Creating a Model of the Impact of Inflation on P/C Reinsurance Loss Reserves

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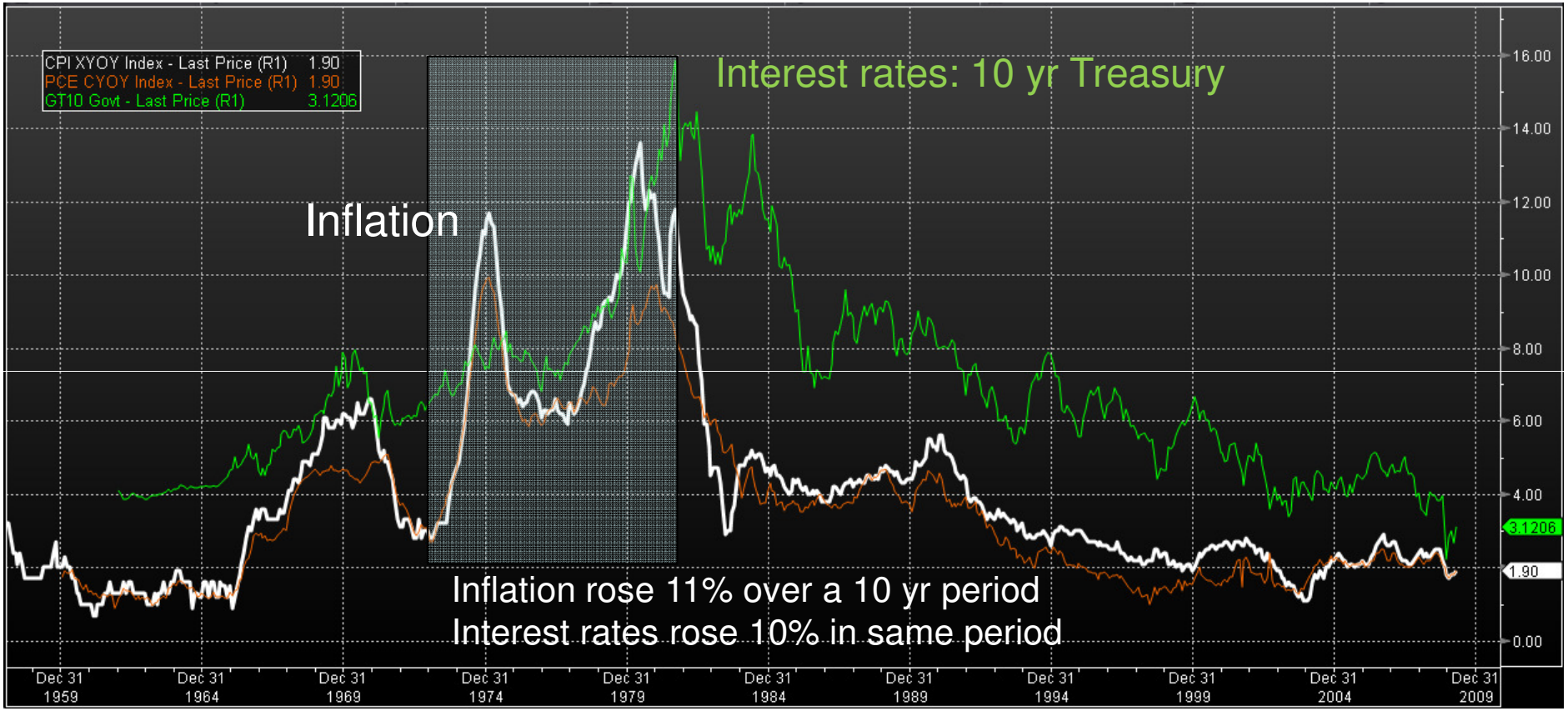
Spikes in Inflation: Historical Perspective

2



- High inflation period in the 1970's accompanied by rising interest rates over a multi-year period.

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Modeling the Effect of Inflation on P/C Loss Reserves

1. Goals and Scope of Presentation
2. How is inflation currently handled?
3. What we're trying to model?
4. "Delta Approach"
5. Communicating Results
6. Future Considerations and Improvements

Questions?

1 Goals and Scope of Presentation

Scope of Presentation

- Overview of steps needed to create a **model** for the effect of inflation on **held** loss reserves
  - not a discussion on inflation itself
- Highlight Considerations to be made

Personal Goals

- Include at least one formula
  (for the mathematical types)
- Keep it short, simple, intuitive
  (for the rest of us)
- Give numbers
  (we all like numbers to look at)
- No actuary jokes
- Slyly avoid questions
- Get home early

2 How is inflation currently handled?

Claims Dept

- reserve set based soley on conditions which exist at the time adjusted
  - results of settlements (recent) of similar claims
    - the "going rate" of similar settlements
  - future inflation is not a consideration
    - though WC , Med Mal will have COLA, inflation factored into initial estimate
- "Modal Reserving"
  - results in IBNER set by actuary
- Keep eye out for use of *predictive claims modeling* by Claims Dept

Actuaries

Implicit assumptions baked into standard triangles

- How recent of a "window" was used for selection
  - e.g all year weighted vs recent 3 yrs
  - Paid Loss Triangles more responsive the Reported Triangles
  - Degree that Reserves depends on IELR (further outdated)
- Were there any explicit, judgemental loads added?
- Afftect Reporting Patterns, and IELR

lag before inflaton hits the actuary's triangle

3 What we're trying to model?

What are we trying to Model?

"Claims Inflation" definition

change in the cost of the claim over time due to external effects

excludes:

i.e. not due to an internal change in philosophy re: claims adequacy - e.g. to strengthen reserves

adverse development due to poor adjusting, misinformation, new discoveries, poor containment

(that's what standard IBNER is for)

i.e. amount we misestimated due to "imperfect" claims adjustment

includes:

trends happening in the external world which will affect the ultimate settlement of the claim

not trying to perfect existing reserves, only factor in inflation

Problems at hand

Considerations

3 What we're trying to model?

What are we trying to Model?

