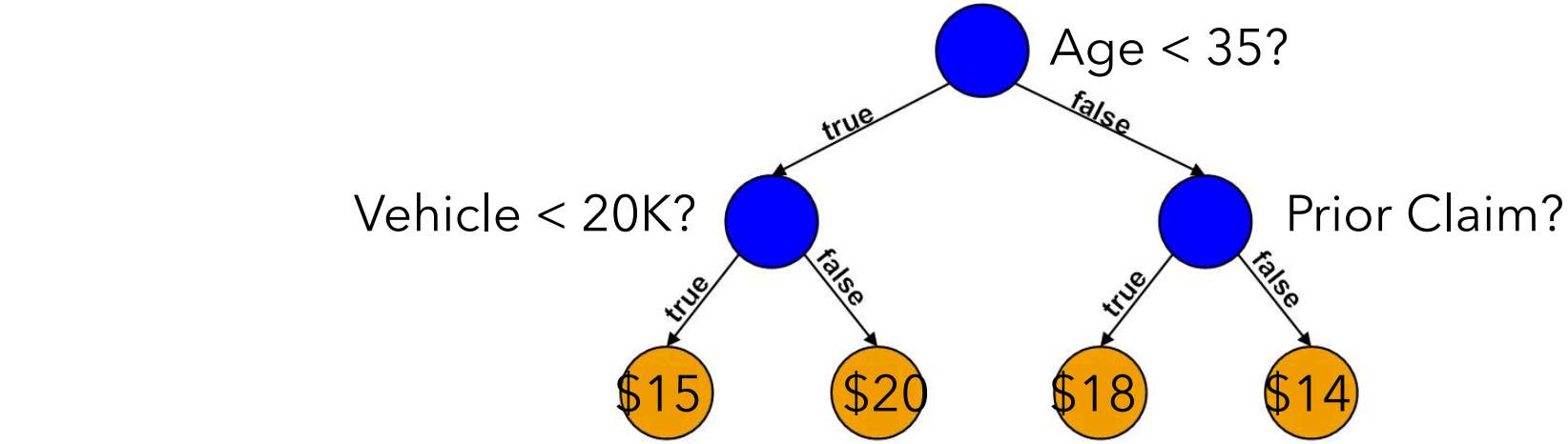




Random Forest

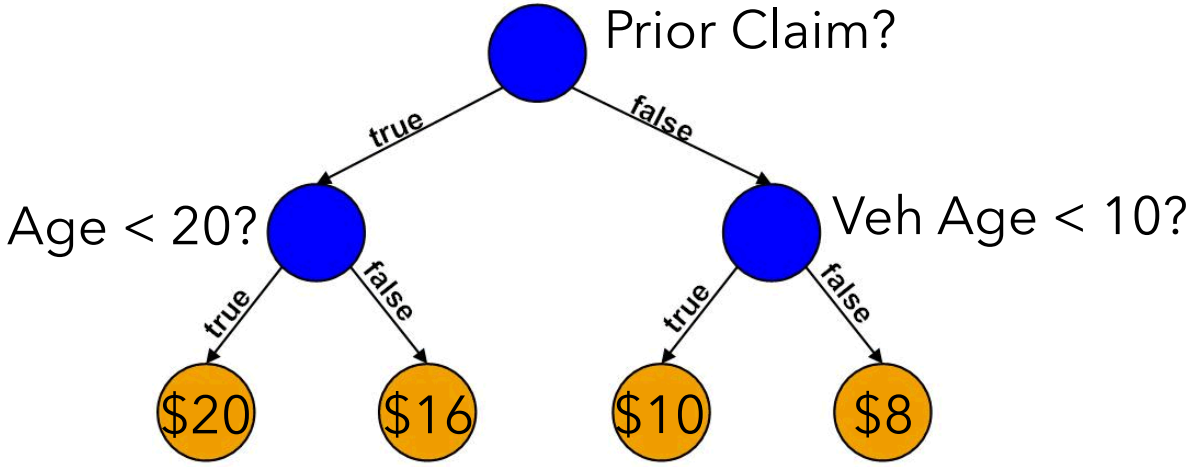
- Example
  - 22 year old driver, no prior claims
  - 5 year old vehicle, $15,000 vehicle
  - ($10+$15)/2 = $12.5

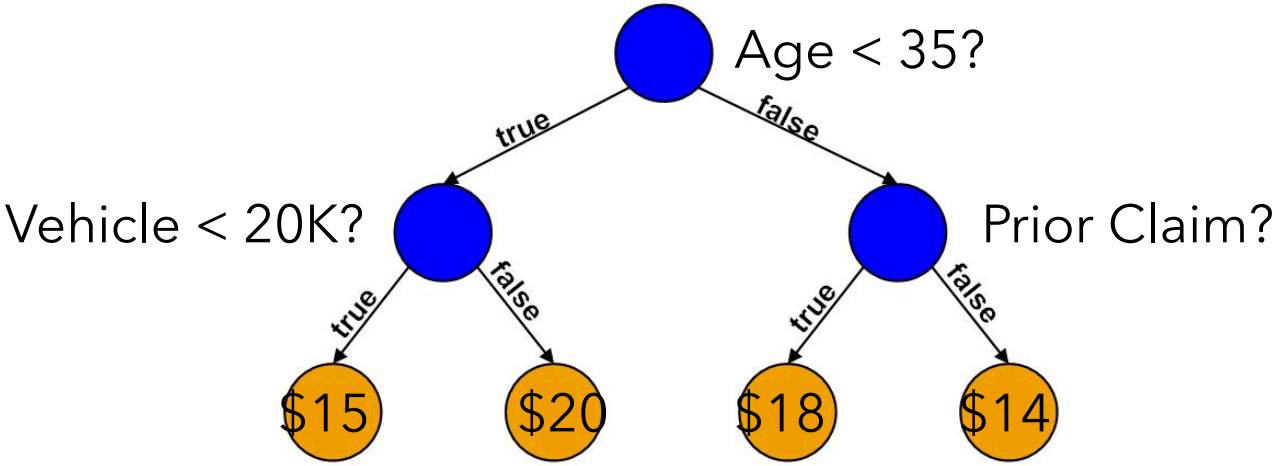




Random Forest

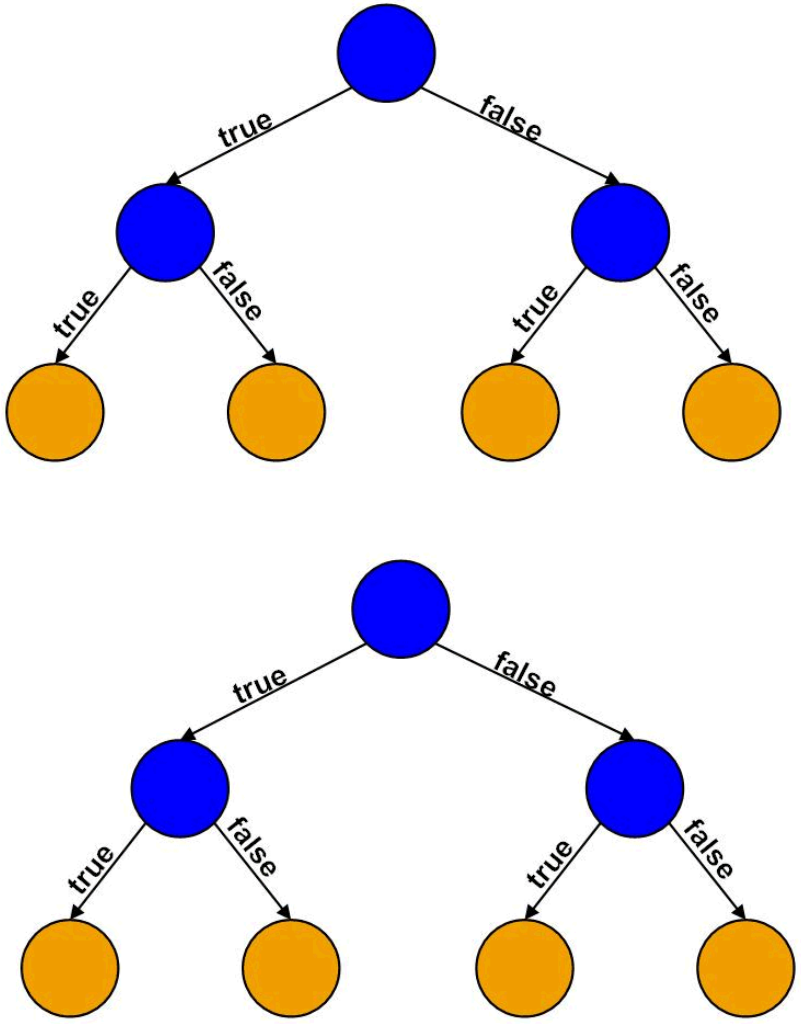
- Interpretation gets difficult
  - Trees can get very deep
  - There can be 100's or 1,000's of trees
- Many GLM statistical tests no longer apply
- There are many hyperparameters
  - Selections may materially impact the model
  - Selections should be checked for reasonability





