

# Reserving in Uncertain Economic Conditions

Compare and Contract  
California Workers Compensation  
and Argentina Auto Liability

Alejandro Ortega, FCAS

Tony Milano, FCAS - WCIRB

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# Reserving in Uncertain Economic Conditions

Argentina  
Auto Liability

Alejandro Ortega, FCAS, CFA



# Inflation

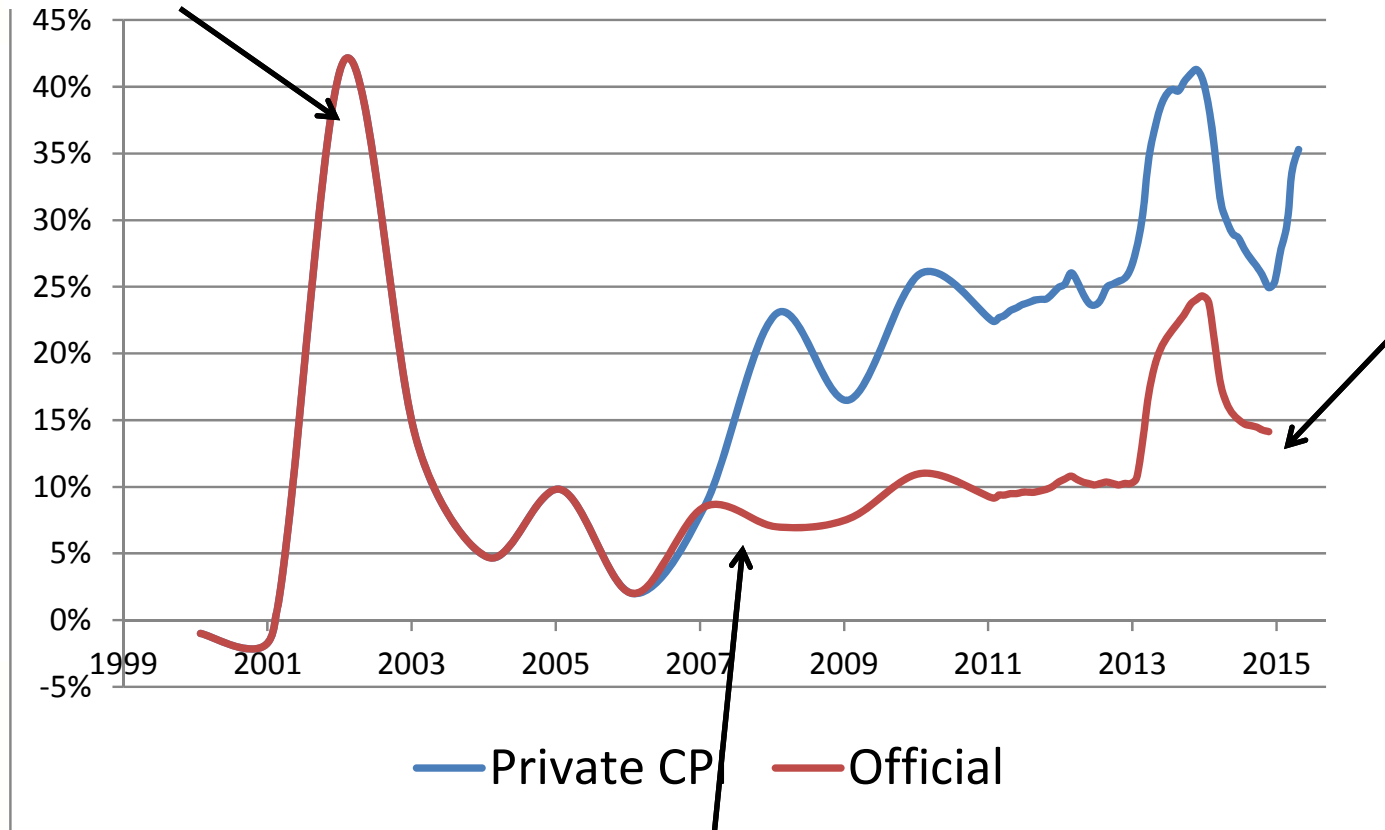
	<b>Low Inflation</b>	<b>High Inflation</b>
<b>Short Tail</b>	US First Party Auto US Personal Property	Venezuela – All products Argentina – Personal Property
<b>Long Tail</b>	US Casualty US (x-CA) Workers Comp	<b>Argentina Auto</b> California Workers Comp