Problems at hand

- Claims Dept doesn't account for inflation
- Actuaries (IBNR) already do but don't know how much
- What to do when a non-explicit assumption changes by an unknown amount
- How can you model add'l margin needed if you don't know how much of it was already reserved for

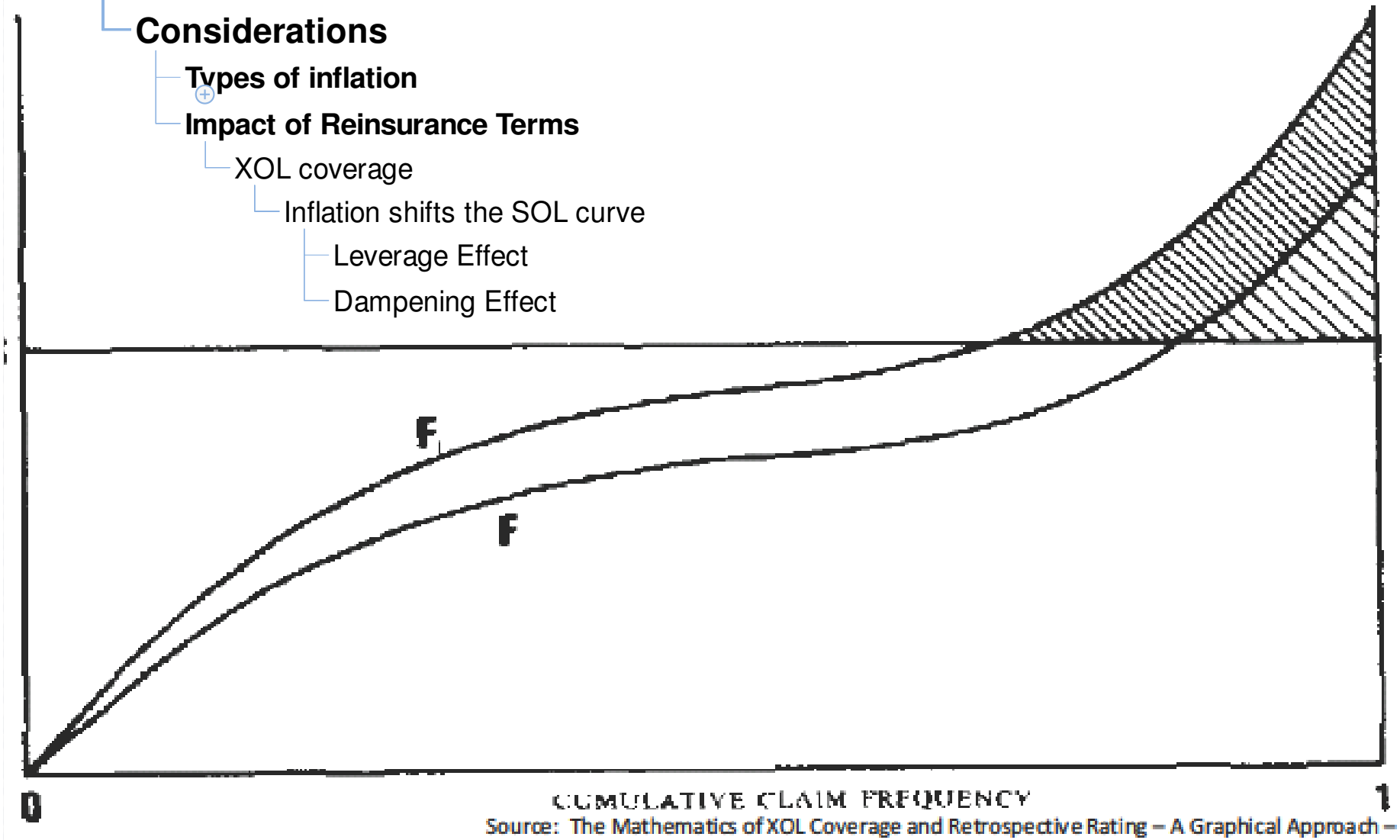
- Year to Year changes in inflation rates are impossible to predict (Feldblum)

Considerations

- **Problems at hand**
- **Considerations**
  - **Types of inflation**
    - Claims Inflation
      - reparation costs more than original estimate
    - Social Inflation
      - Inflation due to changes in the social/political environment
      - Social Inflation affects larger claims more than smaller ones
        - => Greater effect on reinsurers who deal with the large claims
      - Social Inflation affects primarily personal injury claims (Feldblum)
    - claims inflation <> economic inflation trends
      - Impact on Property Claims is subject to debate (Sullivan, Feldblum, others)
    - Larger Claims have longer settlement lag and thus are more affected by year to year changes in inflation rates. (Myers)
    - (Recession) - Change in Retentions and underlying policy deductibles- Insureds move towards higher deductibles/retentions in an attempt to save $.
      - =>a shift in the size of loss distribution from that assumed in past
      - => Inflation will have a more leveraged affect on insured losses
  - **Impact of Reinsurance Terms**

Effect of Inflation on Excess Losses

- **Considerations**
  - **Types of inflation**
  - **Impact of Reinsurance Terms**
    - XOL coverage
      - Inflation shifts the SOL curve
        - Leverage Effect
        - Dampening Effect



Source: The Mathematics of XOL Coverage and Retrospective Rating – A Graphical Approach – Lee

4 "Delta Approach"

Delta Approach

If goal is to maintain reserves adequacy - why bother with explicit knowledge

i.e. model how much a **change** from **past** levels of inflation will impact reserve adequacy

show estimated impact across a range of "delta"s

Basic Formula

Effect of Reinsurance

Slight Double Counting

Other Considerations

4 "Delta Approach"

