FACILITY ASSOCIATION

Financial Services Regulatory Authority
5160 Yonge Street, 17th Floor
North York, ON M2N 6L9

August 13, 2021

Attention: Mr. Bruce Green, Director, Rates Operations, FSRA

RE: OW Preliminary Ontario Private Passenger Vehicle Annual Review (Based on Industry Data Through December 31, 2020) dated July 12, 2021

Dear Mr. Green,

Facility Association has reviewed the draft Oliver Wyman ("OW") report entitled "*Preliminary Ontario Private Passenger Vehicle Annual Review (Based on Industry Data Through December 31, 2020)*" dated July 12, 2021.

We are pleased to provide our attached written submission for your consideration and we appreciate the opportunity to provide feedback. Our comments are focused on the availability of automobile insurance in the voluntary market in Ontario, providing consumers in the province choice, both in terms of insurance provider and choice of the type and amount of coverage available[1].

It is challenging to promote both fairness and predictability in automobile insurance rates at a time when the underlying costs of benefits provided by the insurance product are very difficult to predict. This is especially the case following significant reforms, and challenges in the understanding of changes in frequency of accidents and claims, and their associated severity, both in relation to injured parties and to vehicular damage. Nonetheless, we believe promoting fairness and insurers' ability to set and predict their rates will enhance availability and competition in the marketplace to the ultimate benefit of consumers.

In light of this, we believe it is important to reiterate our position that FSRA should use the benchmarking exercise to inform its consideration of rate filings, rather than to set specific targets, caps, or floors with respect to any one particular assumption. This approach opens the opportunity for insurers to reflect their own assessment of future costs in providing their product / service to the consumer, and allows them to set their rates based on their assessment of the competitive market in which they operate. This, we believe results in the greatest consumer choice in both providers and product, while maintaining fairness to all parties.

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[1] Consumers in Ontario are required to purchase $200,000 of third party liability protection. However, it is clear that consumers see value in broader insurance coverage to protect them and their financial wellbeing, as less than 0.04% of private passenger vehicles were insured for the required minimum third party liability limit, according to 2020 data found in GISA industry data (the AUTO7501). Further, 89% purchased protection for their vehicle against collision/upset, and 73% purchased protection for their vehicle against theft and non-collision damage. We believe these statistics show a clear consumer appetite in the province for automobile insurance across many of the perils to which owning or operating an automobile exposes consumers.

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In contrast, benchmark assumptions as are set values, floors or caps may adversely impact availability of voluntary automobile insurance in the province, to the extent that capital providers in the voluntary market take an adverse view of their ability to charge rates that they have assessed relative to the future costs and risk of providing insurance.

Our concern from a voluntary market availability standpoint, is that benchmarks based on the OW Preliminary Report may act to discourage insurers from filing for rate changes and pull back from the market, reducing competition and availability.

More broadly (i.e. beyond just a focus on reform factors and trends), there are areas of uncertainty where we believe FSRA should allow flexibility for companies selecting assumptions supporting their applications. These include:

- COVID-19 and its impacts;
- selection of industry ultimate claim counts and amounts supporting their analyses (including trend analyses);
- selection of trend models (including the underlying methodology and approach) and associated estimates of trends or other changes to claims metrics;
- return on investment rate;
- operational expenses; and
- profit provisions (both in terms of the metric to use, and the level to target).

We believe that it is important to begin laying the foundation for a flexible future system, where insurers are able to include their best estimates of future costs based on their own assumptions, judged by FSRA on their own merit and basis of reasonableness, giving proper consideration to prediction uncertainty.

More specific to the reform factors and trends outlined in the OW Preliminary report, we discuss the following issues and our views more broadly over the following pages:

- selection of ultimates and valuation methodologies;
- use of indemnity + ALAE + ULAE vs use of indemnity alone;
- models complexity; and
- mobility parameter and COVID-19 Loss adjustment Factors

Any questions related to this submission may be directed to Philippe Gosselin by email at pgosselin@facilityassociation.com or by phone at 416-644-4968.

Best regards

Philippe Gosselin, FCAS, FCIA
VP Actuarial & CRO

GENERAL COMMENTS

The Oliver Wyman (OW) report entitled "*Preliminary Ontario Private Passenger Vehicles Annual Review Based on Insurance Industry Data Through December 31, 2020*", dated July 12, 2021 ("OW Preliminary Report" or "OW Report" or "benchmark report") is a substantial document, involving an level of complexity (in our view) of the analysis that is needed to support trend and reform factor benchmarks.

We support this approach in general, and appreciate that the OW Report includes:

- an assessment of the cost impact of Bill 15 and Bill 91 reforms in their trend models,
- an assessment of the impact of COVID-19 on the 2020 loss experience, and
- an assessment of a full credibility standard for loss trend purposes.

but regret that we lack resources to provide a detailed assessment of all aspects of the OW Report and their modeling approach.

We have focused our comments on the following areas as a result:

1. SELECTION OF ULTIMATES AND VALUATION METHODOLOGIES

For all coverages, the OW selection of ultimates (counts / amounts) is based on the selection of loss development factors (chain ladder method) using industry data through December 31, 2020.

We believe it is uncommon practice in Canada for a valuation actuary to rely on a single valuation methodology in completing a valuation as this introduces significant model risk (the risk that the model employed is not appropriate or has significant shortcomings for the experience being projected). To minimize model risk it is common to employ different models.