# Historical Inflation Argentina

2001 Currency  
Crisis

## Argentina Inflation

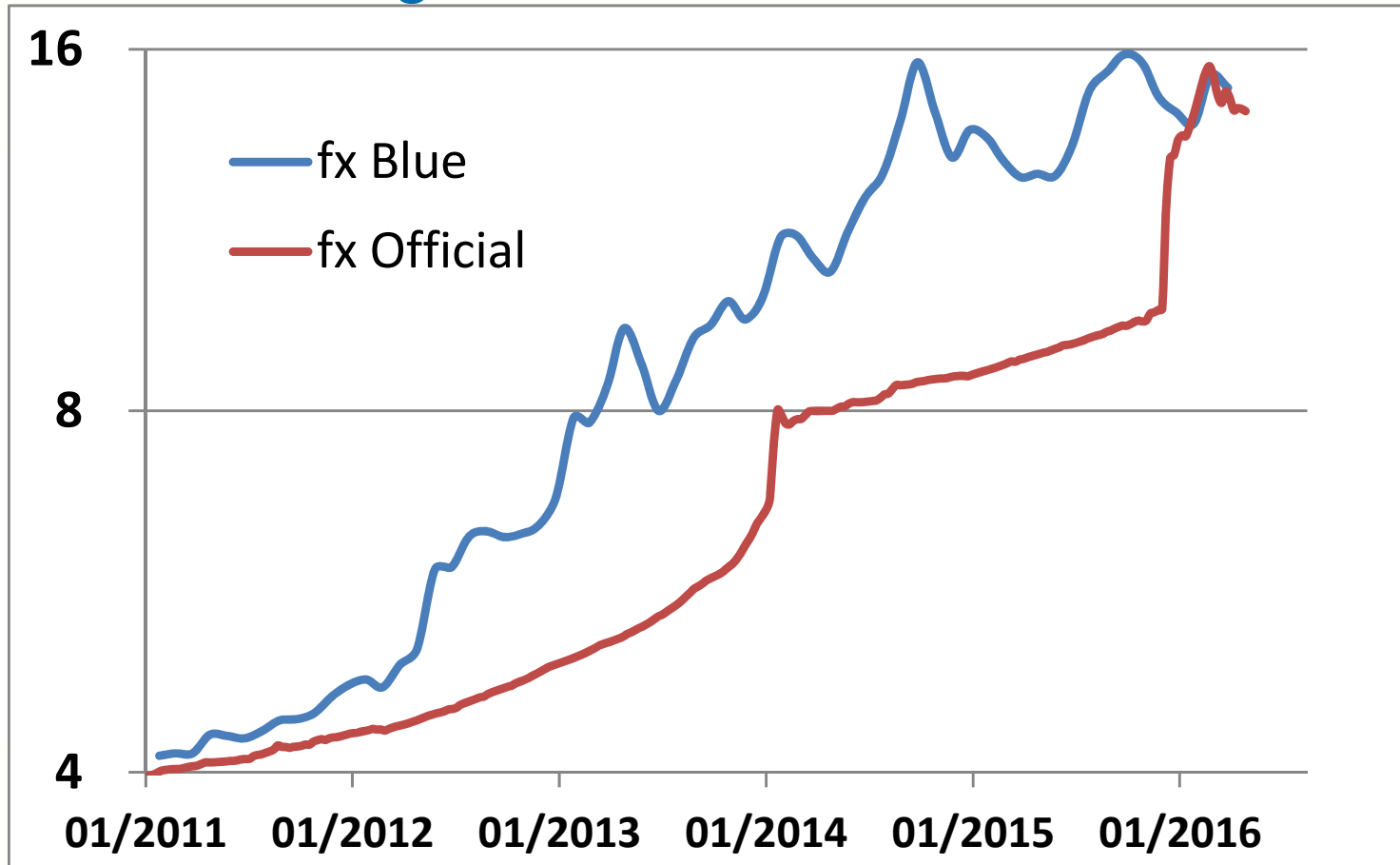


INDEC stops  
reporting.  
Macri

Government Reporting  
no longer reliable

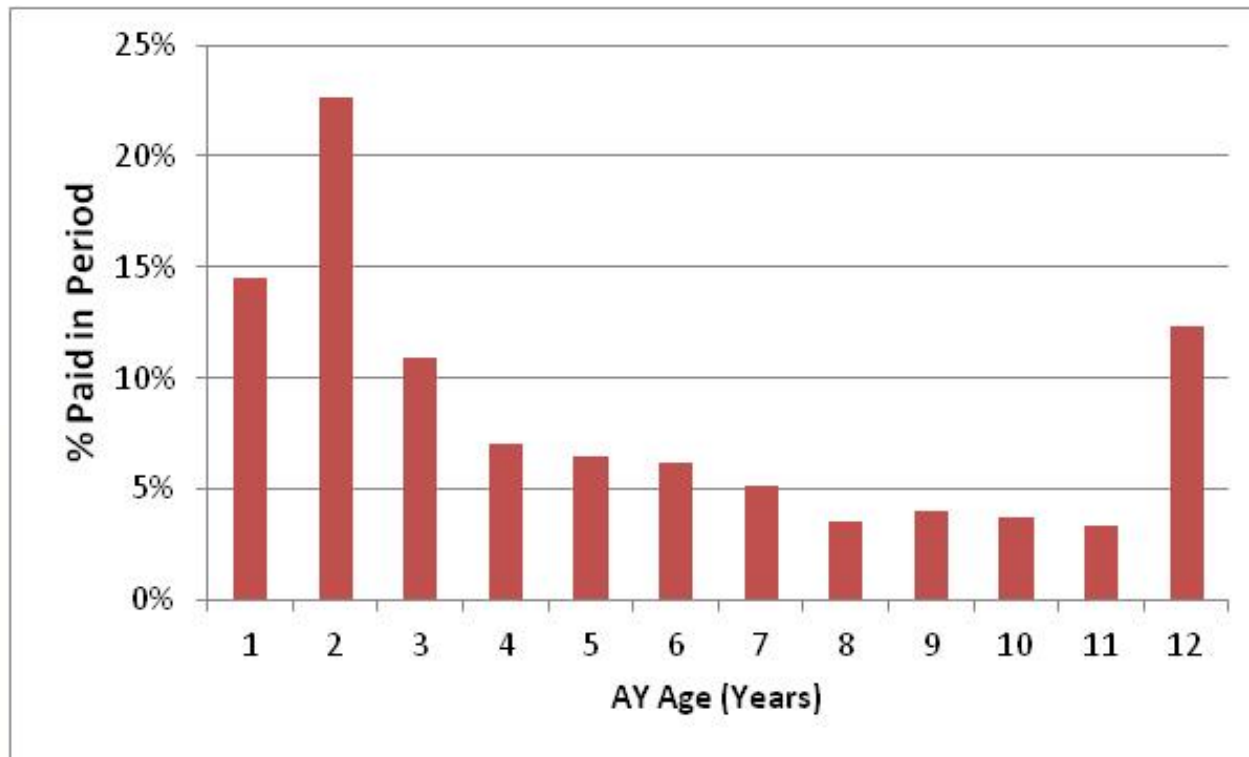


# Historical Exchange Rate Argentina Peso to USD



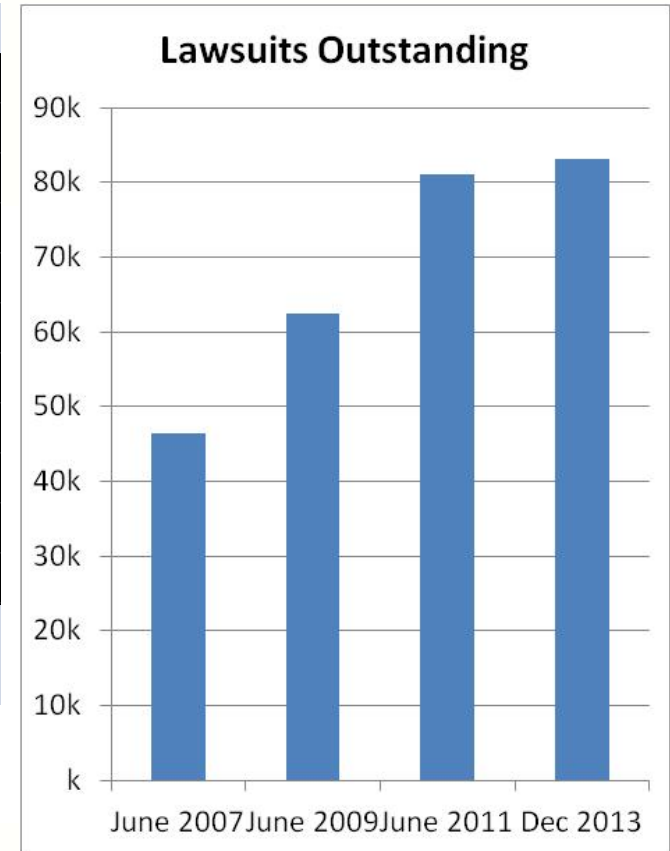
## High Inflation – Long Tail

- Auto – Third Party Bodily Injury
- First Party is short tailed
- The Inflation makes the tail even longer



# Drivers of the Tail – Lawsuits Outstanding

Company	June 2007	June 2009	June 2011	Dec 2013
Federacion Patronal	6,842	9,962	13,939	16,818
Caja Seguros	7,637	11,942	15,864	12,576
Provincia	6,222	7,763	8,242	7,691
QBE LA Buenos Aires	4,552	5,163	5,546	7,335
San Cristobal	2,978	4,637	5,396	6,526
Zurich Argentina	3,506	4,553	7,776	6,207
Seguros Rivadavia	2,640	3,109	3,955	6,104