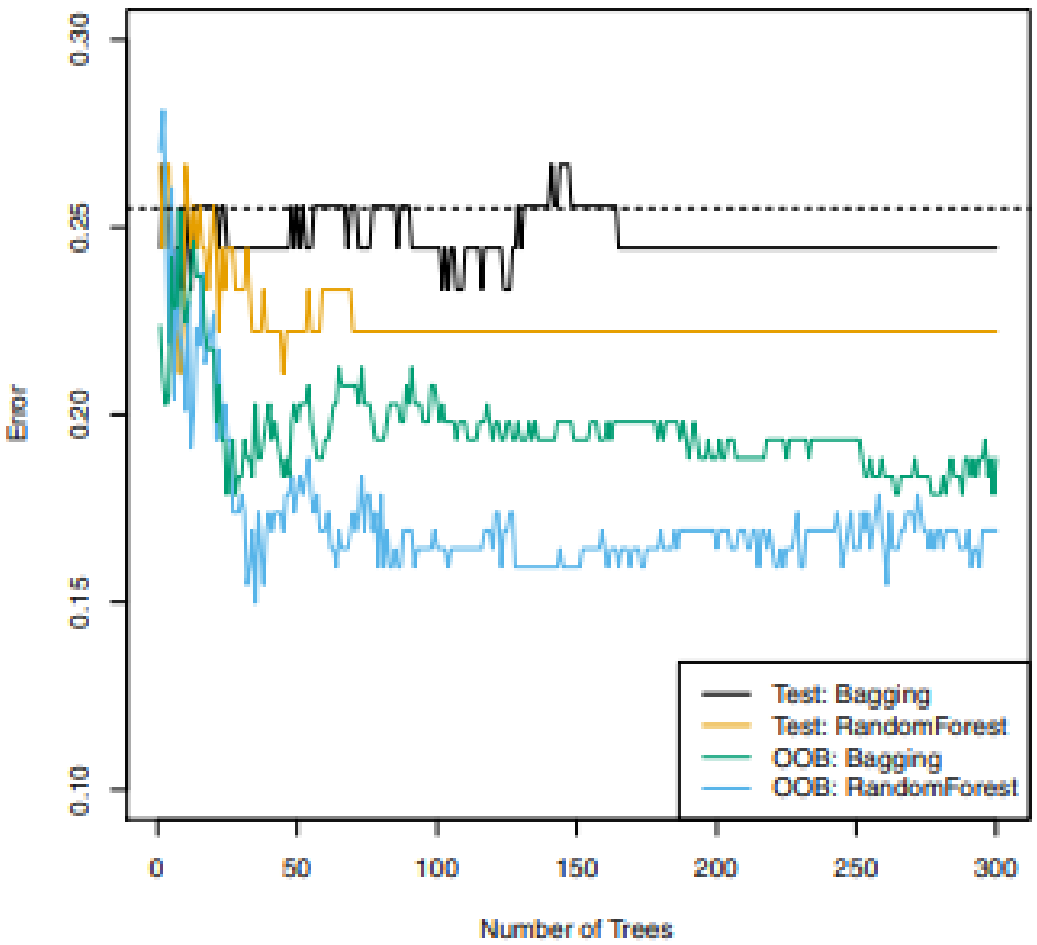
Random Forest

- Hyperparameters
  - Number of trees
  - Criteria on which to split
  - Bootstrap sample size (% of rows)
  - When to stop splitting
    - Max Tree Depth
    - Minimum Node Size
    - Max Leaf Nodes
  - Random Variables for each split (# of columns)



Random Forest

- Number of Trees
  - More trees makes the models more complex
  - The number of trees should be "tuned" to reduce error on either:
    - Separate test dataset
    - Out-Of-Bag data from training dataset
  - Different software may have different "early stopping" rules. Companies should be able to explain these rules.



Introduction to Statistical Learning: https://web.stanford.edu/~hastie/ISLRv2_website.pdf

Random Forest Challenges

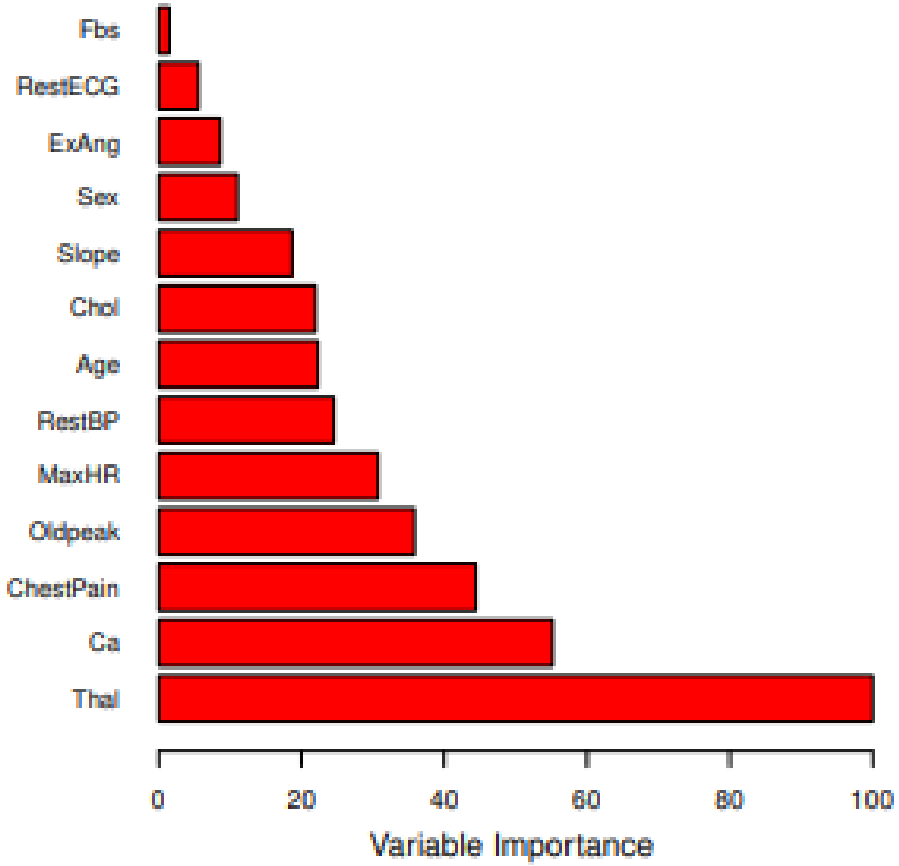
- Interpretability
- Prone to Overfit
- Auditability

Challenges - Interpretability

- GLM's
  - Produce one set of model output
  - P-values provide a measure of statistical significance
    - Higher values can be prioritized for further review
  - Log-link model coefficients are easy to understand
    - Beta < 0 is a discount, Beta > 0 is surcharge
- RF's
  - It is hard to digest the net impact of a collection of trees
  - Variable Importance Plots highlight which variables are relatively less important
  - Interpretability plots help understand the impact of a variable upon the model

Variable Triaging

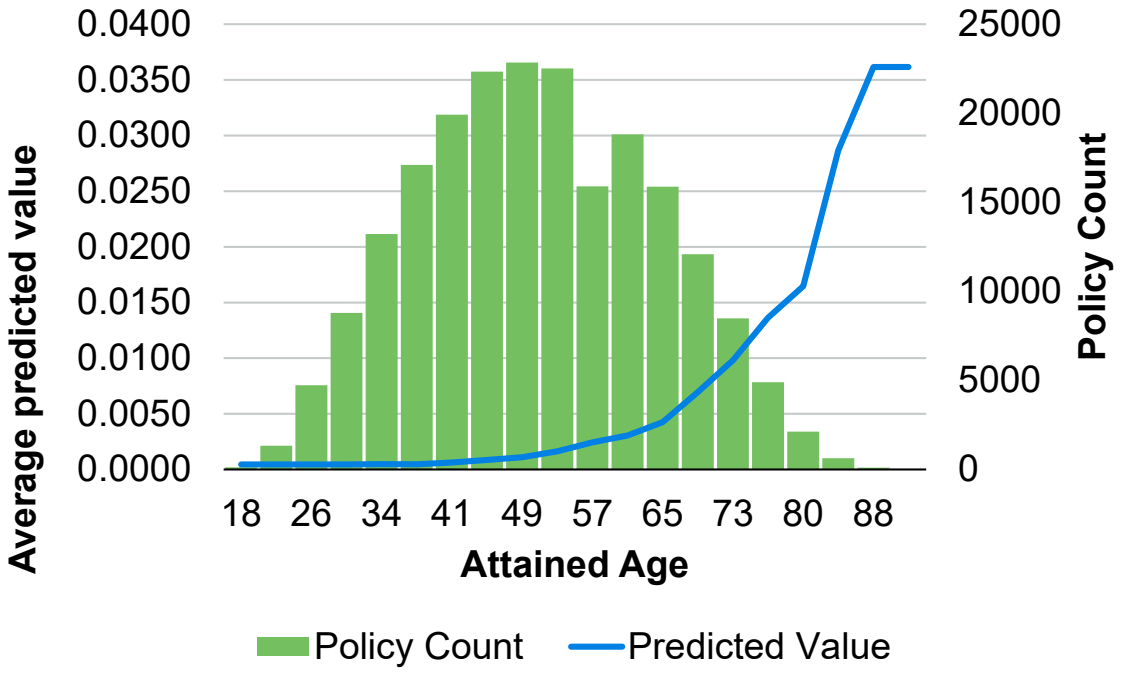
- Variable Importance Plots
  - Provide a measure of which variables are relatively more important than others
  - Variables with low importance measures aren't necessarily unimportant, but they might be
  - Further scrutiny may be appropriate for variables with a low importance measure
    - Similar to looking at variables with high p-values in a GLM
- Types of variable importance
  - Gain: improvement in prediction accuracy from feature
  - Cover: Number of observations influenced
  - Frequency: Number of times used to split data



Introduction to Statistical Learning: https://web.stanford.edu/~hastie/ISLRv2_website.pdf