The strengths and weakness of the chain ladder method are well documented in actuarial literature. Some of the limitations (weaknesses/constraints) of the chain ladder method include:

- dependency on the experience, requiring the past to be perfectly predictive of the future – for Ontario experience in particular, there is evidence that claims reporting and development (link ratios) may be changing for some coverages, particularly in the face of increased catastrophic event activity, changes in economic activity, regulatory and potential product reforms, system changes, recent changes in company reserving patterns (changes in case reserve adequacy) and acknowledged data reporting quality concerns;
- highly-leveraged nature – for coverages with long settlement periods (for example, bodily injury), link ratios tend to have significant levels of volatility, particularly at earlier development ages.

As the selection of ultimates is a critical and foundational input of the loss trend analysis, we believe there are a number of factors contributing to the uncertainty in estimating Ontario PPV Industry ultimates and that the "range of reasonable" valuation estimates is wide which subsequently leads to a wide range of reasonable trend estimates.

2. USE OF INDEMNITY + ALAE + ULAE VS USE OF INDEMNITY ALONE

OW uses indemnity plus allocated loss adjustment expense (ALAE) plus unallocated loss adjustment expense (ULAE) as the basis[2] for loss amounts in their analysis.

We understand that the combined indemnity and expense data is the norm in the industry, but we would like to emphasize that the indemnity and expense data, as well as the underlying development and trend may be significantly different. Consequently, we should consider this if the analysis is based on the combination of both.

We see two primary ways that ULAE/ALAE shifts over time might impact or distort trend estimates: due to differences in development patterns for indemnity and ALAE, and the use of a calendar year ULAE factor applied to accident half coverage data.

- **ALAE develops differently than indemnity:** If the proportion of ALAE to indemnity is reasonably constant, using aggregate indemnity & ALAE triangles to determine ultimate levels is not problematic. However, if the relation changes (e.g impacts related to technology and claims system changes, a legal expense shift from ALAE to ULAE), for any reason, including the situation where ALAE is shifting to or from ULAE, then the aggregate development factors may no longer be appropriate.
- **Calendar year ULAE factors applied to accident half data:** As a calendar year factor, ULAE is made up of the sum of ULAE payments made by insurers during the course of a calendar year (and the change in the estimated unpaid ULAE level). In a steady state, it may be reasonable to assume that this would be stable over time. However, as per the preliminary report, the calendar year ULAE ratios are not stable and range from a low of 6.6% for calendar year 2010 to a high of 13.5% for calendar year 2020. Furthermore, applying these calendar year factors to accident half data at a coverage level will inappropriately apply the factor equally to first and second accident halfs for a given accident year, as well as equally across all coverages.

If the objective, as indicated in the report, is to minimize any impacts or distortions in the data that may arise from insurers change their mix of ULAE and ALAE over time, this can be achieved by modeling indemnity only data and recognizing that individual insurers are in a much better position to make direct adjustments for any shifts in their usage of ULAE vs ALAE over time, as they deem appropriate.

FA is analyzing the Ontario Industry PPV trends on an indemnity basis only and as explained above, this could result in different selections than those made by OW.

[2] *"The claim experience includes allocated loss adjustment expenses, and we include a provision for unallocated loss adjustment expenses (ULAE) based on the accident year ULAE factors published by GISA. In doing so, any distortions in the measured trend rate due to possible shifts over time between ULAE and ALAE from year to year is minimized."* [page 21, OW Preliminary Report]

3. MODEL COMPLEXITY

First, we would like to mention that we appreciate that the OW Report includes the model design matrix with estimated coefficients for the parameters the loss trend models.

OW has indicated that model complexity (or lack thereof, aka model parsimony) is considered[3] in their model selection process.

We agree with this approach. FA similarly considers model complexity in its selection process, with a general preference of simple models over more complex models. We would also suggest that complexity reflects stakeholders' ability (ease or difficulty) to explain the model design and use the model output.

However, as mentioned in our previous submission, we believe that, unfortunately with respect to the Accident Benefits reform factor approach, we would assess the OW models as complex. The model design and output is, in our view, difficult to explain as both reform scalars and trends are modeled as changing over a period of time related to the most recent changes. In particular, the output moves the reform benchmarks from a single factor at a coverage level, to several scalars and several trend factors, as highlighted in table 19 from the OW Preliminary Report (page 48) and replicated below:

Table 19 from OW Preliminary Report

Table 19: Accident Benefits Total Medical & Rehabilitation including Attendant Care – Semi-Annual Loss Cost Trend and Reform Factors

Accident Semester	Semi-Annual Trend Rate	Trend Factor to 10/1/2020	Scalar Reform Factor
2015-01	3.6%	1.050	0.795
2015-02	3.6%	1.013	0.795
2016-01	2.2%	0.979	0.796
2016-02	0.1%	0.958	0.858
2017-01	-0.6%	0.957	0.961
2017-02	-0.6%	0.963	1.000
2018-01	-0.6%	0.969	1.000
2018-02	-0.6%	0.975	1.000
2019-01	-0.6%	0.981	1.000
2019-02	-0.6%	0.988	1.000
2020-01	-0.6%	0.994	1.000
2020-02		1.000	1.000

We believe the OW reform approach is overly complex in approach, and may lead to low variance / higher bias, resulting in future coefficient estimates that are at risk of significant change. We question whether the additional complexity is necessary. In particular, the OW ME and DI models introduced two complexities:

- non-binary explanatory variables for the reform periods – that is, fractional factors applied to accident half data to give weight over time to differentiate between claims arising that were subject to reforms and those that were not

[3] *"Our selected model is based on our assessment of the best model through a holistic view of the statistical tests, historical data (changes in patterns and spikes) and model parsimony."* [page 31, OW Preliminary Report]

- staggered (non-midpoint starting value (2/12ths), and a non-half year first period (5/12ths)) variable for time related to the reform impacts – we recognize that this was set to align with the effective date of the reform, but contend this approach has led to a fragile model

As discussed earlier, due to constraints in attempting to pull the data together as used by OW, we instead applied the OW design matrices to the FA ME (OW Report Appendix H Page 1) and FA DI (OW Report Appendix H Page 2) data sets.