- **Delta Approach**
- **Basic Formula**
  - Existing Claims

$$final\_cost = \sum^{t} (current\_reserves + IBNER) * (1+i_t)^t$$

    - IBNER set via crystal ball
      - i.e. not trying to correct IBNR for anything other than inflation
      - any biases in IBNER will flow through to inflation adjustment
    - **When do we expect the claim to be paid?**
      - *t* = Avg. Payment Lag remaining
      - noise in tail can distort *t* for mature reserves
      - pmt pattern = cdf of pmt date weighted by amount
        - may need to adjust for your existing claims inventory
          - (assuming large claims take longer to settle)
          - using an off-the-shelf pattern for a large claim inventory would result in a large understatement of the effect
        - don't forget mid qtr pmt assumptions
      - adjust for WC/Med Mal
  - IBNR
- **Effect of Reinsurance**

4 "Delta Approach"

- **Delta Approach**
- **Basic Formula**
  - Existing Claims
  - IBNR
    - IBNER/ IBNR split?
      - Judgmentally biforcate IBNR
        - very leveraged
        - arbitrary
      - Use Freq. / Severity analysis to infer

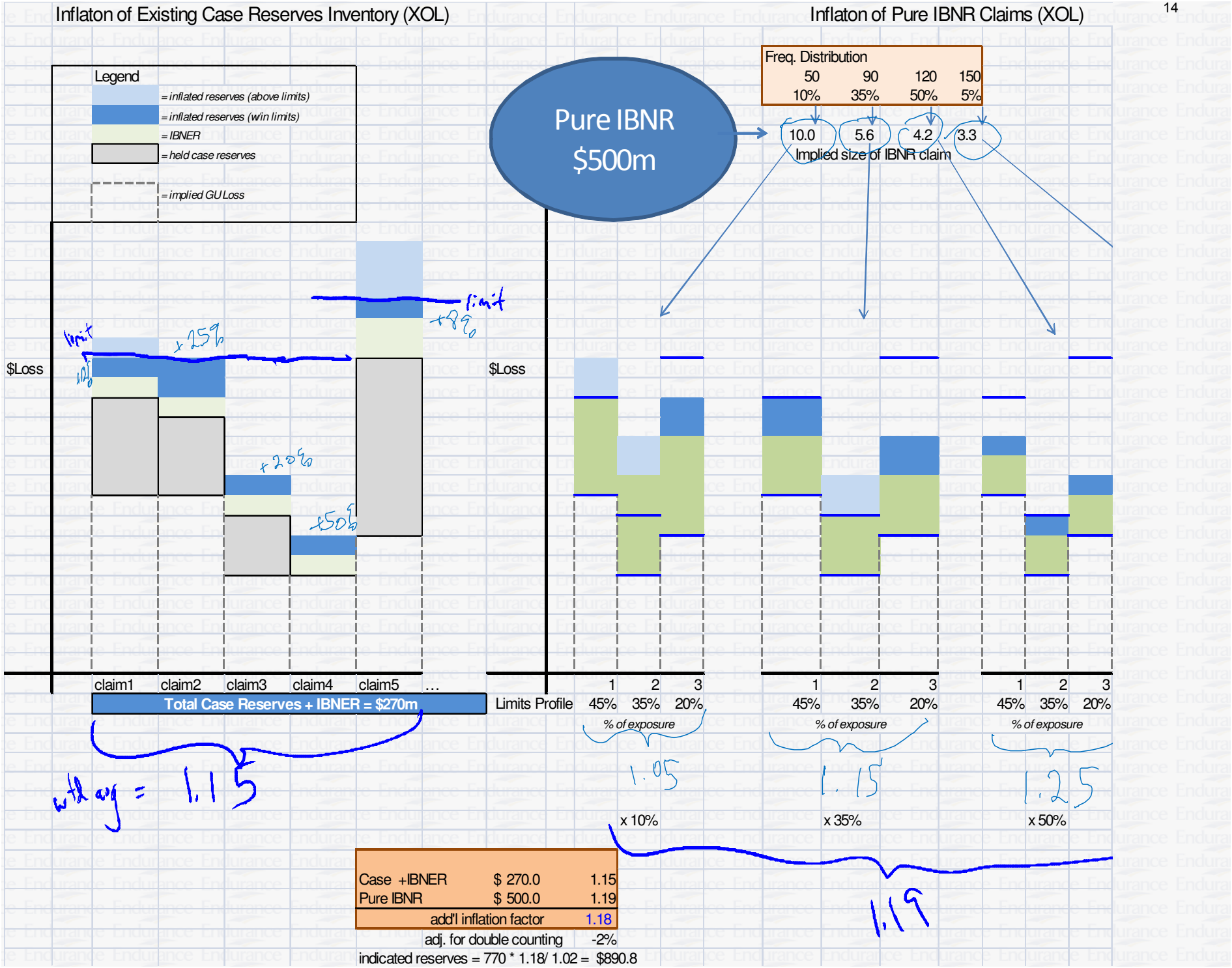
Model requires application of individual treaty limits but IBNR is a bulk amount

Basic Formula

- Existing Claims
- IBNR
  - IBNER/ IBNR split?
    - Judgmentally biforcate IBNR
      - very leveraged
      - arbitrary
    - Use Freq. / Severity analysis to infer

Model requires application of individual treaty limits but IBNR is a bulk amount

- Allocate IBNR to policy
  - allocations are not very accurate
  - need to take into account limits
  - BF allocation - totally inappropriate for this - understates need for existing claims
  - Chainladder allocation - doesn't work well for reinsurance that we're dealing with
  - This is a freq/ based approach
  - In short - aggregate methods don't work well for claim specific analysis
- ☑ Split via Freq. Distribution x Distribution of limits
  - Can also use for IBNR/IBNER split
- Apply Factors from Case Reserves to IBNR
  - understatement (IBNR claims are less mature)
    - though using an aggr pattern anyway
  - IBNR makes up bulk of reserves most affected by inflation