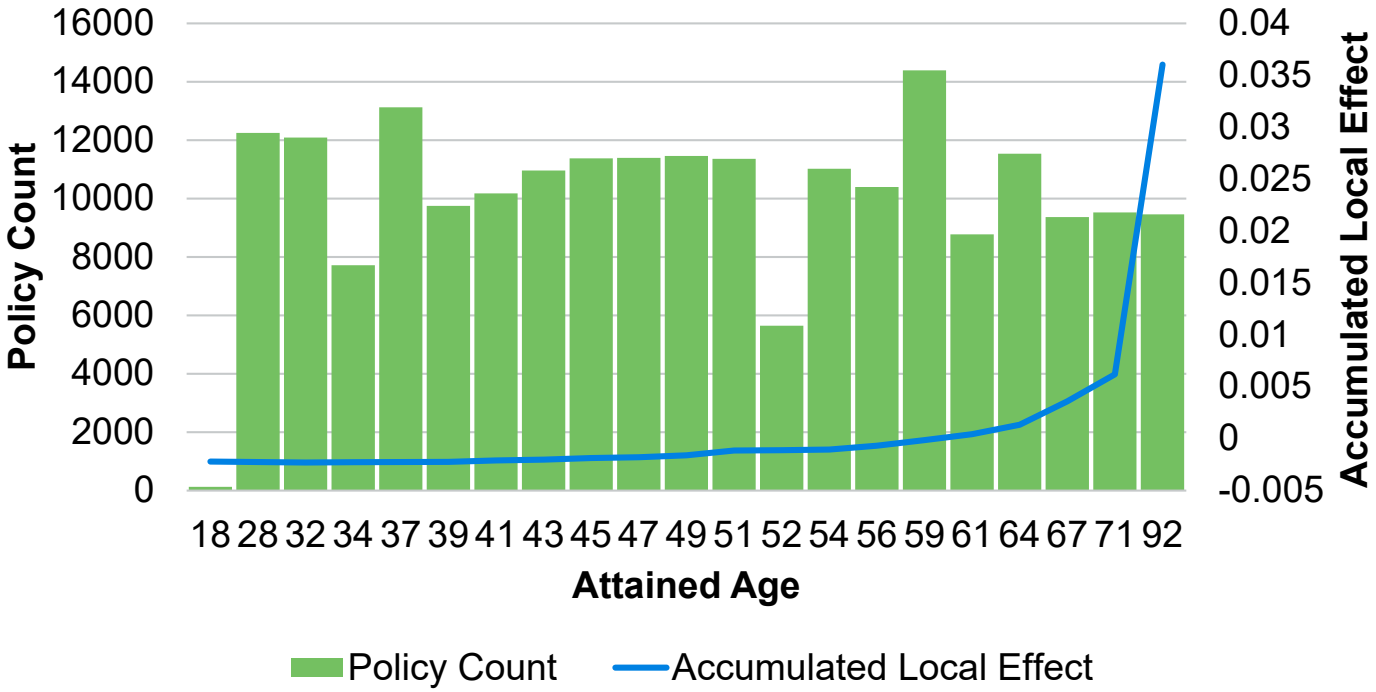
Interpretability Plots

- Partial Dependence Plots
  - Computes the marginal effect of a given feature on the prediction
  - Fixes the value of the predictor variable of interest, calculating the model prediction for each observation using the fixed value
  - Repeat for all values of the predictor variable



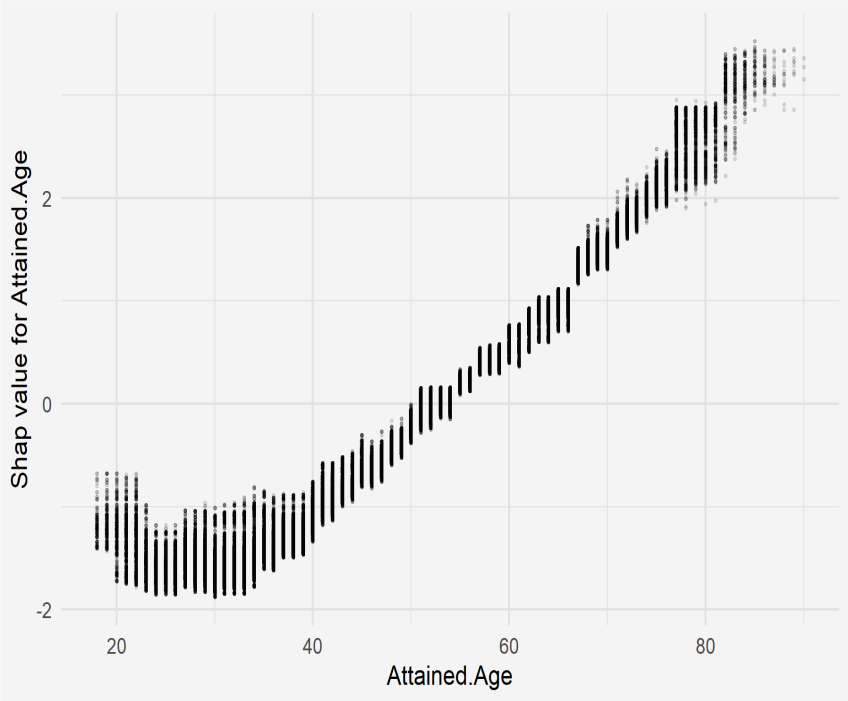
Interpretability Plots

- Accumulated Local Effects
  - Better option in the case of correlated features
  - Calculates and accumulates incremental changes in the feature effects
  - Shows the expected and centered effects of a feature, like a coefficient in a GLM



Interpretability Plots

- Shapely Additive Explanations
  - How much that feature moves the prediction away from the overall average prediction.



Feature increases predicted value higher than average value.

Feature decreases predicted value lower than average value.

Challenges – Prone to Overfit

- Review Hyperparameters
  - Number of trees should be large enough, but no larger
    - Look at plot to minimize OOB/Test Error or Deviance
  - Tree Complexity
    - Minimum node size should be set high enough for reasonable credibility
    - Rule of Thumb: Max depth of > 8 may be too high
  - Other hyperparameters should be disclosed and briefly commented on
    - Bootstrap sample size (% of rows)
    - Random Variables tried for each split (# of columns)
  - Criteria to split should match the model purpose (classification, regression)
- Review lift charts on test/holdout data

Challenges - Auditability

- GLM's
  - Indicated factors are reproducible if you have the coefficients and link function
  - Indicated factors can be stored in lookup tables
  - Auditing model predictions could easily be done, even for a large number of risks
- RF's
  - Complete documentation means diagrams or if statements representing every component tree
  - Sample calculations would include input variable values, each tree's result, and the final result (average of the component trees)
  - A full audit of the logic would likely involve a significant amount of coding

Challenges - Auditability

- Random Forest Documentation
  - Exhibits could be made for spot-checking against tree documentation
    - Input Predictors
    - Individual Tree Predictions
    - Overall Model Prediction (average)

Sample Risk	Driver Age	Prior Claims	Vehicle Age	…	Tree 1	Tree 2	Tree 3	…	Model Prediction
1	16	0	5	…	$ 50.00	$ 40.00	$ 30.00	…	$ 40.00
2	17	0	6	…	$ 49.00	$ 39.20	$ 29.40	…	$ 39.20
3	18	0	2	…	$ 48.02	$ 38.42	$ 28.81	…	$ 38.42
4	19	1	3	…	$ 47.06	$ 37.65	$ 28.23	…	$ 37.65
5	20	0	9	…	$ 46.12	$ 36.90	$ 27.67	…	$ 36.90

  - However, auditing every prediction for a book of business would still be extremely difficult

Draft Random Forest Appendix For Discussion

- Sending out 2 versions
  - Track Changes: Highlights removed, changed, and added items to the GLM Appendix
  - Final: Updated with the tracked changes for easy reading
- Looking for feedback for future Random Forest reviews

References

- Basic Decision Tree Terminology
  - https://medium.datadriveninvestor.com/the-basics-of-decision-trees-e5837cc2aba7
- Theoretical Introduction to Random Forest
  - Introduction to Statistical Learning (Chapter 8 – 8.2.2)
  - https://web.stanford.edu/~hastie/ISLRv2_website.pdf
- Interpretable Machine Learning (Variable Importance and Interpretability Plots)
  - https://us.milliman.com/-/media/milliman/pdfs/2021-articles/4-2-21-interpretable-machine-learning.ashx
  - Book Club Presentation: https://www.youtube.com/watch?v=-yMdTAIkewk
- Tree-Based Models Book Club: https://youtu.be/6UCbpAt4r9M

A. SELECTING MODEL INPUT

Section	Information Element	Level of Importance to the Regulator's Review	Comments
1. Available Data Sources			
A.1.a	Review the details of sources for both insurance and non-insurance data used as input to the model (only need sources for filed input characteristics included in the filed model).	1	Request details of data sources, whether internal to the company or from external sources. For insurance experience (policy or claim), determine whether data are aggregated by calendar, accident, fiscal, or policy year and when it was last evaluated. For each data source, get a list of all data elements used as input to the model that came from that source. For insurance data, get a list all companies whose data is included in the datasets. Request details of any non-insurance data used (customer-provided or other), whether the data was collected by use of a questionnaire/checklist, whether data was voluntarily reported by the applicant, and whether any of the data is subject to the federal Fair Credit Reporting Act (FCRA). If the data is from an outside source, find out what steps were taken to verify the data was accurate, complete, and unbiased in terms of relevant and representative time frame, representative of potential exposures, and lacking in obvious correlation to protected classes. **Note**: Reviewing source details should not make a difference when the model is new or refreshed; refreshed models would report the prior version list with the incremental changes due to the refresh.
A.1.b	Reconcile aggregated insurance data underlying the model with available external insurance reports.	4	Accuracy of insurance data should be reviewed. It is assumed that the data in the insurer's data banks is subject to routine internal company audits and reconciliation. "Aggregated data" is straight from the insurer's data banks without further modification (i.e., not scrubbed or transformed for the purposes of modeling). In other words, the data would not have been specifically modified for the purpose of model building. The company should provide some form of reasonability check that the data makes sense when checked against other audited sources.