Liderar	2,304	2,812	3,836	5,485
Aseg. Federal Arg	1,298	2,578	3,387	5,288
Segunda C.C.L	3,792	4,574	5,064	4,561
La Meridional (AIG)	4,647	5,348	8,166	4,533
<b>Total</b>	<b>46,418</b>	<b>62,441</b>	<b>81,171</b>	<b>83,124</b>



- Litigious Culture in Argentina
- Growing since ~2007



# Assumptions of Chainladder

Thomas Mack

1. **Expected Incremental Losses** are **proportional** to losses Reported to Date
2. Losses in AY are **independent** of losses in other accident years
3. Variance of incremental losses is **proportional** to losses reported to date

- High and Changing Inflation produces Calendar Year Effect
- Litigious Growth also a CY Effect
- Assumptions 1 & 2 are violated





## Assumptions of Chainladder

- Chainladder implicitly takes the inflation in the triangle and forecasts from there
- When inflation is changing – this is not appropriate
- We will end up with a methodology that allows us to forecast different levels of inflation



# How to set Reserves

- Adjust Paid Triangle for Inflation
- Adjust Incurred Triangle for Inflation
- Paid Only Triangle
- Average Severity to Date
- Future Closed Paid Claims x Future Severity

Closed Paid Claims



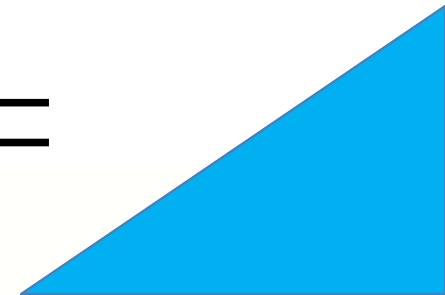
X

Severity



=

Unpaid Losses



## Fisher Lange

- Closed Claims are easy to estimate
- Allows different assumptions for future inflation (and interest)
- Granular Result
- Sensitivity Testing vs Case Reserves

Closed Paid Claims



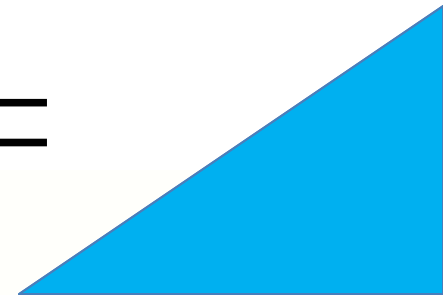
X

Severity



=

Unpaid Losses



# Closed Claims

Forecast the Following

- Newly Reported Claims at each age
- % of Claims Closed Without Payment (CWP)
- % of Claims Closed With Amount (eg. Paid)