Inflaton of Existing Case Reserves Inventory (XOL)
Inflaton of Pure IBNR Claims (XOL)
Legend
= inflated reserves (above limits)
= inflated reserves (w/in limits)
= IBNER
= held case reserves
= implied GU Loss
Pure IBNR
$500m
Freq. Distribution
50 90 120 150
10% 35% 50% 5%
10.0 5.6 4.2 3.3
Implied size of IBNR claim
limit
+25%
+20%
+50%
+8%
$Loss
$Loss
claim1 claim2 claim3 claim4 claim5 …
Total Case Reserves + IBNER = $270m
Limits Profile
1 2 3
45% 35% 20%
% of exposure
1.05
1.15
1.25
x 10%
x 35%
x 50%
wtd avg = 1.15
1.19
Case +IBNER $ 270.0 1.15
Pure IBNR $ 500.0 1.19
add'l inflation factor 1.18
adj. for double counting -2%
indicated reserves = 770 * 1.18/ 1.02 = $890.8

Effect of Reinsurance

- Pro Rata coverage as above
- Any underlying limits?
  - Umbrella policies
- Reinstatements
  - usually in property cat LOB - thus little inflation needed to model
- Retrocessions
- Leverage / Dampening Effect
  - Gross up Reserves to 1st Dollar Full Loss Amount
    - infer from treaty terms
      - assumes good data
      - VARIOUS types of coverage
        - PR on XOL
        - XOL on PR
        - don't blindly use data field
      - assumes only 1 open claim/treaty
        - depending on how high up and cvg provided might not be appropriate
  - Inflate 1st Dollar Estimate
  - Apply actual treaty limits
  - Apply Aggregate Covers (Stop Loss)
- Simple Example - Proportional
- Simple Example - Non-Proportional

A Simple Heuristic Example

Direct or Proportional Reinsurance

(000)'s

$ -	Paid to Date
$ 80.0	Case Reserves Held
$ 20.0	IBNER (net of any embedded inflationary adjustments)
$ 100.0	

Adjustments for Inflation

	embedded	"crystal ball" correct	Delta Approach
assumed remaining payment lag (yrs)	5	5	5
annualized assumed rate	5%	9%	4%
(1+i)^n	1.28	1.54	1.22
Indicated Reserves	$ 127.6	$ 153.9	$ 155.3
Pct Increase in Held Reserves	0%	20.6%	21.7%

error	
$	$ 1.42
%	0.9%

Simple Example - Non-Proportional

Slight Double Counting

Simple Example - Non-Proportional

A Simple Heuristic Example

Non-Proportional Reinsurance

(000)'s						
Ground Up Loss		$1.5m x $500k				
$ -	Paid to Date					
$ 400.0	Case Reserves Held					
$ 100.0	IBNER (net of any embedded inflationary adjustments)					
$ 500.0						
	"worst case scenario" (no reserves held before inflation adjustments)					

Adjustments for Inflation

	embedded		"crystal ball" correct		Delta Approach
assumed remaining payment lag (yrs)	5		5		5
annualized assumed rate	5%		9%		4%
(1+i)^n	1.28		1.54		1.22
Indicated GU Loss	$ 638.1		$ 769.3		$ 776.4
Indicated Reserves (xs $500k)	$ 138.1		$ 269.3		$ 276.4
Pct Increase in Held Reserves	0%		95.0%		100.1%
				error	
				$	$ 7.08
				%	2.6%

Slight Double Counting

4 "Delta Approach"

- **Delta Approach**
- **Basic Formula**
- **Effect of Reinsurance**
- **Slight Double Counting**
  - Maximum error - PR
  - Maximum error - XOL
  - +1-3% overstatement due to ignoring baked in inflation

$$e_{PR} = \frac{(1+i)^n * (1+\Delta i)^n - (1+i+\Delta i)^n}{(1+i+\Delta i)^n}$$

$$e_{XOL} = \frac{(1+i)^n * (1+\Delta i)^n - (1+i+\Delta i)^n}{(1+i+\Delta i)^n - \frac{1}{1+leverageratio}}$$

    - i = annualized inflation embeded in existing reserves
    - *leverageratio* = held XS reserves / attachment point
  - Make blanket reductions to indication
    - 0-1% for Direct and Proportional Reinsurance
    - 2-3% for Non-Proportional Reinsurance
- **Other Considerations**

- **Effect of Reinsurance**
- **Other Considerations**
  - **Data Issues**
    - Consistent coding of XS/PR
    - XS on PR, PR on XS
      - behaves like XOL - get info
    - Mixed XS/PR
    - If consistent U/W w/in groups can make assumptions
    - Multiple Layers
  - **$0 can have a big impact**
  - **Mitigating Effect on Loss Sensitive Provisions**
  - **A Few LOB Specific Notes**

Other Considerations

- **Data Issues**
- **$0 can have a big impact**
  - Pay attention to zero dollar claims
  - Get Feel for likelihood and closeness to breaching layer from Claims Dept.
- **Mitigating Effect on Loss Sensitive Provisions**
- **A Few LOB Specific Notes**
  - Agri
    - although inflation will affect the price of commodities – the lifespan of reserves on current exposure are so short that inflation is not an issue in regards to current reserves.
  - D&O
    - extremely short reporting/emergence lag – long settlement lag
  - WC
    - Effect of structured settlements
    - For indemnity – we purchase an annuity and thus are immune to effects
    - For medical – no annuity purchased, thus experience the full effect.