Section	Information Element	Level of Importance to the Regulator's Review	Comments
A.1.c	Review the geographic scope and geographic exposure distribution of the raw data for relevance to the state where the model is filed.	2	Many models are developed using a countrywide or a regional dataset. The company should explain how the data used to build the model makes sense for a specific state. The regulator should inquire which states were included in the data underlying the model build, testing, and validation. The company should explain why any states were excluded from the countrywide data. The company should provide an explanation where the data came from geographically and that it is a good representation for a state; i.e., the distribution by state should not introduce a geographic bias. However, there could be a bias by peril or wind-resistant building codes. Evaluate whether the data is relevant to the loss potential for which it is being used. For example, verify that hurricane data is only used where hurricanes can occur. The company should provide a demonstration that the model fits well on the specific state or surrounding region.
2. Sub-Models			
A.2.a	Consider the relevance of (i.e., whether there is bias) of overlapping data or variables used in the model and sub-models.	3	Check if the same variables/datasets were used in the model, a sub-model, or as stand-alone rating characteristics. ~~If so, verify the insurance company has processes and procedures in place to assess and address double-counting or redundancy.~~ Random Forest models handle redundant variables by splitting on only one of the variables within each component tree. By contrast, GLM's struggle with redundant variables as they try to include redundant variables simultaneously. However, best actuarial practice is to keep models as parsimonious as possible and only include additional variables that contribute significant additional predictive power.

A.2.b	Determine if the sub-model was previously approved (or accepted) by the regulatory agency.	1	If the sub-model was previously approved/accepted, that may reduce the extent of the sub-model's review. If approved, obtain the tracking number(s) (e.g., state, SERFF) and verify when and if it was the same model currently under review. **Note**: A previous approval does not necessarily confer a guarantee of ongoing approval; e.g., when statutes and/or regulations have changed or if a model's indications have been undermined by subsequent empirical experience. However, knowing whether a model has been previously approved can help focus the regulator's efforts and determine whether the prior decision needs to be revisited. In some circumstances, direct dialogue with the vendor could be quicker and more useful.

Section	Information Element	Level of Importance to the Regulator's Review	Comments
A.2.c	Determine if the sub-model output was used as input to the ~~GLM~~Random Forest; obtain the vendor name, as well as the name and version of the sub-model.	1	To accelerate the review of the filing, it may be desirable to request (from the company), the name and contact information for a vendor representative. The company should provide the name of the third-party vendor and a contact in the event the regulator has questions. The "contact" can be an intermediary at the insurer (e.g., a filing specialist), who can place the regulator in direct contact with a subject-matter expert (SME) at the vendor. Examples of such sub-models include credit/financial scoring algorithms and household composite score models. Sub-models can be evaluated separately and in the same manner as the primary model under evaluation. A sub-model contact for additional information should be provided. Sub-model SMEs may need to be brought into the conversation with regulators (whether in-house or third-party sub-models are used).
A.2.d	If using catastrophe model output, identify the vendor and the model settings/assumptions used when the model was run.	1	To accelerate the review of the filing, get contact information for the SME that ran the model and an SME from the vendor. The "SME" can be an intermediary at the insurer (e.g., a filing specialist), who can place the regulator in direct contact with the appropriate SMEs at the insurer or model vendor. For example, it is important to know hurricane model settings for storm surge, demand surge, and long-term/short-term views.
A.2.e	Obtain an explanation of how catastrophe models are integrated into the model to ensure no double-counting.	1	If a weather-based sub-model is input to the ~~GLM~~ Random Forest under review, loss data used to develop the model should not include loss experience associated with the weather-based sub-model. Doing so could cause distortions in the modeled results by double-counting such losses when determining relativities or loss loadsin the filed rating plan. For example, redundant losses in the data may occur when non-hurricane wind losses are included in the data while also using a severe convective storm model in the actuarial indication. Such redundancy may also occur with the inclusion of fluvial or pluvial flood losses when using a flood model or inclusion of freeze losses when using a winter storm model.

Section	Information Element	Level of Importance to the Regulator's Review	Comments
A.2.f	If using output of any scoring algorithms, obtain a list of the variables used to determine the score and provide the source of the data used to calculate the score.	1	Any sub-model should be reviewed in the same manner as the primary model that uses the sub-model's output as input. Depending on the result of item A.2.b, the importance of this item may be decreased.
3. Adjustments to Data			
A.3.a	Determine if premium, exposure, loss, or expense data were adjusted (e.g., on-leveled, developed, trended, adjusted for catastrophe experience, or capped). If so, how? Do the adjustments vary for different segments of the data? If so, identify the segments and how the data was adjusted.	2	The rating plan or indications underlying the rating plan may provide special treatment of large losses and non-modeled large loss events. If such treatments exist, the company should provide an explanation how they were handled. These treatments need to be identified and the company/regulator needs to determine whether model data needs to be adjusted. For example, should large bodily injury (BI) liability losses in the case of personal automobile insurance be excluded, or should large non-catastrophe wind/hail claims in home insurance be excluded from the model's training, test and validation data? Look for anomalies in the data that should be addressed. For example, is there an extreme loss event in the data? If other processes were used to load rates for specific loss events, how is the impact of those losses considered? Examples of losses that can contribute to anomalies in the data are large losses or flood, hurricane, or severe convective storm losses for personal automobile comprehensive or home insurance. Premium should be brought to current rate level if the target variable is calculated with a premium metric, such as loss ratio. Premium can be brought to current rate level with the extension of exposures method or the parallelogram method. Note that the premium must be on-leveled at a granular variable level for each variable included in the new model if the parallelogram method is used. Statewide on-level factors by coverage are typically sufficient for statewide rate indication development but not sufficient for models that determine rates by variable level.
A.3.b	Identify adjustments that were made to aggregated data (e.g., transformations, binning and/or categorizations). If any, identify the name of the characteristic/variable and obtain a description of the adjustment.	1	Pre-modeling ~~binnings~~binning may be unnecessary in a random forest model. The tree model will naturally segment numerical values in the splitting process of the trees. However, if the insurer does bin variables before modeling, the reason should be understood.

A.3.c	Ask for aggregated data (one dataset of pre-adjusted/scrubbed data and one dataset of post-adjusted/scrubbed data) that allows the regulator to focus on the univariate distributions and compare raw data to adjusted/binned/transformed/etc. data.	4	This is most relevant for variables that have been "scrubbed" or adjusted. Though most regulators may never ask for aggregated data and do not plan to rebuild any models, a regulator may ask for this aggregated data or subsets of it. It would be useful to the regulator if the percentage of exposures and premium for missing information from the model data by category are provided. This data can be displayed in either graphical or tabular formats.

Section	Information Element	Level of Importance to the Regulator's Review	Comments
A.3.d	Determine how missing data was handled.	1	This is most relevant for variables that have been "scrubbed" or adjusted. The regulator should be aware of assumptions the modeler made in handling missing, null, or "not available" values in the data. For example, it would be helpful to the reviewer if the modeler were to provide a statement as to whether there is any systemic reason for missing data. If adjustments or recoding of values were made, they should be explained. It may also be useful to the regulator if the percentage of exposures and premium for missing information from the model data are provided. This data can be displayed in either graphical or tabular formats. The modeler should describe the way the tree fitting process handled missing values. The modeler should specify if missing values are treated before running the tree model or if they are allowed to be handled by the tree model.
A.3.e	If duplicate records exist, determine how they were handled.	1	
A.3.f	Determine if there were any material outliers identified and subsequently adjusted during the scrubbing process.	3	Look for a discussion of how outliers were handled. If necessary, the regulator may want to investigate further by getting a list (with description) of the types of outliers and determine what adjustments were made to each type of outlier. To understand the filer's response, the regulator should ask for the filer's materiality standard.
4. Data Organization			
A.4.a	Obtain documentation on the methods used to compile and organize data, including procedures to merge data from different sources or filter data based on particular characteristics and a description of any preliminary analyses, data checks, and logical tests performed on the data and the results of those tests.	2	This should explain how data from separate sources was merged and/or how subsets of policies, based on selected characteristics, are filtered to be included in the data underlying the model and the rationale for that filtering.
A.4.b	Obtain documentation on the insurer's process for reviewing the appropriateness, reasonableness, consistency, and comprehensiveness of the data, including a discussion of the rational relationship the data has to the predicted variable.	2	An example is when by-peril or by-coverage modeling is performed; the documentation should be for each peril/coverage and make rational sense. For example, if "murder" or "theft" data are used to predict the wind peril, the company should provide support and a rational explanation for their use.

Section	Information Element	Level of Importance to the Regulator's Review	Comments
A.4.c	Identify material findings the company had during its data review and obtain an explanation of any potential material limitations, defects, bias, or unresolved concerns found or believed to exist in the data. If issues or limitations in the data influenced modeling analysis and/or results, obtain a description of those concerns and an explanation how modeling analysis was adjusted and/or results were impacted.	1	"None" or "N/A" may be an appropriate response.

B. BUILDING THE MODEL

Section	Information Element	Level of Importance to Regulator's Review	Comments
1. High-Level Narrative for Building the Model			
B.1.a	Identify the type of model underlying the rate filing (e.g., Random Forest, GLM, decision tree, Bayesian GLM, gradient- boosting machine, neural network, etc.). Understand the model's role in the rating system and provide the reasons why that type of model is an appropriate choice for that role.	1	It is important to understand if the model in question is a ~~GLM~~ Random Forest and, therefore, these information elements are applicable; or if it is some other model type, in which case other reasonable review approaches may be considered. There should be an explanation of why the model (using the variables included in it) is appropriate for the line of business. If by-peril or by-coverage modeling is used, the explanation should be by- peril/by-coverage. **Note**: If the model is not a ~~GLM~~Random Forest, the information elements in this white paper may not apply in their entirety.
B.1.b	Identify the software used for model development. Obtain the name of the software vendor/developer, software product, and a software version reference used in model development.	3	Changes in software from one model version to the next may explain if such changes, over time, contribute to changes in the modeled results. The company should provide the name of the third-party vendor and a "contact" in the event the regulator has questions. The "contact" can be an intermediary at the insurer (e.g., a filing specialist) who can place the regulator in direct contact with the appropriate SME at the vendor. Open-source software/programs used in model development should be identified by name and version the same as if from a vendor.