Complexity #1 - Non-binary explanatory variables for the reform periods

In the FA general approach, Scalars are introduced in models as dummy variables, taking values of 0 or 1. The complexity OW added was to introduce non-binary explanatory variables for the reform as shown by Scalar 1 values below (OW Report Appendix H Page 1 and 2):

- 0.00 for accident halfs 2015-H2 and prior
- 0.01 for accident half 2016-H1
- 0.33 for accident half 2016-H2
- 0.83 for accident half 2017-H1
- for accident halfs 2017-H2 and subsequent

The factors were determined to give weight over time to differentiate between claims arising that were subject to reforms / changes and those that were not. We have no general issue on the approach, but it does beg the question as to whether it results in "better" estimates than a simpler model that picks a single period as the point at which to determine the scalar change.

Complexity #2 – staggered variable for time related to the reform impacts

More difficult for us to comprehend was that the OW models for ME and DI also included explanatory variable values for trend that did not reflect consistent level changes. In our view, trends in the models reflect temporal changes (i.e. changes over time), and a basic assumption is that for an accident half, the claims occur, on average, at the mid-point of the accident half. As a result, time explanatory variables would be an initial value, and increase by half a year. For FA, when a new trend period is introduced, the first period is assigned an explanatory variable value of 0.25, with each subsequent variable value increasing by 0.50 (or half a year). This puts the average accident dates assumed by the model in the middle of the accident halfs.

The complexity OW added was to introduce a non-midpoint starting value, and a non-half year first change as indicated below (OW Report Appendix H Page 1 and 2):

- 0.00 for accident halfs 2016-H1 and prior
- 0.17 for accident half 2016-H2
- 0.58 for accident half 2017-H1 (an increase of 0.41, rather than 0.50)
- 1.08 for accident half 2017-H2 and increasing by 0.50 for each subsequent accident half

For temporal spacing, the first two intervals are unusual, and we would ask whether this is necessary.

We have included some details of our testing in Appendix A and would be happy to discuss if needed.

In sum, we would view two takeaways:

1. the minor weight given to 2016-H1 for scalar 1 do not appear to be necessary from a statistical standpoint (and, as such, we recommended replacing with 0);
2. the additional temporal differences introduced for trend do not appear to be necessary from a statistical standpoint (and, as such, we recommended replacing with standard values).

4. MOBILITY PARAMETER AND COVID-19 LOSS ADJUSTMENT FACTORS

OW Report includes estimated COVID-19 Loss adjustment Factors for 2020-H1, 2020-H2, 2021-H1 and 2021-H2, and introduces Mobility Parameter in the loss trend models.

The OW models introduce non-binary explanatory variables for mobility parameter as indicated below (as examples, we are using ME and DI, OW Report Appendix H Page 1 and 2):

- 0.00 for accident halfs 2019-H2 and prior
- -28.63 for accident half 2020-H1 for ME and -29.00 (should this be -28.63?) for DI
- -33.22 for accident half 2020-H2 for ME and -33.22 for DI

We appreciate the inclusion of COVID-19 Loss adjustment Factors[4], but not sure about the Mobility parameter with COVID-19 Loss Adjustment Factors as temporal variables in the loss trend model. The model design and output is, in our view, difficult to explain and use.

In the FA general approach, Scalars are introduced in models as dummy variables, taking values of 0 or 1. The model results based on FA approach, with only replaced Scalar 2 temporal variables of COVID-19 Loss Adjustment Factors to 1, are summarized below:

Model Output – OW ME Design Matrix applied to FA ME data set, but with the temporal variables at 2020-H1 and 2020-H2 (-28.63 & -33.22) change to FA standard value 1

FITTED TREND STRUCTURE REGRESSION STATISTICS

Multiple R	R^2	Adjusted R^2	S.E. of Estimate	# of Obs. n	# of Obs. Excluded	# parameters p
0.9559	**0.9138**	**0.8830**	0.0469	20	20	6

Runs-Test Result: 2.2779 RESIDUALS RUNS NOT RANDOM ; residuals normal

parameters with p-value >5%: 0 (intercept specifically not included)

	Coefficients	S.E.	t-Stat	p-value	C.I. 95% Lower	C.I. 95% Upper	Selected Coeff.	
	1	2						
Intercept	(130.578)	17.208	(7.588)	0.0%	(167.486)	(93.670)	(130.578)	6
Season	0.132	0.021	6.225	0.0%	0.087	0.178	0.132	5
All Years	0.067	0.009	7.897	0.0%	0.049	0.086	0.067	4
Scalar 1	(0.256)	0.061	(4.212)	0.1%	(0.386)	(0.125)	(0.256)	3
Trend 1	(0.065)	0.024	(2.658)	1.9%	(0.117)	(0.013)	(0.065)	2
Scalar 2	(0.174)	0.060	(2.875)	1.2%	(0.303)	(0.044)	(0.174)	1
Trend 2	-	-	-	n/a	-	-	-	0
Scalar 3	-	-	-	n/a	-	-	-	0
Trend 3	-	-	-	n/a	-	-	-	0
Scalar 4	-	-	-	n/a	-	-	-	0
Trend 4	-	-	-	n/a	-	-	-	0