Illustration of Model (5% increase shown)

Sample LOB

IBNR Split	QS	XOL
	35%	65%

I. Inflation Effect - Straight QS

II. Inflationary Effect- IBNR Claims - XOL Coverage

IBNR Distr	1.7%	71.7%	20.5%	0.9%	1.4%	0.2%	0.0%
Treaty Layer Retention	[$5m - $10m)	[$10m-$25m)	[$25m-$50m)	[$50m-$75m)	[$75m-$100m)	[$100m-$150m	[$200m-$250m
1.1% [$0-$500k)	1.00	1.31	1.31	1.31	1.31	1.31	1.31
0.0% [$500k-$1m)	1.00	1.31	1.31	1.31	1.31	1.31	1.31
20.0% [$1m - $5m)	1.00	1.34	1.34	1.34	1.34	1.34	1.34
0.7% [$5m - $10m)	1.00	1.34	1.38	1.38	1.38	1.38	1.38
1.1% [$10m-$25m)	1.00	1.34	1.48	1.48	1.48	1.48	1.48
23.5% [$25m-$50m)	1.00	1.34	1.69	1.69	1.69	1.69	1.69
10.7% [$50m-$75m)	1.00	1.34	1.94	1.94	1.94	1.94	1.94
11.6% [$75m-$100m)	1.00	1.34	2.19	2.19	2.19	2.19	2.19
16.5% [$100m-$150m)	1.00	1.34	2.57	2.57	2.57	2.57	2.57
6.7% [$150m-$200m)	1.00	1.34	2.88	3.08	3.08	3.08	3.08
3.5% [$200m-$250m)	1.00	1.34	2.88	3.58	3.58	3.58	3.58
2.3% [$250m-$300m)	1.00	1.34	2.88	4.09	4.09	4.09	4.09
1.5% [$300m-$350m)	1.00	1.34	2.88	4.59	4.59	4.59	4.59
0.0% [$350m-$400m)	1.00	1.34	2.88	4.80	5.10	5.10	5.10
0.2% [$400m-$450m)	1.00	1.34	2.88	4.80	5.60	5.60	5.60
0.2% [$450m-$500m)	1.00	1.34	2.88	4.80	6.11	6.11	6.11

Total = ~90% of IBNR

5 Communicating Results

- **Don't get married to a point estimate**
  - show effect across various coverage levels
- **Investment Team**
  - Coordinate strategy
  - Discuss how inflation is handled in reserves
- **Management**
  - Solvency concern
  - Standard of Living Change

6 Future Considerations and Improvements

Keep eye on changes in exposure

- Change in Leverage/Dampening effect if the company decides to move up/down the "tower"

Areas of Improvement / Shortcomings

- Ignores Risk Margin
  - assumes IBNR is 100% accurate
- Lack of explicit provision
  - harder to accurately take down as info becomes disseminated (industry pub., anecdotal claims info)
  - how much much was baked into triangles?
    - this doesn't give full picture
- Requires robust database of layer info
  - or homogenous grouping
- +1-3% overstatement due to ignoring baked in inflation
- Needs to be adjusted for interim payments
  - WC, Med Mal, ALAE (D&O)
- Guaranteed someone confuses this for TOTAL impact of inflation
  - requires effective communication
- **Highly leverages freq. analysis**

Benefits of Model

Recommended Readings / References

6 Future Considerations and Improvements

- **Keep eye on changes in exposure**
  - Change in Leverage/Dampening effect if the company decides to move up/down the "tower"
- **Areas of Improvement / Shortcomings**
- **Benefits of Model**
  - No explicit knowledge of inflation rates needed
    - can be used to model effects of social inflation
  - Doesn't distinguish between social/economic inflation
  - Intuitive, easy to explain to auditors
  - Can reserve to quantify effect of deflation
  - Easily overlay stochastic approach, inflation index
- **Recommended Readings / References**

6 Future Considerations and Improvements

- **Keep eye on changes in exposure**
- **Areas of Improvement / Shortcomings**
- **Benefits of Model**
- **Recommended Readings / References**
  - *The Effect of Inflation of Losses and Premiums for Property-Liability Insurers* - Butsic
  - *The Effect of Trend on Excess of Loss Coverage* - Keatinge
  - *Verying Trend Factors by Size of Loss* - Feldblum
  - *An Illustration of the Impact of Inflation on Insurance Company Operations* - Darcy
  - *Loss Reserving and Ratemaking in an Inflationary Environment* - Shatoff
  - *Evaluating the Impact of Inflation of Loss Reserves* - Richards
  - Inflation Implications for P/C Insurance - Munro
    - Overview of other papers written on the subject
  - *Non-Proportional Reinsurance and the Index Clause* - Ferguson
    - he argues that since inflation shifts the SOL curve, can index to solve problems
    - see review by Levin
  - *Separation of Inflation and Other Effects From the Distribution of Non-Life Insurance Claim Delays* - Taylor
    - very different approach - worth reading

Questions?

Summary of Key Points

1. Inflation is already implicitly embedded in existing IBNR
   - nonetheless explicit knowledge is not necessary to calc. add'l margin needed via claims level and treaty limit info
2. Calculation of Leverage/Dampening Effect is necessary for XOL Reinsurance
   - main goal of model
3. Split of bulk IBNR to individual claims is critical to model
   - IBNR/ IBNER split determines dampening effect
   - sensitivity testing needed

Questions?