Section	Information Element	Level of Importance to Regulator's Review	Comments
B.1.c	Obtain a description how the available data was divided between model training, test, and/or validation datasets. The description should include an explanation why the selected approach was deemed most appropriate, whether the company made any further subdivisions of available data, and reasons for the subdivisions (e.g., a portion separated from training data to support testing of components during model building). Determine if the validation data was accessed before model training was completed and, if so, obtain an explanation of why that came to occur. Obtain a discussion of whether the model was rebuilt using all the data or if it was only based on the training data.	1	The reviewer should be aware that modelers may break their data into three or just two datasets. Although the term "training" is used with little ambiguity, "test" and "validation" are terms that are sometimes interchanged, or the word "validation" may not be used at all. ~~It would be unexpected if validation and/or test data were used for any purpose other than validation and/or test, prior to the selection of the final model. However, according to the CAS monograph, "Generalized Linear Models for Insurance Rating": "Once a final model is chosen, … we would then go back and rebuild it using all of the data, so that the parameter estimates would be at their most credible."~~ The reviewer should note whether a company employed cross-validation techniques instead of a training/test/validation dataset approach. If cross-validation techniques were used, the reviewer should request a description of how cross-validation was done and confirm that the final model was not built on any particular subset of the data, but rather the full dataset. The discussion of training, test, and/or validation datasets is a separate discussion from the % of observations (rows of data) or % of features (columns of data) used within each tree. These splits are based on hyperparameters and are commented on in other sections.
B.1.d	Obtain a brief description of the development process, from initial concept to final model and filed rating plan.	1	The narrative should have the same scope as the filing.
B.1.e	Obtain a narrative on whether loss ratio, pure premium, or frequency/severity analyses were performed and, if separate frequency/severity modeling was performed, how pure premiums were determined.	1	
B.1.f	Identify the model's target variable.	1	A clear description of the target variable is key to understanding the purpose of the model. It may also prove useful to obtain a sample calculation of the target variable in Excel format, starting with the "raw" data for a policy, or a small sample of policies, depending on the complexity of the target variable calculation.

B.1.g	Obtain a description of the candidate variable selection process prior to the model building.	1	Candidate variables are the variables used as input to the modeling process. Certain variables may not end up used in the final model if none of the component trees of the model split on the variable. The narrative regarding the candidate variable selection process may address matters such as the criteria upon which variables were selected or omitted, identification of the number of preliminary variables considered in developing the model versus the number of variables that remained, and any statutory or regulatory limitations that were taken into account when making the decisions regarding candidate variable selection. The modeler should comment on the use of automated feature selection algorithms to choose candidate predictor variables and explain how potential overfitting that can arise from these techniques was addressed.

Section	Information Element	Level of Importance to Regulator's Review	Comments
B.1.h	In conjunction with variable selection, obtain a narrative on how the company determined the granularity of the rating variables during model development.	3	The narrative should include discussion of how credibility was considered in the process of determining the level of granularity of the variables selected. Minimum data volume constraints can be applied to a tree based model, such that the trees will not create a split that would result in terminal nodes with volume below a set amount. The modeler should comment on how the threshold was chosen.
B.1.i	Determine if model input data was segmented in any way (e.g., by-coverage, by-peril, or by-form basis). If so, obtain a description of data segmentation and the reasons for data segmentation.	1	The regulator would use this to follow the logic of the modeling process.
B.1.j	If adjustments to the model were made based on credibility considerations, obtain an explanation of the credibility considerations and how the adjustments were applied.	2	~~Adjustments may be needed, given that models do not explicitly consider the credibility of the input data or the model's resulting output; models take input data at face value and assume 100% credibility when producing modeled output.~~ If there was no minimum data volume threshold applied to the trees, or if the threshold was very small, obtain an explanation of any post modeling adjustments the modeler made to address the credibility considerations and how the adjustments were applied.
2. Medium-Level Narrative for Building the Model			
B.2.a	At crucial points in model development, if selections were made among alternatives regarding model assumptions, ~~or~~ techniques, or hyperparameters, obtain a narrative on the judgment used to make those selections.	~~3~~2	
B.2.b	If post-model adjustments were made to the data and the model was rerun, obtain an explanation on the details and the rationale for those adjustments.	2	Evaluate the addition or removal of variables and the model fitting. It is not necessary for the company to discuss each iteration of adding and subtracting variables, but the regulator should gain a general understanding of how these adjustments were done, including any statistical improvement measures relied upon.

Section	Information Element	Level of Importance to Regulator's Review	Comments
~~B.2.c~~	~~Obtain a description of the testing that was performed during the model building process, including an explanation of the decision making process to determine which interactions were included and which were not.~~	~~3~~	~~There should be a description of the testing that was performed during the model building process. Examples of tests that may have been performed include univariate testing and review of a correlation matrix.~~ ~~The number of interaction terms that could potentially be included in a model increases far more quickly than the number of "main effect" variables (i.e., the basic predictor variables that can be interacted together). Analyzing each possible interaction term individually can be unwieldy. It is typical for interaction terms to be excluded from the model by default, and only included where they can be shown to be particularly important. So, as a rule of thumb, the regulator's emphasis should be on understanding why the insurer included the interaction terms it did, rather than on why other candidate interactions were excluded.~~ ~~In some cases, however, it could be reasonable to inquire about why a particular interaction term was excluded from a model for example, if that interaction term was ubiquitous in similar filings and was known to be highly predictive, or if the regulator had reason to believe that the interaction term would help differentiate dissimilar risks within an excessively heterogenous rating segment.~~
B.2.d	~~For the GLM, identify the link function used.~~ Identify which distribution was used for the model (e.g., Regression based on Poisson, ~~Gaussian~~Gamma, ~~log normal~~Logistic, or Tweedie are common choices). Obtain an explanation of why the ~~link function and~~ distribution ~~were~~ was chosen. Certain distribution assumptions will involve numerical parameters, for example regression with a Tweedie assumed distribution will have a p power value. Obtain the ~~formulas for the distribution and link functions, including~~ specific numerical parameters ~~of the distribution~~associated with the distribution. ~~If changed from the default, obtain a discussion of applicable convergence criterion.~~	1	~~Solving the GLM is iterative and the modeler can check to see if fit is improving. At some point, convergence occurs; however, when it occurs can be subjective or based on threshold criteria. If the software's default convergence criteria were not relied upon, an explanation of any deviation should be provided.~~
B.2.e	Obtain a narrative on how the predictions from the component trees are combined to arrive at a final model prediction. ~~the formula relationship between the data and the model outputs, with a definition of each model input and output. The narrative should include all coefficients necessary to evaluate the predicted pure premium, relativity, or other value, for any real or hypothetical set of inputs.~~	2	Tree based methods combine predictions from multiple component trees and aggregate them into a final prediction for each observation. Common methods for combining random forest model predictions include the arithmetic or geometric mean of all the component trees.

B.2.f	If there were data situations in which ~~GLM~~ weights were used, obtain an explanation of how and why they were used.	3	Investigate whether identical records were combined to build the model.
New B.3.1	Obtain the number of component trees comprising the Random Forest model. Obtain a narrative on how this number was chosen.	**1**	Random Forest models should contain enough trees to reduce error to an acceptable level. Random forest models should balance this with the concept of parsimony. A model with fewer trees that achieves relatively similar reduction in error is preferable to a model with more trees. Checking the error on a test dataset or out of bag error for different numbers of trees can reveal at what value the error on test data starts to level off. Modelers might rely on early stopping rules within modeling software to arrive at the final number of trees. The narrative on the number of trees should discuss the stopping criterion, which defines what condition is met when the model stopped adding more trees.
New B.3.2	Obtain the sampling parameters that apply to both the percent of observations used in each component tree and the number of features tested for each split within each tree. Obtain a narrative on how the sampling parameters were selected.	**1**	Random forest models often sample both the observations (typically rows of modeling data) with replacment and sample the features (typically columns of modeling data) This means that each tree has~~hasmay have~~ a bootstrapped dataset. The company should discuss the bagging fraction (aka sample size) applied to observations (typically rows of data). This is often expressed as a percent. For example: perhaps each tree is based on a bootstrapped sample which is 50% of the original dataset. The company should discuss the number of features considered at each split. This is often expressed as an integer, A common choice for the number of features is equal to roughly the square root of the total number of candidate variables. For example: perhaps each split is based on 10 randomly selected features (typically columns of data) when there are 100 candidate variables.
New B.3.3	Obtain the maximum depth that applies to the component trees in the model. Obtain a narrative on how this number was chosen.	**1**	The depth of a tree is the number of splits that are allowed to occur between the root node and the terminal nodes. This number can be set explicitly in modeling software or may be implicitly set if the company applies a splitting constraint, such as a minimum observations per node. Maximum tree depths of 8 or higher are considered extremely high.