Closed Paid Claims



# Severity

## Underlying Components of Severity:

- % Disability awarded by the Court (similar to WC)
- Cost of a Point of Disability in each Jurisdiction (2,500 – 4,000 pesos)
- The final cost of the claim is proportional the product of these two
- Four General Categories of a Claim:
  - Indemnity
  - Treatment Expenses
  - Court and Attorney Fees
  - Interest and Inflation

Severity



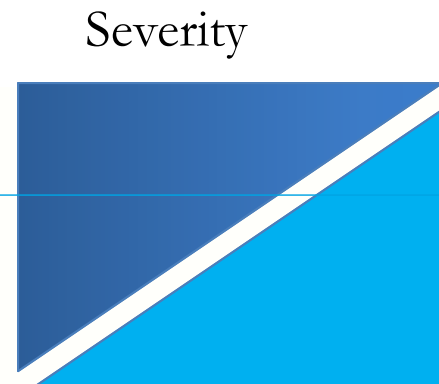
# Severity

## Interest Costs

- In addition to the base cost of the claim, the insurer must pay interest from the date of the accident
- A Claim occurring in 2009, and closing in 2014, we would pay 5 years of interest

## Inflation (Calendar Year Trend)

- The base cost of this claim is based on the **Cost per Point** in **2014** – not, 2009



# Severity

- We are paying for the time value of money – twice
- Our 2009 claim, in 2013 is 60 months old
- By waiting one more year to close it in 2014:
  - We pay an additional year of interest (~12%)
  - Cost of a Point is also increased (~9%)
  - Total cost of claim goes up about 22%

Severity



# Severity

## Forecasting Severity

- Forecast Severity on the Diagonal
- Forecast Down the Triangle using Inflation (CY Trend)
- Reasonability Check – going Across the Triangle for Interest, and Development Year Trend

Severity





# Severity

Pesos (000)

AY	12	24	36	48	60	72	84	96	108	120	132	144
2002				35	47	124	28	44	55	38	110	<b>265</b>
2003			57	144	51	24	37	127	55	107	<b>241</b>	292
2004		29	50	64	75	95	140	89	221	<b>217</b>	265	321
2005	10	18	55	68	103	74	70	164	<b>193</b>	238	291	353
2006	9	19	65	74	101	117	162	<b>175</b>	213	262	320	388
2007	11	17	43	70	95	182	<b>155</b>	193	234	288	352	427
2008	9	19	41	69	147	<b>144</b>	174	212	257	317	388	470
2009	7	20	49	73	<b>128</b>	158	191	233	283	349	426	517
2010	11	20	58	<b>86</b>	141	174	210	257	311	384	469	569
2011	10	24	<b>65</b>	95	155	192	231	282	342	422	516	626
2012	11	<b>28</b>	71	104	171	211	254	311	377	465	568	688
2013	<b>13</b>	30	78	114	188	232	280	342	414	511	624	757

Historical Severity  
 Selected Diagonal Severity  
 Forecast Severity

All scaled by a factor

Severity



# Closed Paid Claims

AY	12	24	36	48	60	72	84	96	108	120	132	144
2002	-	788	28	15	8	4	9	3	3	2	1	-
2003	623	323	51	8	16	11	11	2	5	5	4	3
2004	1,045	474	50	41	39	15	16	8	2	3	2	7
2005	1,444	855	129	66	37	25	22	16	17	9	7	20
2006	2,085	1,334	195	91	45	40	49	23	20	15	11	33
2007	2,705	1,436	219	78	83	60	17	23	21	16	12	36
2008	2,462	1,682	208	183	51	53	33	19	17	13	10	29
2009	2,007	1,309	317	134	92	51	35	20	18	14	10	31
2010	1,533	1,572	195	128	60	47	32	18	17	13	9	28
2011	1,913	1,182	247	99	55	43	30	17	16	12	9	26
2012	1,941	1,477	238	119	66	52	36	20	19	14	10	31
2013	2,374	1,463	254	127	70	55	38	21	20	15	11	33

## Closed Paid Claims



Historical Closed Paid Claims  
Forecast Severity Closed Paid Claims

All scaled by a factor

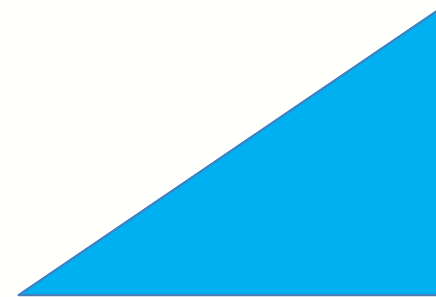


# Unpaid Losses

## Reasonability Checks are Performed

- Compare Ultimate Losses to Prior Analysis
- Look at Loss per Exposure across accident years
- Compare Unpaid Losses to Case Reserves
- This method does not calculate IBNR, but rather Unpaid Losses