Illustration of Model (5% increase shown)

Sample LOB

I. Inflation Effect - Straight QS

			IBNR Split	QS	XOL
				35%	65%

Reserves	Pct	Avg. Remaining Pmt Lag (yrs)	1%	2%	3%	4%	5%	6%	7%	8%	9%	10%
85.2	27%	*2.0 - 2.3*	1.02	1.05	1.07	1.09	1.11	1.14	1.16	1.19	1.21	1.24
185.1	60%	*2.3 - 2.6*	1.03	1.05	1.08	1.11	1.13	1.16	1.19	1.22	1.25	1.28
40.0	13%	*2.6 - 2.8*	1.03	1.06	1.09	1.12	1.15	1.18	1.21	1.24	1.27	1.31
310.3	100%	*2.5*	1.03	1.05	1.08	1.10	1.13	1.16	1.18	1.21	1.24	1.27

II. Inflationary Effect- IBNR Claims - XOL Coverage

(shaded areas - are areas not capped by treaty limits (provides a range of potentiality around the estimate)

(lighter shading signifies additional potential even at lower rates, and thus represent the more likely scenarios)

Retention/Limit combinations that are unlikely are greyed out.

IBNR Distr		0.3%	0.0%	3.5%	1.7%	71.7%	20.5%	0.9%	1.4%	0.2%	0.0%	0.0%
Treaty Layer Retention		[$0-$500k)	[$500k-$1m)	[$1m - $5m)	[$5m - $10m)	[$10m-$25m)	[$25m-$50m)	[$50m-$75m)	[$75m-$100m)	[$100m-$150m)	[$150m-$200m)	[$200m-$250m)
1.1%	[$0-$500k)	1.00	1.00	1.00	1.00	1.31	1.31	1.31	1.31	1.31	1.31	1.31
0.0%	[$500k-$1m)	1.00	1.00	1.00	1.00	1.31	1.31	1.31	1.31	1.31	1.31	1.31
20.0%	[$1m - $5m)	1.00	1.00	1.00	1.00	1.34	1.34	1.34	1.34	1.34	1.34	1.34
0.7%	[$5m - $10m)	1.00	1.00	1.00	1.00	1.34	1.38	1.38	1.38	1.38	1.38	1.38
1.1%	[$10m-$25m)	1.00	1.00	1.00	1.00	1.34	1.48	1.48	1.48	1.48	1.48	1.48
23.5%	[$25m-$50m)	1.00	1.00	1.00	1.00	1.34	1.69	1.69	1.69	1.69	1.69	1.69
10.7%	[$50m-$75m)	1.00	1.00	1.00	1.00	1.34	1.94	1.94	1.94	1.94	1.94	1.94
11.6%	[$75m-$100m)	1.00	1.00	1.00	1.00	1.34	2.19	2.19	2.19	2.19	2.19	2.19
16.5%	[$100m-$150m)	1.00	1.00	1.00	1.00	1.34	2.57	2.57	2.57	2.57	2.57	2.57
6.7%	[$150m-$200m)	1.00	1.00	1.00	1.00	1.34	2.88	3.08	3.08	3.08	3.08	3.08
3.5%	[$200m-$250m)	1.00	1.00	1.00	1.00	1.34	2.88	3.58	3.58	3.58	3.58	3.58
2.3%	[$250m-$300m)	1.00	1.00	1.00	1.00	1.34	2.88	4.09	4.09	4.09	4.09	4.09
1.5%	[$300m-$350m)	1.00	1.00	1.00	1.00	1.34	2.88	4.59	4.59	4.59	4.59	4.59
0.0%	[$350m-$400m)	1.00	1.00	1.00	1.00	1.34	2.88	4.80	5.10	5.10	5.10	5.10
0.2%	[$400m-$450m)	1.00	1.00	1.00	1.00	1.34	2.88	4.80	5.60	5.60	5.60	5.60
0.2%	[$450m-$500m)	1.00	1.00	1.00	1.00	1.34	2.88	4.80	6.11	6.11	6.11	6.11
0.0%	[$500m-$550m)	1.00	1.00	1.00	1.00	1.34	2.88	4.80	6.62	6.62	6.62	6.62
0.0%	[$550m-$600m)	1.00	1.00	1.00	1.00	1.34	2.88	4.80	6.72	7.12	7.12	7.12
0.0%	[$600m-$650m)	1.00	1.00	1.00	1.00	1.34	2.88	4.80	6.72	7.63	7.63	7.63
0.2%	[$650m-$700m)	1.00	1.00	1.00	1.00	1.34	2.88	4.80	6.72	8.13	8.13	8.13

Total = ~90% of IBNR

* Effect allowed to go below 1.00 for Pure IBNR Claims = favorable emergence (actual losses occurred to treaties with smaller exposure than expected)

III. Inflationary Effect on Existing Claims

Is a functon of the above 2 distributions, dampened by the % of the layer already exhausted (below)

	Average % of Limit Already Exhausted on Outstanding Claims										
	10%	20%	30%	40%	50%	60%	70%	80%	90%	100%	Avg
% of Case Reserves	1.4%	3.0%	5.0%	9.0%	12.4%	13.8%	17.2%	18.0%	25.4%	100.0%	20.5%
% of Claim Count	18.0%	28.0%	38.4%	49.7%	62.0%	74.2%	88.0%	92.0%	96.8%	100.0%	64.7%

Distribution of Total Reserves

		Non-Proportional		Indication	
	Proportional	Existing Claims	Pure IBNR	@ + 5%	@ + 10%
	35%	20%	45%		
	1.18	1.04	1.42	1.26	1.34
			Selected	1.26	1.34