Section	Information Element	Level of Importance to Regulator's Review	Comments
3. Predictor Variables			
B.3.a	Obtain a complete data dictionary, including the names, types, definitions, and rationales for each variable. ~~and uses of each predictor variable, offset variable, control variable, proxy variable, geographic variable, geodemographic variable, and all other variables in the model used ontheir own or as an interaction with other variables (including sub-models and external models).~~	1	Types of variables might be continuous, discrete, Boolean, etc. ~~Definitions should not use programming language or code. For any variable(s) intended to function as a control or offset, obtain an explanation of its purpose and impact. Also, for any use of interaction between variables, obtain an explanation of its rationale and impact.~~ Tree based models do not have offset or control variables, as all variables are treated the same way in the trees.
B.3.b	Obtain a list of predictor variables considered but not used in the final model, and the rationale for their removal.	4	The purpose of this requirement is to identify variables the company finds to be predictive but ultimately may reject for reasons other than loss-cost considerations (e.g., price optimization). Also, look for variables the company tested and then rejected. This item could help address concerns about data dredging. ~~The reasonableness of including a variable with a given significance level could depend greatly on the other variables the company evaluated for inclusion in the model and the criteria for inclusion or omission.~~ ~~For instance, if the company tested 1,000 similar variables and selected the one with the lowest p-value of 0.001, this would be a far, far weaker case for statistical significance than if that variable was the only one the company evaluated. **Note**: Context matters.~~
B.3.c	Obtain a correlation matrix for all predictor variables included in the model and sub-model(s).	3	~~While GLMs accommodate collinearity, the correlation matrix provides more information about the magnitude of correlation between variables.~~ High correlation is less of an issue for tree based models than it is for GLM's. Tree based models naturally only use one variable at a time during each split in each tree. However, a correlation matrix still helps the reviewer understand relationships in the data being modeled better. The company should indicate what statistic was used (e.g., Pearson, Cramer's V) in the correlation matrix. The regulatory reviewer should understand what statistic was used to produce the matrix but should not prescribe the statistic.
B.3.d	Obtain plots describing the relationship between each predictor variable and the target variable. Obtain a rational explanation for ~~why an increase in~~ the observed relationship between each predictor variable ~~should increase or decrease~~and the target variable (~~-~~frequency, severity, loss costs, expenses, or any element or characteristic being predicted).	~~3~~1	~~The explanation should go beyond demonstrating correlation.~~ Partial dependence plots, accumulated local effects plots, or shapley plots will help improve model interpretability. The plots should be accompanied by commentary on why the visualized relationship is reasonable. Considering possible causation may be relevant, but proving causation is neither practical nor expected. If no rational explanation can be provided, greater scrutiny may be

			appropriate. For example, the regulator should look for unfamiliar predictor variables and, if found, the regulator should seek to understand the ~~connection~~ relationship that variable has to ~~increasing or decreasing~~ the target variable.

Section	Information Element	Level of Importance to Regulator's Review	Comments
B.3.e	If the modeler made use of one or more dimensionality reduction techniques, such as a principal component analysis (PCA), obtain a narrative about that process, an explanation why that technique was chosen, and a description of the step-by-step process used to transform observations (usually correlated) into a set of linearly uncorrelated variables. In each instance, obtain a list of the pre-transformation and post-transformation variable names, as well as an explanation of how the results of the dimensionality reduction technique was used within the model.	2	
New B.3.f	Obtain variable importance plots. Obtain a description of how variable importance was calculated.	1	Variable Importance Plots for tree based methods highlight which variables contributed most to the model. There are multiple ways to calculate variable importance. Variables with the lowest importance measures should be prioritized when reviewing predictor variables for significance.
4. Adjusting Data, Model Validation, and Goodness-of-Fit Measures			
B.4.a	Obtain a description of the methods used to assess the statistical significance/goodness-of-fit of the model to validation data, such as lift charts and statistical tests. Compare the model's projected results to historical actual results and verify that modeled results are reasonably similar to actual results from validation data.	1	For models that are built using multistate data, validation data for some segments of risk is likely to have low credibility in individual states. Nevertheless, some regulators require model validation on state-only data, especially when analysis using state-only data contradicts the countrywide results. State-only data might be more applicable but could also be impacted by low credibility for some segments of risk. **Note**: It may be useful to consider geographic stability measures for territories within the state.

~~B.4.b~~	~~For all variables (discrete or continuous), review the appropriate parameter values and relevant tests of significance, such as confidence intervals, chi-square tests, p-values, or F tests. Determine if model development data, validation data, test data, or other data was used for these tests.~~	1	~~Typical p-values greater than 5% are large and should be questioned. Reasonable business judgment can sometimes provide legitimate support for high p-values. Reasonableness of the p-value threshold could also vary depending on the context of the model; e.g., the threshold might be lower when many candidate variables were evaluated for inclusion in the model.~~ ~~Overall lift charts and/or statistical tests using validation data may not provide enough of the picture. If there is concern about one or more individual variables, the reviewer may obtain, for each discrete variable level, the parameter value, confidence intervals, chi-square tests, p-values, and any other relevant and material tests.~~ ~~For variables that are modeled continuously, it may be sufficient to obtain statistics around the modeled parameters; e.g., confidence intervals around each level of an AOI curve might be more than what is needed.~~

Section	Information Element	Level of Importance to Regulator's Review	Comments
~~B.4.c~~	~~Identify the threshold for statistical significance and explain why it was selected. Obtain a reasonable and appropriately supported explanation for keeping the variable for each discrete variable level where the p-values were not less than the chosen threshold.~~	~~1~~	~~The explanation should clearly identify the thresholds for statistical significance used by the modeler. Typical p-values greater than 5% are large and should be questioned. Reasonable business judgment can sometimes provide legitimate support for high p-values. Reasonableness of the p-value threshold could also vary depending on the context of the model; e.g., the threshold might be lower when many candidate variables were evaluated for inclusion in the model.~~ ~~Overall lift charts and/or statistical tests using validation data may not provide enough of the picture. If there is concern about one or more individual variables, the reviewer may obtain, for each discrete variable level, the parameter value, confidence intervals, chi-square tests, p-values, and any other relevant and material tests.~~
~~B.4.d~~	~~For overall discrete variables, review type 3 chi-square tests, p-values, F-tests and any other relevant and material test. Determine if model development data, validation data, test data, or other data was used for these tests.~~	2	~~Typical p-values greater than 5% are large and should be questioned. Reasonable business judgment can sometimes provide legitimate support for high p-values. Reasonableness of the p-value threshold could also vary depending on the context of the model; e.g., the threshold might be lower when many candidate variables were evaluated for inclusion in the model.~~ ~~Overall lift charts and/or statistical tests using validation data may not provide enough of the picture. If there is concern about one or more individual variables, the reviewer may obtain, for each discrete variable level, the parameter value, confidence intervals, chi-square tests, p-values, and any other relevant and material tests.~~ ~~For variables that are modeled continuously, it may be sufficient to obtain statistics around the modeled parameters; e.g., confidence intervals around each level of an AOI curve might be more than what is needed.~~
B.4.e	Obtain evidence that the model fits the training data well~~, for individual variables, for any relevant combinations of variables,~~by variable and for the overall model.	2	~~For a GLM, such evidence may be available using chi-square tests, p-values, F-tests and/or other means.~~ ~~The steps taken during modeling to achieve goodness-of-fit are likely to be numerous and laborious to describe, but they contribute much of what is generalized about a GLM.~~ The regulator should ask for the company to provide exhibits or plots that show the fitted average makes sense when compared to the observed average for variables of interest. Regulators would ideally review this comparison for every variable, but time

			constraints may limit the focus to just variables of interest. Variables of interest should include those with a low importance measure according to diagnostic tests, variables without an intuitive relationship to loss, or variables that may be a proxy for a protected class attribute. ~~The regulator should not assume to know what the company did and ask, "How?" Instead, the regulator should ask what the company did and be prepared to ask follow-up questions.~~

Section	Information Element	Level of Importance to Regulator's Review	Comments
~~B.4.f~~	~~For continuous variables, provide confidence intervals, chi-square tests, p-values, and any other relevant and material test. Determine if model development data, validation data, test data, or other data was used for these tests.~~	~~2~~	~~Typical p-values greater than 5% are large and should be questioned. Reasonable business judgment can sometimes provide legitimate support for high p-values. Reasonableness of the p-value threshold could also vary depending on the context of the model; e.g., the threshold might be lower when many candidate variables were evaluated for inclusion in the model.~~ ~~Overall lift charts and/or statistical tests using validation data may not provide enough of the picture. If there is concern about one or more individual variables, the reviewer may obtain, for each discrete variable level, the parameter value, confidence intervals, chi-square tests, p-values and any other relevant and material tests.~~ ~~For variables that are modeled continuously, it may be sufficient to obtain statistics around the modeled parameters; for example, confidence intervals around each level of an AOI curve might be more than what is needed.~~
B.4.g	Obtain a description how the model was tested for stability over time.	2	Evaluate the build/test/validation datasets for potential time-sensitive model distortions (e.g., a winter storm in year 3 of 5 can distort the model in both the testing and validation datasets). Obsolescence over time is a model risk (e.g., old data for a variable or a variable itself may no longer be relevant). If a model being introduced now is based on losses from years ago, the reviewer should be interested in knowing whether that model would be predictive in the proposed context. Validation using recent data from the proposed context might be requested. Obsolescence is a risk even for a new model based on recent and relevant loss data. The reviewer may want to inquire as to the following: What steps, if any, were taken during modeling to prevent or delay obsolescence? What controls exist to measure the rate of obsolescence? What is the plan and timeline for updating and ultimately replacing the model? The reviewer should also consider that as newer technologies enter the market (e.g., personal automobile) their impact may change claim activity over time (e.g., lower frequency of loss). So, it is not necessarily a bad thing that the results are not stable over time.
B.4.h	Obtain a narrative on how potential concerns with overfitting were addressed.	2	Tree based models such as Random Forest models are notorious for over-fitting. The company should provide a narrative on how overfitting was addressed. The company

			should provide lift charts on training data and testing data that is separate from the training data.