Unpaid Losses



## High Inflation Environment

- Argentina has additional complications due to changing legal environment
- High Inflation is typically associated with a weak currency, and changing inflation
- Sometimes it is associated with Social Changes (eg. higher litigiousness)
- Understanding the underlying drivers of Claim Costs is Key
- Fisher-Lange allows you to forecast different levels of inflation and interest
- Great Tool for Sensitivity Testing



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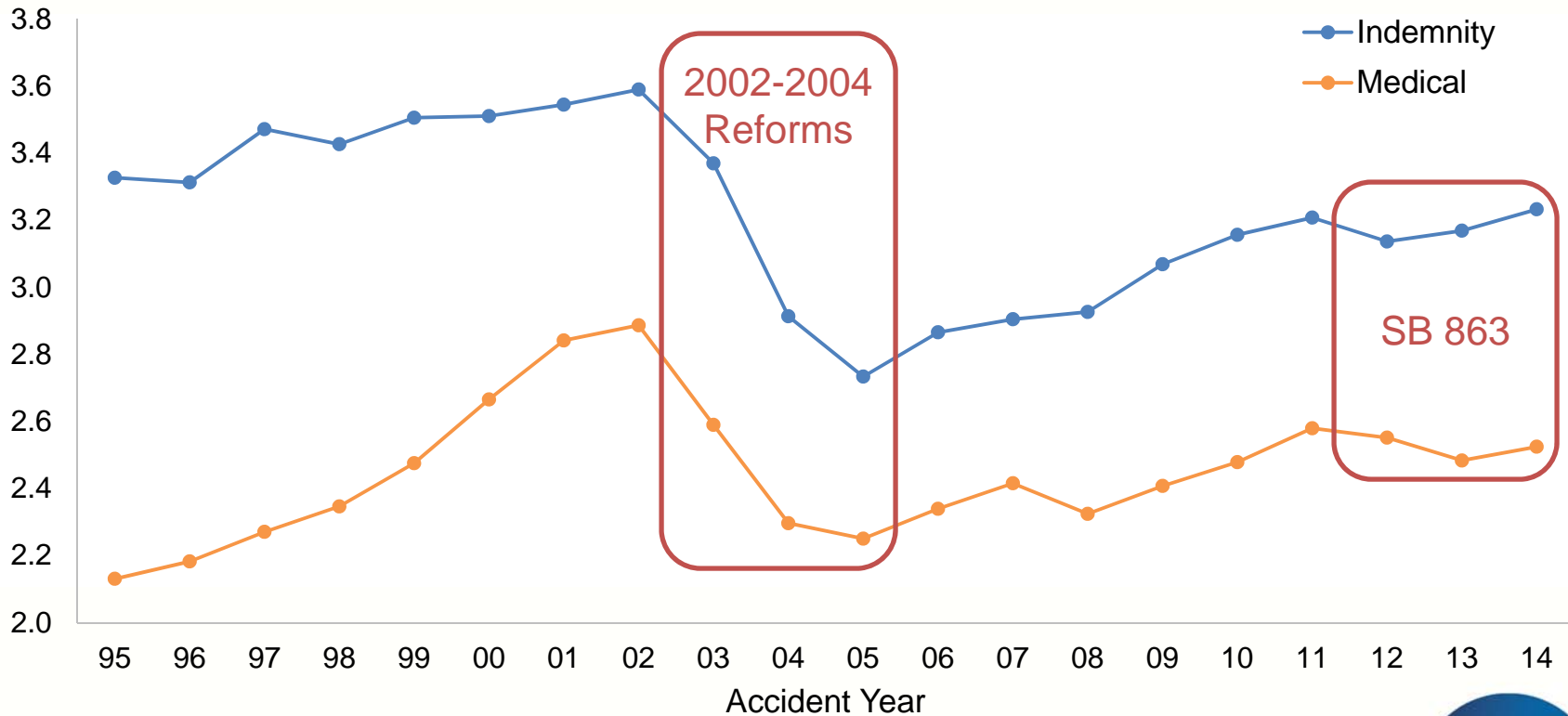
# CA WC – A Changing System