MAXIMUM error due to ignoring unknown existing inflation load

Direct or Proportional Reinsurance

i assumed	Remaining Pmt Lag (yrs)	"delta *i*" + 1%	+ 2%	+ 3%	+ 4%	+ 5%	+ 6%	+ 7%	+ 8%	+ 9%	+ 10%	+ 15%
1%	1	0.0%	0.0%	0.0%	0.0%	0.0%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%
	2	0.0%	0.0%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.2%	0.2%	0.3%
	3	0.0%	0.1%	0.1%	0.1%	0.1%	0.2%	0.2%	0.2%	0.2%	0.3%	0.4%
	4	0.0%	0.1%	0.1%	0.2%	0.2%	0.2%	0.3%	0.3%	0.3%	0.4%	0.5%
	5	0.0%	0.1%	0.1%	0.2%	0.2%	0.3%	0.3%	0.4%	0.4%	0.5%	0.6%
	6	0.1%	0.1%	0.2%	0.2%	0.3%	0.3%	0.4%	0.4%	0.5%	0.5%	0.8%
	7	0.1%	0.1%	0.2%	0.3%	0.3%	0.4%	0.5%	0.5%	0.6%	0.6%	0.9%
	15	0.1%	0.3%	0.4%	0.6%	0.7%	0.8%	1.0%	1.1%	1.2%	1.4%	2.0%
3%	1	0.0%	0.1%	0.1%	0.1%	0.1%	0.2%	0.2%	0.2%	0.2%	0.3%	0.4%
	2	0.1%	0.1%	0.2%	0.2%	0.3%	0.3%	0.4%	0.4%	0.5%	0.5%	0.8%
	3	0.1%	0.2%	0.3%	0.3%	0.4%	0.5%	0.6%	0.7%	0.7%	0.8%	1.1%
	4	0.1%	0.2%	0.3%	0.4%	0.6%	0.7%	0.8%	0.9%	1.0%	1.1%	1.5%
	5	0.1%	0.3%	0.4%	0.6%	0.7%	0.8%	1.0%	1.1%	1.2%	1.3%	1.9%
	6	0.2%	0.3%	0.5%	0.7%	0.8%	1.0%	1.2%	1.3%	1.5%	1.6%	2.3%
	7	0.2%	0.4%	0.6%	0.8%	1.0%	1.2%	1.3%	1.5%	1.7%	1.9%	2.7%
	15	0.4%	0.9%	1.3%	1.7%	2.1%	2.5%	2.9%	3.3%	3.7%	4.1%	5.9%
5%	1	0.0%	0.1%	0.1%	0.2%	0.2%	0.3%	0.3%	0.4%	0.4%	0.4%	0.6%
	2	0.1%	0.2%	0.3%	0.4%	0.5%	0.5%	0.6%	0.7%	0.8%	0.9%	1.3%
	3	0.1%	0.3%	0.4%	0.6%	0.7%	0.8%	0.9%	1.1%	1.2%	1.3%	1.9%
	4	0.2%	0.4%	0.6%	0.7%	0.9%	1.1%	1.3%	1.4%	1.6%	1.8%	2.5%
	5	0.2%	0.5%	0.7%	0.9%	1.1%	1.4%	1.6%	1.8%	2.0%	2.2%	3.2%
	6	0.3%	0.6%	0.8%	1.1%	1.4%	1.6%	1.9%	2.1%	2.4%	2.6%	3.8%
	7	0.3%	0.7%	1.0%	1.3%	1.6%	1.9%	2.2%	2.5%	2.8%	3.1%	4.5%
	15	0.7%	1.4%	2.1%	2.8%	3.5%	4.1%	4.8%	5.4%	6.1%	6.7%	9.8%
7%	1	0.1%	0.1%	0.2%	0.3%	0.3%	0.4%	0.4%	0.5%	0.5%	0.6%	0.9%
	2	0.1%	0.3%	0.4%	0.5%	0.6%	0.7%	0.9%	1.0%	1.1%	1.2%	1.7%
	3	0.2%	0.4%	0.6%	0.8%	0.9%	1.1%	1.3%	1.5%	1.6%	1.8%	2.6%
	4	0.3%	0.5%	0.8%	1.0%	1.3%	1.5%	1.7%	2.0%	2.2%	2.4%	3.5%
	5	0.3%	0.6%	1.0%	1.3%	1.6%	1.9%	2.2%	2.5%	2.7%	3.0%	4.4%
	6	0.4%	0.8%	1.2%	1.5%	1.9%	2.3%	2.6%	3.0%	3.3%	3.6%	5.3%
	7	0.5%	0.9%	1.3%	1.8%	2.2%	2.6%	3.0%	3.5%	3.9%	4.3%	6.2%
	15	1.0%	1.9%	2.9%	3.9%	4.8%	5.7%	6.6%	7.6%	8.5%	9.4%	13.7%
9%	1	0.1%	0.2%	0.2%	0.3%	0.4%	0.5%	0.5%	0.6%	0.7%	0.8%	1.1%
	2	0.2%	0.3%	0.5%	0.6%	0.8%	0.9%	1.1%	1.2%	1.4%	1.5%	2.2%
	3	0.2%	0.5%	0.7%	1.0%	1.2%	1.4%	1.6%	1.9%	2.1%	2.3%	3.3%
	4	0.3%	0.7%	1.0%	1.3%	1.6%	1.9%	2.2%	2.5%	2.8%	3.1%	4.4%
	5	0.4%	0.8%	1.2%	1.6%	2.0%	2.4%	2.7%	3.1%	3.5%	3.8%	5.6%
	6	0.5%	1.0%	1.5%	1.9%	2.4%	2.9%	3.3%	3.7%	4.2%	4.6%	6.7%
	7	0.6%	1.1%	1.7%	2.3%	2.8%	3.3%	3.9%	4.4%	4.9%	5.4%	7.9%
	15	1.2%	2.5%	3.7%	4.9%	6.1%	7.3%	8.5%	9.6%	10.8%	12.0%	17.6%