SELECTED TREND STRUCTURE REGRESSION STATISTICS

Multiple R	R^2	Adjusted R^2	S.E. of Estimate	# of Obs. n	# of Obs. Excluded	# parameters p
0.9559	**0.9138**	**0.8830**	0.0469	20	20	6

Runs-Test Result: 2.2779 RESIDUALS RUNS NOT RANDOM ; residuals normal

	Fitted Annual	Previous Selected	Selected Annual	selected = fitted	
past	**7.0%**	**4.1%**	**7.0%**	'15H2	=> last period in "past"
future	**0.3%**	**4.1%**	**0.3%**		

Cumulative Trends (summed coefficients)	fitted coeff	S.E.	t-Stat	p-value	C.I. 95% Lower	C.I. 95% Upper	Selected Coeff.
All Yrs or AY	0.067	0.009	7.897	0.0%	0.049	0.086	0.067
AY+1	0.003	0.024	0.110	91.4%	(0.049)	0.054	0.003
AY+1+2	n/a	n/a	n/a	n/a	n/a	n/a	n/a
AY+1+2+3	n/a	n/a	n/a	n/a	n/a	n/a	n/a
AY+1+2+3+4	n/a	n/a	n/a	n/a	n/a	n/a	n/a

Comparing the coefficient estimates for All Years, Trend 1 and Scalar 1, it does not indicate any statistically significant difference between the two models (OW's estimated coefficients are within 1 standard error of the FA's estimated coefficients), except Scalar 2 (mobility parameter,

[4] OW Report Appendix I provides analysis for COVID-19 loss adjustment factors.

which is associated with COVID-19). The FA model based on the industry data (without adjustment) estimated scalar 2 coefficient of -17.4%, and it is easy to explain that the estimated average annual COVID-19 impact based on the industry data is about -15.9% decreasing comparing to pre-pandemic. However, it is difficult to explain the OW estimated mobility coefficient of 1.1% and the COVID-19 Loss Adjustment Factors.

We conducted the same exercise in relation to DI and found that the temporal variables for mobility parameter were influential. If change the mobility temporal variables from COVID-19 Loss Adjustment Factors to 1 as FA's standard values, the model indicates a 0.0% trend and a mobility scalar coefficient of -46.6% +/-4.3% started at 2020 comparing to pre-pandemic loss cost level.

Model Output – OW DI Design Matrix applied to FA DI data set, but with the temporal variable at 2020-H1 and 2020-H2 (-29.00 & -33.22) change to FA standard value 1, All Years, Trend 1 and Scalar 1 removed as not being statistical significant

FITTED TREND STRUCTURE REGRESSION STATISTICS

Multiple R	R^2	Adjusted R^2	S.E. of Estimate	# of Obs. n	# of Obs. Excluded	# parameters p
0.9412	**0.8858**	**0.8724**	0.0582	20	20	3

Runs-Test Result: 3.7940 RESIDUALS RUNS NOT RANDOM ; residuals normal

parameters with p-value >5%: 0 (intercept specifically not included)

	Coefficients	S.E.	t-Stat	p-value	C.I. 95% Lower	C.I. 95% Upper	Selected Coeff.	
	1	2						
Intercept	0.737	0.019	39.008	0.0%	0.698	0.777	0.737	3
Season	0.109	0.026	4.195	0.1%	0.054	0.164	0.109	2
All Years	-	-	-	n/a	-	-	-	0
Scalar 1	-	-	-	n/a	-	-	-	0
Trend 1	-	-	-	n/a	-	-	-	0
Scalar 2	(0.464)	0.043	(10.690)	0.0%	(0.555)	(0.372)	(0.464)	1
Trend 2	-	-	-	n/a	-	-	-	0
Scalar 3	-	-	-	n/a	-	-	-	0
Trend 3	-	-	-	n/a	-	-	-	0
Scalar 4	-	-	-	n/a	-	-	-	0
Trend 4	-	-	-	n/a	-	-	-	0

SELECTED TREND STRUCTURE REGRESSION STATISTICS

Multiple R	R^2	Adjusted R^2	S.E. of Estimate	# of Obs. n	# of Obs. Excluded	# parameters p
0.9412	**0.8858**	**0.8724**	0.0582	20	20	3

Runs-Test Result: 3.7940 RESIDUALS RUNS NOT RANDOM ; residuals normal

	Fitted Annual	Previous Selected	Selected Annual	selected = fitted		
past	0.0%	(0.1%)	0.0%		'15H2	=> last period in "past"
future	0.0%	(0.1%)	0.0%			

Cumulative Trends (summed coefficients)	fitted coeff	S.E.	t-Stat	p-value	C.I. 95% Lower	C.I. 95% Upper	Selected Coeff.
All Yrs or AY	n/a	n/a	n/a	n/a	n/a	n/a	n/a
AY+1	n/a	n/a	n/a	n/a	n/a	n/a	n/a
AY+1+2	n/a	n/a	n/a	n/a	n/a	n/a	n/a
AY+1+2+3	n/a	n/a	n/a	n/a	n/a	n/a	n/a
AY+1+2+3+4	n/a	n/a	n/a	n/a	n/a	n/a	n/a

Appendix A - Testing of Complexities #1 and #2

Total Medical & Rehabilitation including Attendant Care (ME)

First, we applied the OW design matrix to the FA ME data set (with data for 2010-H2 and earlier excluded to follow our understanding of the data OW modeled). The result is summarized below.