- Long-tailed Line
- Significant Historical Medical Inflation
- Major System Reforms
  - 2002 through 2004 reforms
  - Senate Bill No. 863 (2012)
  - Impact both frequency and severity
  - Both CY/DY and AY impacts
- Volatility Makes Traditional Methods Inaccurate



# Paid Loss Development Highly Impacted by System Reforms

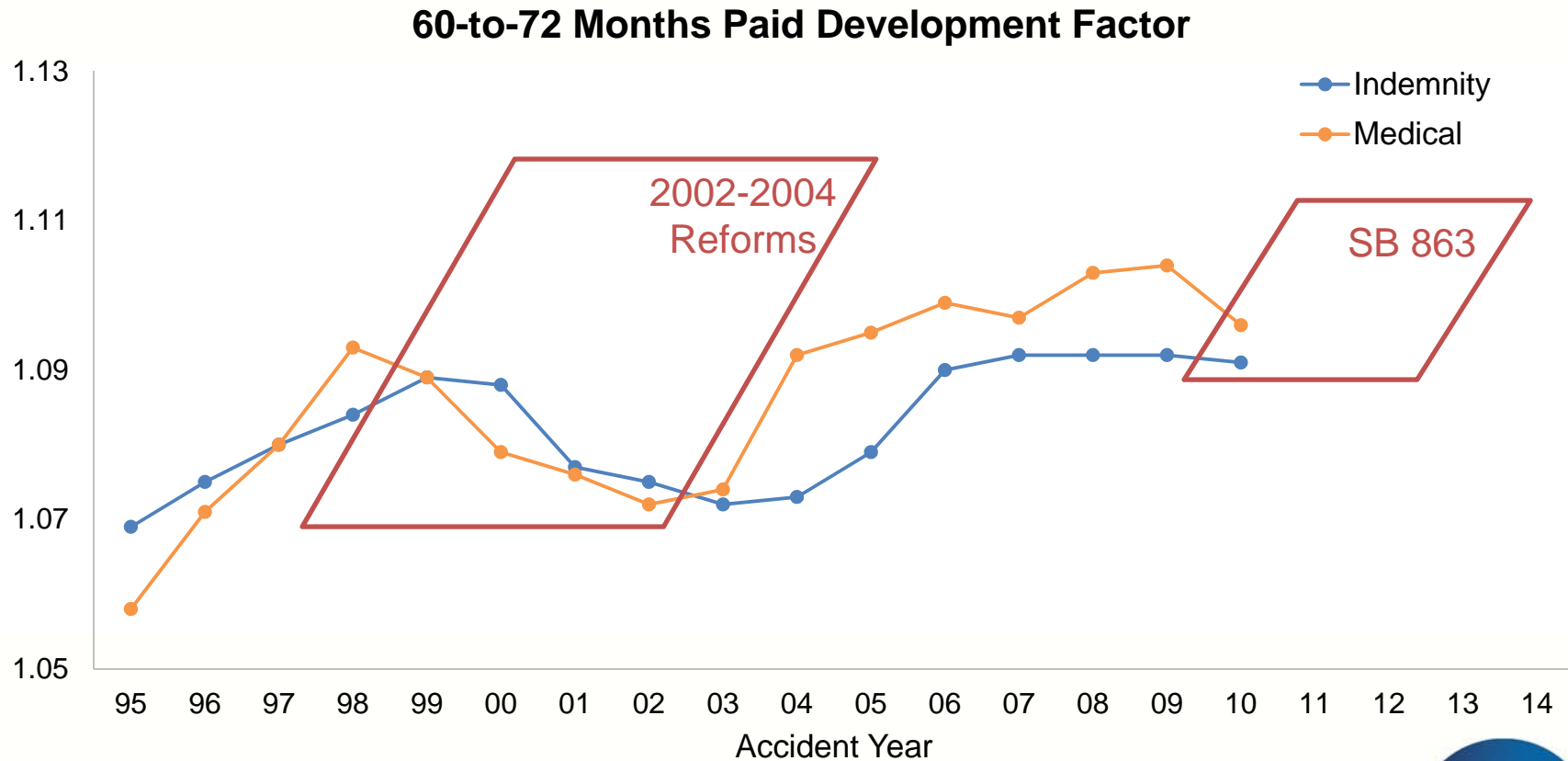
## 12-to-24 Months Paid Development Factor