Maximum error - XOL

+1-3% overstatement due to ignoring baked in inflation

Maximum error - XOL

MAXIMUM error due to ignoring unknown existing inflation load

Non-Proportional Reinsurance

i assumed	Remaining Pmt Lag (yrs)	"delta *i*" + 1%	+ 2%	+ 3%	+ 4%	+ 5%	+ 6%	+ 7%	+ 8%	+ 9%	+ 10%	+ 15%
1%	1	0.5%	0.7%	0.7%	0.8%	0.8%	0.9%	0.9%	0.9%	0.9%	0.9%	0.9%
	2	0.5%	0.7%	0.8%	0.8%	0.9%	0.9%	0.9%	0.9%	0.9%	1.0%	1.0%
	3	0.5%	0.7%	0.8%	0.8%	0.9%	0.9%	0.9%	1.0%	1.0%	1.0%	1.1%
	4	0.5%	0.7%	0.8%	0.9%	0.9%	0.9%	1.0%	1.0%	1.0%	1.1%	1.2%
	5	0.5%	0.7%	0.8%	0.9%	0.9%	1.0%	1.0%	1.0%	1.1%	1.1%	1.2%
	6	0.5%	0.7%	0.8%	0.9%	1.0%	1.0%	1.1%	1.1%	1.1%	1.2%	1.3%
	7	0.5%	0.7%	0.8%	0.9%	1.0%	1.0%	1.1%	1.1%	1.2%	1.2%	1.4%
	15	0.6%	0.8%	1.0%	1.1%	1.2%	1.3%	1.4%	1.5%	1.6%	1.7%	2.2%
3%	1	0.7%	1.2%	1.5%	1.7%	1.9%	2.0%	2.1%	2.2%	2.2%	2.3%	2.5%
	2	0.8%	1.2%	1.5%	1.8%	1.9%	2.1%	2.2%	2.3%	2.4%	2.5%	2.7%
	3	0.8%	1.3%	1.6%	1.8%	2.0%	2.2%	2.3%	2.4%	2.5%	2.6%	2.9%
	4	0.8%	1.3%	1.6%	1.9%	2.1%	2.3%	2.4%	2.5%	2.7%	2.8%	3.2%
	5	0.8%	1.3%	1.7%	2.0%	2.2%	2.4%	2.5%	2.7%	2.8%	2.9%	3.4%
	6	0.8%	1.4%	1.7%	2.0%	2.3%	2.5%	2.6%	2.8%	2.9%	3.1%	3.7%
	7	0.8%	1.4%	1.8%	2.1%	2.3%	2.6%	2.8%	2.9%	3.1%	3.3%	3.9%
	15	1.0%	1.7%	2.2%	2.7%	3.1%	3.5%	3.8%	4.2%	4.5%	4.8%	6.4%
5%	1	0.8%	1.4%	1.9%	2.2%	2.5%	2.7%	2.9%	3.1%	3.2%	3.3%	3.8%
	2	0.9%	1.5%	1.9%	2.3%	2.6%	2.9%	3.1%	3.3%	3.4%	3.6%	4.1%
	3	0.9%	1.5%	2.0%	2.4%	2.7%	3.0%	3.3%	3.5%	3.7%	3.8%	4.5%
	4	0.9%	1.6%	2.1%	2.5%	2.9%	3.2%	3.4%	3.7%	3.9%	4.1%	4.9%
	5	0.9%	1.6%	2.2%	2.6%	3.0%	3.3%	3.6%	3.9%	4.1%	4.4%	5.3%
	6	1.0%	1.7%	2.3%	2.7%	3.1%	3.5%	3.8%	4.1%	4.4%	4.6%	5.7%
	7	1.0%	1.7%	2.3%	2.9%	3.3%	3.7%	4.0%	4.4%	4.7%	4.9%	6.2%
	15	1.2%	2.2%	3.1%	3.8%	4.6%	5.2%	5.9%	6.5%	7.1%	7.7%	10.5%
7%	1	0.9%	1.6%	2.1%	2.5%	2.9%	3.2%	3.5%	3.7%	3.9%	4.1%	4.8%
	2	0.9%	1.6%	2.2%	2.7%	3.1%	3.4%	3.7%	4.0%	4.2%	4.5%	5.3%
	3	0.9%	1.7%	2.3%	2.8%	3.3%	3.6%	4.0%	4.3%	4.6%	4.8%	5.8%
	4	1.0%	1.8%	2.4%	3.0%	3.4%	3.9%	4.2%	4.6%	4.9%	5.2%	6.4%
	5	1.0%	1.8%	2.5%	3.1%	3.6%	4.1%	4.5%	4.9%	5.2%	5.6%	6.9%
	6	1.1%	1.9%	2.6%	3.3%	3.8%	4.3%	4.8%	5.2%	5.6%	6.0%	7.6%
	7	1.1%	2.0%	2.8%	3.4%	4.0%	4.6%	5.1%	5.5%	6.0%	6.4%	8.2%
	15	1.4%	2.7%	3.8%	4.9%	5.9%	6.8%	7.7%	8.6%	9.5%	10.3%	14.4%
9%	1	0.9%	1.6%	2.2%	2.8%	3.2%	3.6%	3.9%	4.2%	4.5%	4.7%	5.6%
	2	0.9%	1.7%	2.4%	2.9%	3.4%	3.9%	4.2%	4.6%	4.9%	5.2%	6.3%
	3	1.0%	1.8%	2.5%	3.1%	3.7%	4.1%	4.6%	4.9%	5.3%	5.6%	6.9%
	4	1.0%	1.9%	2.7%	3.3%	3.9%	4.4%	4.9%	5.3%	5.7%	6.1%	7.7%
	5	1.1%	2.0%	2.8%	3.5%	4.1%	4.7%	5.2%	5.7%	6.2%	6.6%	8.4%
	6	1.1%	2.1%	2.9%	3.7%	4.4%	5.0%	5.6%	6.1%	6.7%	7.1%	9.3%
	7	1.2%	2.2%	3.1%	3.9%	4.7%	5.3%	6.0%	6.6%	7.1%	7.7%	10.1%
	15	1.6%	3.1%	4.5%	5.8%	7.1%	8.3%	9.5%	10.6%	11.8%	12.9%	18.4%