Model Output – OW ME Design Matrix applied to FA ME data set

FITTED TREND STRUCTURE REGRESSION STATISTICS

Multiple R	R^2	Adjusted R^2	S.E. of Estimate	# of Obs. n	# of Obs. Excluded	# parameters p
0.9506	0.9037	0.8693	0.0496	20	20	6

Runs-Test Result: 2.2779 RESIDUALS RUNS NOT RANDOM ; residuals normal

parameters with p-value >5%: 0 (intercept specifically not included)

	Coefficients	S.E.	t-Stat	p-value	C.I. 95% Lower	C.I. 95% Upper	Selected Coeff.	
	1	2						
Intercept	(130.157)	18.189	(7.156)	0.0%	(169.169)	(91.146)	(130.157)	6
Season	0.136	0.022	6.051	0.0%	0.087	0.184	0.136	5
All Years	0.067	0.009	7.448	0.0%	0.048	0.087	0.067	4
Scalar 1	(0.248)	0.064	(3.845)	0.2%	(0.386)	(0.110)	(0.248)	3
Trend 1	(0.069)	0.026	(2.670)	1.8%	(0.125)	(0.014)	(0.069)	2
Scalar 2	0.005	0.002	2.434	2.9%	0.001	0.010	0.005	1
Trend 2	-	-	-	n/a	-	-	-	0
Scalar 3	-	-	-	n/a	-	-	-	0
Trend 3	-	-	-	n/a	-	-	-	0
Scalar 4	-	-	-	n/a	-	-	-	0
Trend 4	-	-	-	n/a	-	-	-	0

SELECTED TREND STRUCTURE REGRESSION STATISTICS

Multiple R	R^2	Adjusted R^2	S.E. of Estimate	# of Obs. n	# of Obs. Excluded	# parameters p
0.9506	0.9037	0.8693	0.0496	20	20	6

Runs-Test Result: 2.2779 RESIDUALS RUNS NOT RANDOM ; residuals normal

	Fitted Annual	Previous Selected	Selected Annual	selected = fitted	
past	7.0%	4.1%	7.0%	'15H2	=> last period in "past"
future	(0.2%)	4.1%	(0.2%)		

Cumulative Trends (summed coefficients)	fitted coeff	S.E.	t-Stat	p-value	C.I. 95% Lower	C.I. 95% Upper	Selected Coeff.
All Yrs or AY	0.067	0.009	7.448	0.0%	0.048	0.087	0.067
AY+1	(0.002)	0.026	(0.086)	93.3%	(0.057)	0.053	(0.002)
AY+1+2	n/a	n/a	n/a	n/a	n/a	n/a	n/a
AY+1+2+3	n/a	n/a	n/a	n/a	n/a	n/a	n/a
AY+1+2+3+4	n/a	n/a	n/a	n/a	n/a	n/a	n/a

As indicated above,

- the model's estimate of Scalar 1 (i.e. the reform factor) is -24.8% +/-6.4% vs OW estimate of -23.0%,
- the model's estimate of All Years is +6.7% +/-0.9% vs. OW estimate of +7.0%,
- Trend 1 is -6.9% +/-2.6%[5] vs. OW estimate of -8.3%, and
- the model's estimate of Scalar 2 (mobility parameter) is +0.5% +/-0.2% vs OW estimate of +1.1%.

We notice that both OW reform scalar and trends estimates are within a standard error of the FA estimates, except mobility parameter (scalar 2) that is slightly outside a standard error of the FA estimate.

So, our first test is to see if the temporal differences used by OW are influential to the model results. To test this, we have replaced the 0.17, 0.58, 1.08 etc. with the FA standard 0.25, 0.75, 1.25 etc. The model results are summarized at the top of the next page.

[5]Because of the model design where Trend 1 is introduced as an addition to the All Years coefficient, the cumulative trend estimate table on the lower right applies.

Model Output – OW ME Design Matrix applied to FA ME data set, but with the temporal variables changed to FA standard values

FITTED TREND STRUCTURE REGRESSION STATISTICS

Multiple R	R^2	Adjusted R^2	S.E. of Estimate	# of Obs. n	# of Obs. Excluded	# parameters p
0.9510	0.9043	0.8702	0.0494	20	20	6

Runs-Test Result: 2.2779 RESIDUALS RUNS NOT RANDOM ; residuals normal

parameters with p-value >5%: 0 (intercept specifically not included)

	Coefficients	S.E.	t-Stat	p-value	C.I. 95% Lower	C.I. 95% Upper	Selected Coeff.	
	1	2						
Intercept	(130.387)	18.139	(7.188)	0.0%	(169.291)	(91.482)	(130.387)	6
Season	0.136	0.022	6.074	0.0%	0.088	0.183	0.136	5
All Years	0.067	0.009	7.481	0.0%	0.048	0.087	0.067	4
Scalar 1	(0.234)	0.067	(3.466)	0.4%	(0.379)	(0.089)	(0.234)	3
Trend 1	(0.071)	0.026	(2.697)	1.7%	(0.127)	(0.014)	(0.071)	2
Scalar 2	0.005	0.002	2.405	3.1%	0.001	0.009	0.005	1
Trend 2	-	-	-	n/a	-	-	-	0
Scalar 3	-	-	-	n/a	-	-	-	0
Trend 3	-	-	-	n/a	-	-	-	0
Scalar 4	-	-	-	n/a	-	-	-	0
Trend 4	-	-	-	n/a	-	-	-	0