Section	Information Element	Level of Importance to Regulator's Review	Comments
B.4.i	Obtain support demonstrating that the ~~GLM~~ Random Forest assumptions are appropriate.	3	A visual review of plots of actual errors is usually sufficient. The reviewer should look for a conceptual narrative covering these topics: How does this particular ~~GLM~~ Random Forest work? Why did the rate filer do what it did? Why employ this design instead of alternatives? Why choose this particular distribution function and this particular link function? A company response may be at a fairly high level and reference industry practices. If the reviewer determines that the model makes no assumptions that are considered to be unreasonable, the importance of this item may be reduced.
B.4.j	Obtain 5-10 sample records with corresponding output from the model for those records.	~~4~~2	The company should provide 5-10 sample records with corresponding input variable values, the prediction from each component tree in the model, and the final ensemble model prediction. The company should describe how the final model prediction aggregates the individual tree model predictions.
New B.4.k	Obtain a deviance analysis by number of trees	~~1~~2	The company should provide a plot showing that the deviance of the overall model decreases after each iteration (each additional tree)
5. "Old Model" Versus "New Model"			
B.5.a	Obtain an explanation of why this model is an improvement to the current rating plan. If it replaces a previous model, find out why it is better than the one it is replacing; determine how the company reached that conclusion and identify metrics relied on in reaching that conclusion. Look for an explanation of any changes in calculations, assumptions, parameters, and data used to build this model from the previous model.	2	The regulator should expect to see improvement in the new class plan's predictive ability or other sufficient reason for the change.
B.5.b	Determine if two Gini coefficients were compared and obtain a narrative on the conclusion drawn from this comparison.	3	This information element requests a comparison of the Lorenz curve and Gini coefficient from the prior model to the Gini coefficient of proposed model. It is expected that there should be improvement in the Gini coefficient. A higher Gini coefficient indicates greater differentiation produced by the model and how well the model fits that data. This is relevant when one model is being updated or replaced. The regulator should expect to see improvement in the new class plan's predictive ability. One example of a comparison might be sufficient. **Note**: This comparison is not applicable to initial model introduction. Reviewer can look to CAS monograph, "Generalized Linear Models for Insurance Rating."

B.5.c	Determine if double-lift charts were analyzed and obtain a narrative on the conclusion drawn from this analysis.	3	One example of a comparison might be sufficient. **Note**: "Not applicable" is an acceptable response.

Section	Information Element	Level of Importance to Regulator's Review	Comments
B.5.d	If replacing an existing model, obtain a list of any predictor variables used in the old model that are not used in the new model as candidate variables. Obtain an explanation of why these variables were dropped from the new model. Obtain a list of all new predictor variables in the new model that were not in the prior old model.	2	It is useful to differentiate between old and new variables, so the regulator can prioritize more time on variables not yet reviewed.
6. Modeler Software			
B.6.a	Request access to SMEs (e.g., modelers) who led the project, compiled the data, and/or built the model.	4	The filing should contain a contact that can put the regulator in touch with appropriate SMEs and key contributors to the model development to discuss the model.

C. THE FILED RATING PLAN

Section	Information Element	Level of Importance to Regulator's Review	Comments
1. General Impact of Model on Rating Algorithm			
C.1.a	In the actuarial memorandum or explanatory memorandum, for each model and sub-model (including external models), look for a narrative that explains each model and its role (i.e., how it was used) in the rating system.	1	The "role of the model" relates to how the model integrates into the rating plan as a whole and where the effects of the model are manifested within the various components of the rating plan. This is not intended as an overarching statement of the model's goal, but rather a description of how specifically the model is used. This item is particularly important, if the role of the model cannot be immediately discerned by the reviewer from a quick review of the rate and/or rule pages. (Importance is dependent on state requirements and ease of identification by the first layer of review and escalation to the appropriate review staff.)
C.1.b	Obtain an explanation of how the model was used to adjust the filed rating algorithm.	1	~~Models are often used to produce factor-based indications, which are then used as the basis for the selected changes to the rating plan. It is the changes to the rating plan that create impacts.~~ The regulator should consider asking for an explanation of how the model was used to adjust the rating algorithm.
C.1.c	Obtain a complete list of characteristics/variables used in the proposed rating plan, including those used as input to the model (including sub-models and composite variables) and all other characteristics/variables (not input to the model) used to calculate a premium. For each characteristic/variable, determine if it is only input to the model, whether it is only a separate univariate rating characteristic, or whether it is both input to the model and a separate univariate rating characteristic. The list should include transparent descriptions (in plain language) of each listed characteristic/variable.	1	Examples of variables used as inputs to the model and used as separate univariate rating characteristics might be criteria used to determine a rating tier or household composite characteristic.

Section	Information Element	Level of Importance to Regulator's Review	Comments
2. Relevance of Variables and Relationship to Risk of Loss			
C.2.a	Obtain a narrative regarding how the characteristics/rating variables included in the filed rating plan relate to the risk of insurance loss (or expense) for the type of insurance product being priced.	2	The narrative should include a discussion of the relevance each characteristic/rating variable has on consumer behavior that would lead to a difference in risk of loss (or expense). The narrative should include a rational relationship to cost, and model ~~results~~ visualization plots (such as partial dependence plots, accumulated local effects plots, or Shapley plots) shouldbe consistent with the expected direction of the relationship. **Note**: This explanation would not be needed if the connection between variables and risk of loss (or expense) has already been illustrated.
3. Comparison of Model Outputs to Current and Selected Rating Factors			
~~C.3.a~~	~~Compare relativities indicated by the model to both current relativities and the insurer's selected relativities for each risk characteristic/variable in the rating plan.~~	~~1~~	~~"Significant difference" may vary based on the risk characteristic/variable and context. However, the movement of a selected relativity should be in the direction of the indicated relativity; if not, an explanation is necessary as to why the movement is logical.~~
C.3.b	Obtain documentation and support for all calculations, judgments, or adjustments that connect the model's indicated values to the selected ~~relativities~~ rates filed in the rating plan.	1	The documentation should include explanations for the necessity of any such adjustments and each significant difference between the model's indicated values and the selected values. This applies even to models that produce scores, tiers, or ranges of values for which indications can be derived. **Note**: This information is especially important if differences between model-indicated values and selected values are material and/or impact one consumer population more than another.
C.3.c	For each characteristic/variable used as both input to the model (including sub-models and composite variables) and as a separate univariate rating characteristic, obtain a narrative regarding how each characteristic/variable was tempered or adjusted to account for possible overlap or redundancy in what the characteristic/variable measures.	2	~~Modeling loss ratios with these characteristics/variables as control variables would account for possible overlap.~~ The insurer should address this possibility or other considerations; e.g., tier placement models often use risk characteristics/variables that are also used elsewhere in the rating plan. One way to do this would be to model the loss ratios resulting from a process that already uses univariate rating variables. Then the model/composite variables would be attempting to explain the residuals.

Section	Information Element	Level of Importance to Regulator's Review	Comments
4. Responses to Data, Credibility, and Granularity Issues			
C.4.a	Determine what, if any, consideration was given to the credibility of the output data.	2	The regulator should determine at what level of granularity credibility is applied. If modeling was by-coverage, by-form, or by-peril, the company should explain how these were handled when there was not enough credible data by coverage, form, or peril to model. The company should comment on the minimum data volume requirement at each node before splitting.
C.4.b	If the rating plan is less granular than the model, obtain an explanation of why.	2	This is applicable if the company had to combine modeled output in order to reduce the granularity of the rating plan.
C.4.c	If the rating plan is more granular than the model, obtain an explanation of why.	2	A more granular rating plan may imply that the company had to extrapolate certain rating treatments, especially at the tails of a distribution of attributes, in a manner not specified by the model indications. It may be necessary to extrapolate due to data availability or other considerations.
5. Definitions of Rating Variables			
C.5.a	Obtain a narrative regarding adjustments made to model output (e.g., transformations, binning and/or categorizations). If adjustments were made, obtain the name of the characteristic/variable and a description of the adjustment.	2	If rating tiers or other intermediate rating categories are created from model output, the rate and/or rule pages should present these rating tiers or categories. The company should provide an explanation of how model output was translated into these rating tiers or intermediate rating categories.
6. Supporting Data			
C.6.a	Obtain aggregated state-specific, book-of-business-specific univariate historical experience data, separately for each year included in the model, consisting of loss ratio or pure premium relativities and the data underlying those calculations for each category of model output(s) proposed to be used within the rating plan. For each data element, obtain an explanation of whether it is raw or adjusted and, if the latter, obtain a detailed explanation for the adjustments.	4	For example, were losses developed/undeveloped, trended/untrended, capped/uncapped, etc.? Univariate indications should not necessarily be used to override more sophisticated multivariate indications. However, they do provide additional context and may serve as a useful reference.

Section	Information Element	Level of Importance to Regulator's Review	Comments
~~C.6.b~~	~~Obtain an explanation of any material (especially directional) differences between model indications and state-specific univariate indications.~~	~~4~~	~~Multivariate indications may be reasonable as refinements to univariate indications, but possibly not for bringing about significant reversals of those indications.~~ ~~For instance, if the univariate indicated relativity for an attribute is 1.5 and the multivariate indicated relativity is 1.25, this is potentially a plausible application of the multivariate techniques. If, however, the univariate indicated relativity is 0.7 and the multivariate indicated relativity is 1.25, a regulator may question whether the attribute in question is negatively correlated with other determinants of risk.~~ ~~Credibility of state-level data should be considered when state indications differ from modeled results based on a broader dataset. However, the relevance of the broader dataset to the risks being priced should also be considered. Borderline reversals are not of as much concern. If multivariate indications perform well against the state-level data, this should suffice. However, credibility considerations need to be taken into account as state-level segmentation comparisons may not have enough credibility.~~
7. Consumer Impacts			
C.7.a	Obtain a listing of the top five rating variables that contribute the most to large swings in renewal premium, both as increases and decreases, as well as the top five rating variables with the largest spread of impact for both new and renewal business.	4	These rating variables may represent changes to rating factors, be newly introduced to the rating plan, or have been removed from the rating plan.
C.7.b	Determine if the company performed sensitivity testing to identify significant changes in premium due to small or incremental change in a single risk characteristic. If such testing was performed, obtain a narrative that discusses the testing and provides the results of that testing.	3	One way to see sensitivity is to analyze a graph of each risk characteristic's/variable's ~~possible relativities~~average fitted model prediction. Look for significant variation between the average fitted model predictions for adjacent rating variable levels~~relativities~~ and evaluate if such variation is reasonable and credible.
C.7.c	For the proposed filing, obtain the impacts on renewal business and describe the process used by management, if any, to mitigate those impacts.	2	Some mitigation efforts may substantially weaken the connection between premium and expected loss and expense and, hence, may be viewed as unfairly discriminatory by some states.