SELECTED TREND STRUCTURE REGRESSION STATISTICS

Multiple R	R^2	Adjusted R^2	S.E. of Estimate	# of Obs. n	# of Obs. Excluded	# parameters p
0.9510	0.9043	0.8702	0.0494	20	20	6

Runs-Test Result: 2.2779 RESIDUALS RUNS NOT RANDOM ; residuals normal

	Fitted Annual	Previous Selected	Selected Annual	selected = fitted	
past	7.0%	4.1%	7.0%	'15H2	=> last period in "past"
future	(0.3%)	4.1%	(0.3%)		

Cumulative Trends (summed coefficients)	fitted coeff	S.E.	t-Stat	p-value	C.I. 95% Lower	C.I. 95% Upper	Selected Coeff.
All Yrs or AY	0.067	0.009	7.481	0.0%	0.048	0.087	0.067
AY+1	(0.003)	0.026	(0.128)	90.0%	(0.058)	0.052	(0.003)
AY+1+2	n/a	n/a	n/a	n/a	n/a	n/a	n/a
AY+1+2+3	n/a	n/a	n/a	n/a	n/a	n/a	n/a
AY+1+2+3+4	n/a	n/a	n/a	n/a	n/a	n/a	n/a

Comparing the coefficient estimates for all parameters (All Years, Trend 1, Scalar 1, and Scalar 2), it does not indicate any statistically significant difference between the two models. As a result, we would view the temporal differences introduced by OW as being unnecessary. We believe replacing them with standard values will make the model easier to interpret and explain, with no loss in statistical accuracy in the estimation of coefficients.

We next consider whether the 0.01 scalar weight given to 2016-H1 is worthwhile. The model results are summarized below.

Model Output – OW ME Design Matrix applied to FA ME data set, but with the temporal variable at 2016-H1 (0.01) change to FA standard value 0

FITTED TREND STRUCTURE REGRESSION STATISTICS

Multiple R	R^2	Adjusted R^2	S.E. of Estimate	# of Obs. n	# of Obs. Excluded	# parameters p
0.9510	0.9044	0.8702	0.0494	20	20	6

Runs-Test Result: 2.2779 RESIDUALS RUNS NOT RANDOM ; residuals normal

parameters with p-value >5%: 0 (intercept specifically not included)

	Coefficients	S.E.	t-Stat	p-value	C.I. 95% Lower	C.I. 95% Upper	Selected Coeff.	
	1	2						
Intercept	(129.874)	18.068	(7.188)	0.0%	(168.627)	(91.121)	(129.874)	6
Season	0.136	0.022	6.086	0.0%	0.088	0.184	0.136	5
All Years	0.067	0.009	7.482	0.0%	0.048	0.086	0.067	4
Scalar 1	(0.248)	0.064	(3.872)	0.2%	(0.385)	(0.110)	(0.248)	3
Trend 1	(0.069)	0.026	(2.667)	1.8%	(0.125)	(0.014)	(0.069)	2
Scalar 2	0.005	0.002	2.448	2.8%	0.001	0.009	0.005	1
Trend 2	-	-	-	n/a	-	-	-	0
Scalar 3	-	-	-	n/a	-	-	-	0
Trend 3	-	-	-	n/a	-	-	-	0
Scalar 4	-	-	-	n/a	-	-	-	0
Trend 4	-	-	-	n/a	-	-	-	0

SELECTED TREND STRUCTURE REGRESSION STATISTICS

Multiple R	R^2	Adjusted R^2	S.E. of Estimate	# of Obs. n	# of Obs. Excluded	# parameters p
0.9510	0.9044	0.8702	0.0494	20	20	6

Runs-Test Result: 2.2779 RESIDUALS RUNS NOT RANDOM ; residuals normal

	Fitted Annual	Previous Selected	Selected Annual	selected = fitted	
past	6.9%	4.1%	6.9%	'15H2	=> last period in "past"
future	(0.2%)	4.1%	(0.2%)		

Cumulative Trends (summed coefficients)	fitted coeff	S.E.	t-Stat	p-value	C.I. 95% Lower	C.I. 95% Upper	Selected Coeff.
All Yrs or AY	0.067	0.009	7.482	0.0%	0.048	0.086	0.067
AY+1	(0.002)	0.025	(0.080)	93.7%	(0.057)	0.053	(0.002)
AY+1+2	n/a	n/a	n/a	n/a	n/a	n/a	n/a
AY+1+2+3	n/a	n/a	n/a	n/a	n/a	n/a	n/a
AY+1+2+3+4	n/a	n/a	n/a	n/a	n/a	n/a	n/a

Comparing the coefficient estimates for all parameters (All Years, Trend 1, Scalar 1, and Scalar 2), it does not indicate any statistically significant difference between the two models. As a result, we would view the 0.01 scalar weight given to 2016-H1 being unnecessary. We believe replacing it with 0 will make the model easier to interpret and explain, with no loss in statistical accuracy in the estimation of coefficients.

Total Disability Income (DI)

We conducted the same exercise in relation to DI. We reached the same conclusion with respect to the temporal variables and the 0.01 weight given to 2016-H1 were not influential, and we would recommend that it be omitted for simplicity.

The model summary tables are provided on the follow pages (the FA data as modeled does not result in negative future loss cost trend estimates).

Model Output – OW DI Design Matrix applied to FA DI data set

FITTED TREND STRUCTURE REGRESSION STATISTICS

Multiple R	R^2	Adjusted R^2	S.E. of Estimate	# of Obs. n	# of Obs. Excluded	# parameters p
0.9367	0.8773	0.8335	0.0447	20	20	6

Runs-Test Result: 3.2822 RESIDUALS RUNS NOT RANDOM; resids NOT normal
parameters with p-value >5%: 1 (intercept specifically not included)

	Coefficients	S.E.	t-Stat	p-value	C.I. Lower	95% Upper	Selected Coeff.	
	1	2						
Intercept	(88.950)	16.381	(5.430)	0.0%	(124.083)	(53.817)	(88.950)	6
Season	0.122	0.020	6.046	0.0%	0.079	0.165	0.122	5
All Years	0.046	0.008	5.679	0.0%	0.029	0.064	0.046	4
Scalar 1	(0.150)	0.058	(2.583)	2.2%	(0.274)	(0.025)	(0.150)	3
Trend 1	(0.032)	0.023	(1.381)	18.9%	(0.083)	0.018	(0.032)	2
Scalar 2	0.006	0.002	3.445	0.4%	0.002	0.010	0.006	1
Trend 2	-	-	-	n/a	-	-	-	0
Scalar 3	-	-	-	n/a	-	-	-	0
Trend 3	-	-	-	n/a	-	-	-	0
Scalar 4	-	-	-	n/a	-	-	-	0
Trend 4	-	-	-	n/a	-	-	-	0

SELECTED TREND STRUCTURE REGRESSION STATISTICS

Multiple R	R^2	Adjusted R^2	S.E. of Estimate	# of Obs. n	# of Obs. Excluded	# parameters p
0.9367	0.8773	0.8335	0.0447	20	20	6

Runs-Test Result: 3.2822 RESIDUALS RUNS NOT RANDOM; resids NOT normal

	Fitted Annual	Previous Selected	Selected Annual	selected = fitted	
past	4.7%	1.0%	4.7%	'15H2	=> last period in "past"
future	1.4%	1.0%	1.4%		

Cumulative Trends (summed coefficients)	fitted coeff	S.E.	t-Stat	p-value	C.I. Lower	95% Upper	Selected Coeff.
All Yrs or AY	0.046	0.008	5.679	0.0%	0.029	0.064	0.046
AY+1	0.014	0.023	0.601	55.7%	(0.036)	0.063	0.014
AY+1+2	n/a	n/a	n/a	n/a	n/a	n/a	n/a
AY+1+2+3	n/a	n/a	n/a	n/a	n/a	n/a	n/a
AY+1+2+3+4	n/a	n/a	n/a	n/a	n/a	n/a	n/a

Model Output – OW DI Design Matrix applied to FA DI data set, Trend 1 removed as being not statistical significant

FITTED TREND STRUCTURE REGRESSION STATISTICS

Multiple R	R^2	Adjusted R^2	S.E. of Estimate	# of Obs. n	# of Obs. Excluded	# parameters p
0.9277	0.8606	0.8235	0.0460	20	20	5

Runs-Test Result: 3.9497 RESIDUALS RUNS NOT RANDOM ; residuals normal
parameters with p-value >5%: 0 (intercept specifically not included)

	Coefficients	S.E.	t-Stat	p-value	C.I. Lower	95% Upper	Selected Coeff.	
	1	2						
Intercept	(83.950)	16.452	(5.103)	0.0%	(119.017)	(48.883)	(83.950)	5
Season	0.119	0.021	5.773	0.0%	0.075	0.164	0.119	4
All Years	0.044	0.008	5.351	0.0%	0.026	0.061	0.044	3
Scalar 1	(0.200)	0.047	(4.283)	0.1%	(0.300)	(0.100)	(0.200)	2
Trend 1	-	-	-	n/a	-	-	-	0
Scalar 2	0.008	0.001	6.394	0.0%	0.006	0.011	0.008	1
Trend 2	-	-	-	n/a	-	-	-	0
Scalar 3	-	-	-	n/a	-	-	-	0
Trend 3	-	-	-	n/a	-	-	-	0
Scalar 4	-	-	-	n/a	-	-	-	0
Trend 4	-	-	-	n/a	-	-	-	0

SELECTED TREND STRUCTURE REGRESSION STATISTICS

Multiple R	R^2	Adjusted R^2	S.E. of Estimate	# of Obs. n	# of Obs. Excluded	# parameters p
0.9277	0.8606	0.8235	0.0460	20	20	5

Runs-Test Result: 3.9497 RESIDUALS RUNS NOT RANDOM ; residuals normal

	Fitted Annual	Previous Selected	Selected Annual	selected = fitted	
past	4.5%	1.0%	4.5%	'15H2	=> last period in "past"
future	4.5%	1.0%	4.5%		

Cumulative Trends (summed coefficients)	fitted coeff	S.E.	t-Stat	p-value	C.I. Lower	95% Upper	Selected Coeff.
All Yrs or AY	0.044	0.008	5.351	0.0%	0.026	0.061	0.044
AY+1	n/a	n/a	n/a	n/a	n/a	n/a	n/a
AY+1+2	n/a	n/a	n/a	n/a	n/a	n/a	n/a
AY+1+2+3	n/a	n/a	n/a	n/a	n/a	n/a	n/a
AY+1+2+3+4	n/a	n/a	n/a	n/a	n/a	n/a	n/a

Model Output – OW DI Design Matrix applied to FA DI data set, but with the temporal variables changed to FA standard values, Trend 1 removed as not being statistical significant