Section	Information Element	Level of Importance to Regulator's Review	Comments
C.7.d	Obtain a rate disruption/dislocation analysis, demonstrating the distribution of percentage and/or dollar impacts on renewal business (created by rerating the current book of business) and sufficient information to explain the disruptions to individual consumers.	2	The analysis should include the largest dollar and percentage impacts arising from the filing, including the impacts arising specifically from the adoption of the model or changes to the model as they translate into the proposed rating plan. While the default request would typically be for the distribution/dislocation of impacts at the overall filing level, the regulator may need to delve into the more granular variable-specific effects of rate changes if there is concern about particular variables having extreme or disproportionate impacts, or significant impacts that have otherwise yet to be substantiated. See Appendix D for an example of a disruption analysis.
C.7.e	Obtain exposure distributions for the model's output variables and show the effects of rate changes at granular and summary levels, including the overall impact on the book of business.	3	See Appendix D for an example of an exposure distribution.
C.7.f	Identify policy characteristics, used as input to a model or sub-model, that remain "static" over a policy's lifetime versus those that will be updated periodically. Obtain a narrative on how the company handles policy characteristics that are listed as "static," yet change over time.	3	Some examples of "static" policy characteristics are prior carrier tenure, prior carrier type, prior liability limits, claim history over past X years, or lapse of coverage. These are specific policy characteristics usually set at the time new business is written, used to create an insurance score or to place the business in a rating/underwriting tier, and often fixed for the life of the policy. The reviewer should be aware, and possibly concerned, how the company treats an insured over time when the insured's risk profile based on "static" variables changes over time but the rate charged, based on a new business insurance score or tier assignment, no longer reflect the insured's true and current risk profile. A few examples of "non-static" policy characteristics are age of driver, driving record, and credit information (FCRA-related). These are updated automatically by the company on a periodic basis, usually at renewal, with or without the policyholder explicitly informing the company.

Section	Information Element	Level of Importance to Regulator's Review	Comments
C.7.g	Obtain a means to calculate the rate charged a consumer.	3	The filed rating plan should contain enough information for a regulator to be able to validate policy premium. However, for a complex model or rating plan, a score or premium calculator via Excel or similar means would be ideal, but this could be elicited on a case-by-case basis. The ability to calculate the rate charged could allow the regulator to perform sensitivity testing when there are small changes to a risk characteristic/variable. **Note**: This information may be proprietary. For the rating plan, the rate order of calculation rule may be sufficient. However, it may not be feasible for a regulator to get all the input data necessary to reproduce a model's output. Credit and telematics models are examples of model types where model output would be readily available, but the input data would not be readily available to the regulator.
C.7.h	In the filed rating plan, be aware of any non-insurance data used as input to the model (customer-provided or other). In order to respond to consumer inquiries, it may be necessary to inquire as to how consumers can verify their data and correct errors.	1	If the data is from a third-party source, the company should provide information on the source. Depending on the nature of the data, it may need to be documented with an overview of who owns it. The topic of consumer verification may also need to be addressed, including how consumers can verify their data and correct errors.
8. Accurate Translation of Model into a Rating Plan			
C.8.a	Obtain sufficient information to understand how the model outputs are used within the rating system and to verify that the rating plan's manual, in fact, reflects the model output and any adjustments made to the model output.	1	The regulator can review the rating plan's manual to see that modeled output is properly reflected in the manual's rules, rates, factors, etc.

Section	Information Element	Level of Importance to Regulator's Review	Comments
9. Efficient and Effective Review of Rate Filing			
C.9.a	Establish procedures to efficiently review rate filings and models contained therein.	1	"Speed to market" is an important competitive concept for insurers. Although the regulator needs to understand the rate filing before accepting the rate filing, the regulator should not request information that does not increase his/her understanding of the rate filing. The regulator should review the state's rate filing review process and procedures to ensure that they are fair and efficient.
C.9.b	Be knowledgeable of state laws and regulations in order to determine if the proposed rating plan (and models) are compliant with state laws and/or regulations.	1	This is a primary duty of state insurance regulators. The regulator should be knowledgeable of state laws and regulations and apply them to a rate filing fairly and efficiently. The regulator should pay special attention to prohibitions of unfair discrimination.
C.9.c	Be knowledgeable of state laws and regulations in order to determine if any information contained in the rate filing (and models) should be treated as confidential.	1	The regulator should be knowledgeable of state laws and regulations regarding confidentiality of rate filing information and apply them to a rate filing fairly and efficiently. Confidentiality of proprietary information is key to innovation and competitive markets.
C.10.d	Obtain complete documentation of all component trees and how the individual predictions are aggregated together into a final prediction	**1**	The company should provide either tree diagrams for each component tree or comprehensive if-else statements that would replicate the logic of the trees. The company should state how the individual component tree predictions are combined into a final prediction.

New Glossary Terms:

Accumulated Local Effects Plots: A type of interpretability plot. Accumulated Local Effects plots calculate smaller, incremental changes in the feature effects. ALE shows the expected and centered effects of a variable.

Bagged Trees: An ensemble of trees model where each tree is based on a "bootstrap aggregated" sample.

Branch: A connection on a decision tree between a parent node and a child node. A relationship based on a predictor variable is checked at each node, determining which branch applies.

Candidate Variables: The variables specified by the modeler to be used within the full model. The random variable selection by a random forest means that component trees might only use a subset of these variables in each tree.

Child node: The node below a parent node. The child node is the result of a split that occurs based on a predictor variable. The node above the child node, which is where the split occurred resulting in the creation of the child nodes, is called the parent note. There is 1 parent node for every child node. The root node is the only node which is not a child node.

Component Tree: An individual tree within an ensemble of trees based method such as random forest or gradient boosting machine.

Deviance: A measure of model fit. Deviance is based on the difference between the log-likelihood of the saturated model and the log-likelihood of the proposed model being evaluated. Smaller values of deviance demonstrate that a model's predictions fit closer to actual. Deviance on training data will always decrease as model complexity increases.

Hyperparameter: A model hyperparameter is a model setting specified by the modeler that is external to the model and whose value cannot be estimated from data.

Node: A point on a decision tree. Nodes are either root nodes (the top node), leaf nodes (a terminal node at which point no further splitting occurs), or a internal node which appears in the middle of the tree while splitting is still taking place.

Out-of-Bag Error: Error calculated for observations based on the trees that did not include them in the set of training observations. Out-of-Bag Error is calculable when bootstrapping is used to generate different datasets for each component tree in an ensemble tree method.

Parent node: The node above a child node. The parent node is where a split occurs based on a predictor variable. The nodes below the parent node, which are a direct result of the parent node's split, are called child nodes. There are typically 2 child nodes for every parent node. Terminal nodes can not be parent nodes.

Partial Dependence Plots: A type of interpretability plot. The partial dependence plot computes the marginal effect of a given variable on the prediction.

Pruning: The process of scaling back a tree to reduce it's complexity. This results in trees with fewer branches and terminal nodes appearing higher on the tree. Pruning is more common on models built on

a single decision tree rather than on ensemble models such as random forests or Gradient Boosting Machines.

Random Forest: An ensemble of trees model where each tree is based on a bootstrap aggregated sample and each split is based on a random sample of the candidate variables.

Root node: The first (top) node in a decision tree. This node contains the entire set of data used by the tree as no splits have occurred yet.

Shapley Additive Explanation Plots: A type of interpretability plot. Shapley plots investigate the effect of including a variable in the model by the order in which it is added. The Shapley value represents the amount the variable of interest contributes to the prediction.

Splitting: The process of dividing a node into two or more sub-nodes, starting from the root node. Splitting occurs at every node up until the terminal (leaf) nodes when the stopping criterion is met.

Stopping Criterion: A criterion applied to the splitting process that informs the node when it is ineligible to split any further. Volume of data is often used as a stopping criterion, such that each leaf node is based on at least a pre-determined amount of data.

Terminal Node: An end node containing no child nodes, because the node has met the stopping criterion. The terminal node is associated with a prediction for one of the component trees. The terminal node is also known as a "leaf" node, the resulting endpoint of a decision tree.

Tree Based Model: Models that can be represented as a decision tree or a collection of decision trees.

Tree Depth: The maximum number of splits between the root node and a leaf node for a tree.

Variable Importance: A measure of how the variables (aka features) contribute to the overall model. There are multiple ways to measure variable importance.

Attachment Four
Casualty Actuarial and Statistical (C) Task Force
12/7/21

Dee Dee Mays, Vice Chairperson, Casualty Practice Council

Derek Freihaut, Chairperson, Committee on Property and Liability Financial Reporting

American Academy of Actuaries
Objective. Independent. Effective.™

Casualty Practice Council (CPC) Update

- Comment Letters
  - Response to Federal Insurance Office (FIO) on availability and affordability of automobile insurance.
  - Response to Federal Insurance Office (FIO) on climate-related insurance financial risk in the insurance sector.
- Auto
  - Consumer Cost of Automobile Insurance
  - Auto Insurance and COVID-19
- Cyber Toolkit (Expansion in early January)
- DE&I Efforts
  - Presentation to NAIC Special (EX) Committee on Race and Insurance Workstream 3
  - Colorado Department of Insurance Comment Letter (December)
  - Causation-Correlation Issue Brief (Early January)
  - Protected Class Data Issue Brief (Early January)
- Medical Professional Liability issue brief on COVID-19 impact
- Wildfire Paper Update (December)

Committee on Property and Liability Financial Reporting (COPLFR) Update

- Recent Activities
  - Comments on annual statements and premiums and losses to the Blanks Working Group and CASTF
  - 2021 Seminar on Effective P/C Loss Reserve Opinions: Tools for the Appointed Actuary (Dec. 6 and 7) Upcoming events
  - Release of 2021 Practice Note on SAOs on P/C Loss Reserves (December)
  - P/C Loss Reserve Law Manual (December or early January) – thank you for your help!
  - Risk Transfer Practice Note Update (Q1 2022)

- Questions?

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