FITTED TREND STRUCTURE REGRESSION STATISTICS

Multiple R	R^2	Adjusted R^2	S.E. of Estimate	# of Obs. n	# of Obs. Excluded	# parameters p
0.9277	0.8606	0.8235	0.0460	20	20	5

Runs-Test Result: 3.9497 RESIDUALS RUNS NOT RANDOM ; residuals normal
parameters with p-value >5%: 0 (intercept specifically not included)

	Coefficients	S.E.	t-Stat	p-value	C.I. Lower	95% Upper	Selected Coeff.	
	1	2						
Intercept	(83.950)	16.452	(5.103)	0.0%	(119.017)	(48.883)	(83.950)	5
Season	0.119	0.021	5.773	0.0%	0.075	0.164	0.119	4
All Years	0.044	0.008	5.351	0.0%	0.026	0.061	0.044	3
Scalar 1	(0.200)	0.047	(4.283)	0.1%	(0.300)	(0.100)	(0.200)	2
Trend 1	-	-	-	n/a	-	-	-	0
Scalar 2	0.008	0.001	6.394	0.0%	0.006	0.011	0.008	1
Trend 2	-	-	-	n/a	-	-	-	0
Scalar 3	-	-	-	n/a	-	-	-	0
Trend 3	-	-	-	n/a	-	-	-	0
Scalar 4	-	-	-	n/a	-	-	-	0
Trend 4	-	-	-	n/a	-	-	-	0

SELECTED TREND STRUCTURE REGRESSION STATISTICS

Multiple R	R^2	Adjusted R^2	S.E. of Estimate	# of Obs. n	# of Obs. Excluded	# parameters p
0.9277	0.8606	0.8235	0.0460	20	20	5

Runs-Test Result: 3.9497 RESIDUALS RUNS NOT RANDOM ; residuals normal

	Fitted Annual	Previous Selected	Selected Annual	selected = fitted	
past	4.5%	1.0%	4.5%	'15H2	=> last period in "past"
future	4.5%	1.0%	4.5%		

Cumulative Trends (summed coefficients)	fitted coeff	S.E.	t-Stat	p-value	C.I. Lower	95% Upper	Selected Coeff.
All Yrs or AY	0.044	0.008	5.351	0.0%	0.026	0.061	0.044
AY+1	n/a	n/a	n/a	n/a	n/a	n/a	n/a
AY+1+2	n/a	n/a	n/a	n/a	n/a	n/a	n/a
AY+1+2+3	n/a	n/a	n/a	n/a	n/a	n/a	n/a
AY+1+2+3+4	n/a	n/a	n/a	n/a	n/a	n/a	n/a

Model Output – OW DI Design Matrix applied to FA DI data set, but with the temporal variable at 2016-H1 (0.01) change to FA standard value 0, Trend 1 removed as not being statistical significant

FITTED TREND STRUCTURE REGRESSION STATISTICS

Multiple R	R^2	Adjusted R^2	S.E. of Estimate	# of Obs. n	# of Obs. Excluded	# parameters p
0.9282	**0.8616**	**0.8247**	0.0458	20	20	5

Runs-Test Result: 3.9497 **RESIDUALS RUNS NOT RANDOM** ; residuals normal

 # parameters with p-value >5% **0** (intercept specifically not included)

	Coefficients	S.E.	t-Stat	p-value	C.I. Lower	95% Upper	Selected Coeff.	
	1	2						
Intercept	(83.811)	16.329	(5.133)	0.0%	(118.614)	(49.007)	(83.811)	5
Season	0.120	0.021	5.806	0.0%	0.076	0.164	0.120	4
All Years	0.044	0.008	5.383	0.0%	0.026	0.061	0.044	3
Scalar 1	(0.200)	0.046	(4.312)	0.1%	(0.298)	(0.101)	(0.200)	2
Trend 1	-	-	-	n/a	-	-	-	0
Scalar 2	0.008	0.001	6.413	0.0%	0.006	0.011	0.008	1
Trend 2	-	-	-	n/a	-	-	-	0
Scalar 3	-	-	-	n/a	-	-	-	0
Trend 3	-	-	-	n/a	-	-	-	0
Scalar 4	-	-	-	n/a	-	-	-	0
Trend 4	-	-	-	n/a	-	-	-	0

SELECTED TREND STRUCTURE REGRESSION STATISTICS

Multiple R	R^2	Adjusted R^2	S.E. of Estimate	# of Obs. n	# of Obs. Excluded	# parameters p
0.9282	**0.8616**	**0.8247**	0.0458	20	20	5

Runs-Test Result: 3.9497 **RESIDUALS RUNS NOT RANDOM** ; residuals normal

	Fitted Annual	Previous Selected	Selected Annual	selected = fitted	
past	4.5%	1.0%	4.5%	'15H2	=> last period in "past"
future	4.5%	1.0%	4.5%		

Cumulative Trends (summed coefficients)	fitted coeff	S.E.	t-Stat	p-value	C.I. Lower	95% Upper	Selected Coeff.
All Yrs or AY	0.044	0.008	5.383	0.0%	0.026	0.061	0.044
AY+1	n/a	n/a	n/a	n/a	n/a	n/a	n/a
AY+1+2	n/a	n/a	n/a	n/a	n/a	n/a	n/a
AY+1+2+3	n/a	n/a	n/a	n/a	n/a	n/a	n/a
AY+1+2+3+4	n/a	n/a	n/a	n/a	n/a	n/a	n/a