Source: WCIRB aggregate data calls



# Reforms Impact Development on Older Years

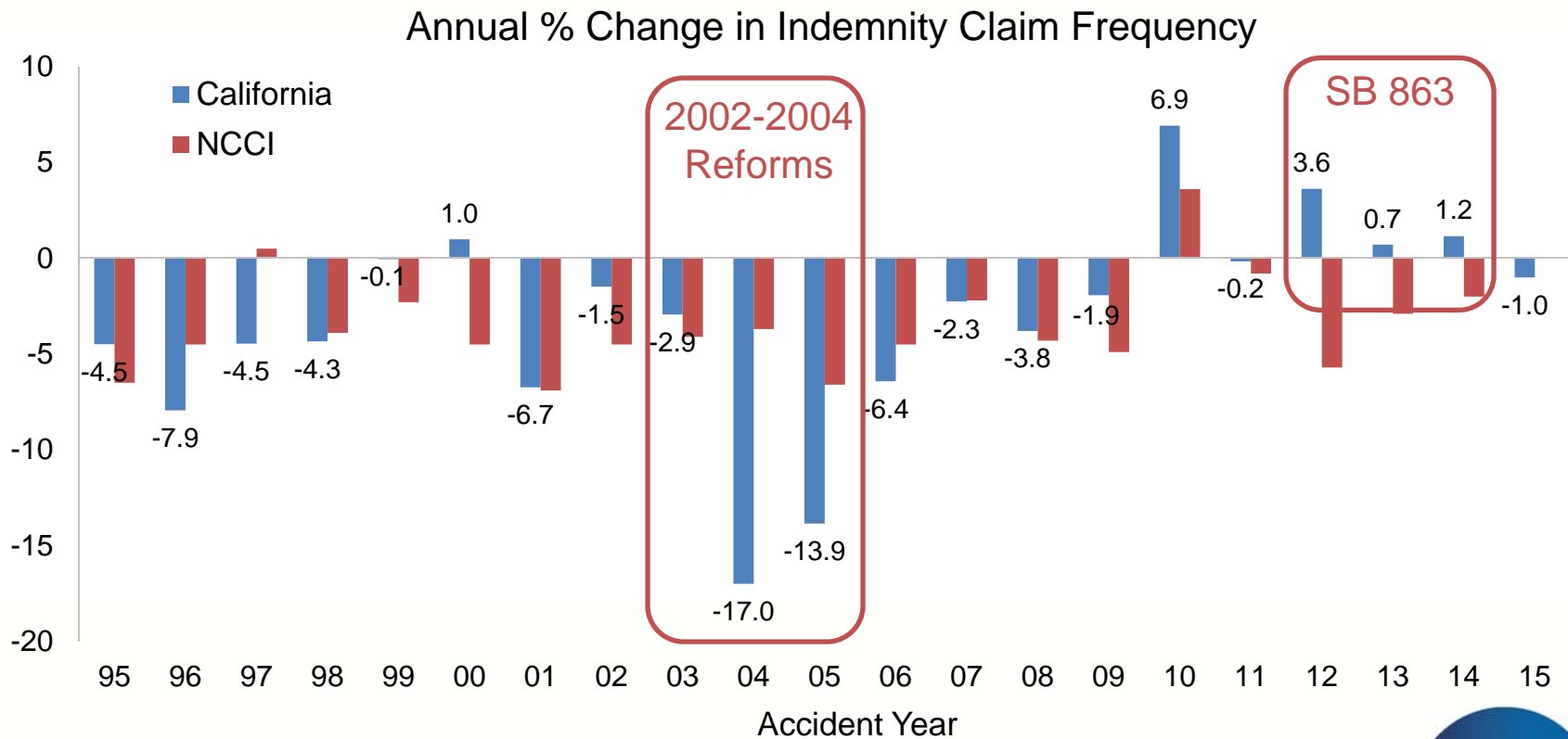


Source: WCIRB aggregate data calls





# Changes in Benefits Correlated with Shifts in Claim Frequency

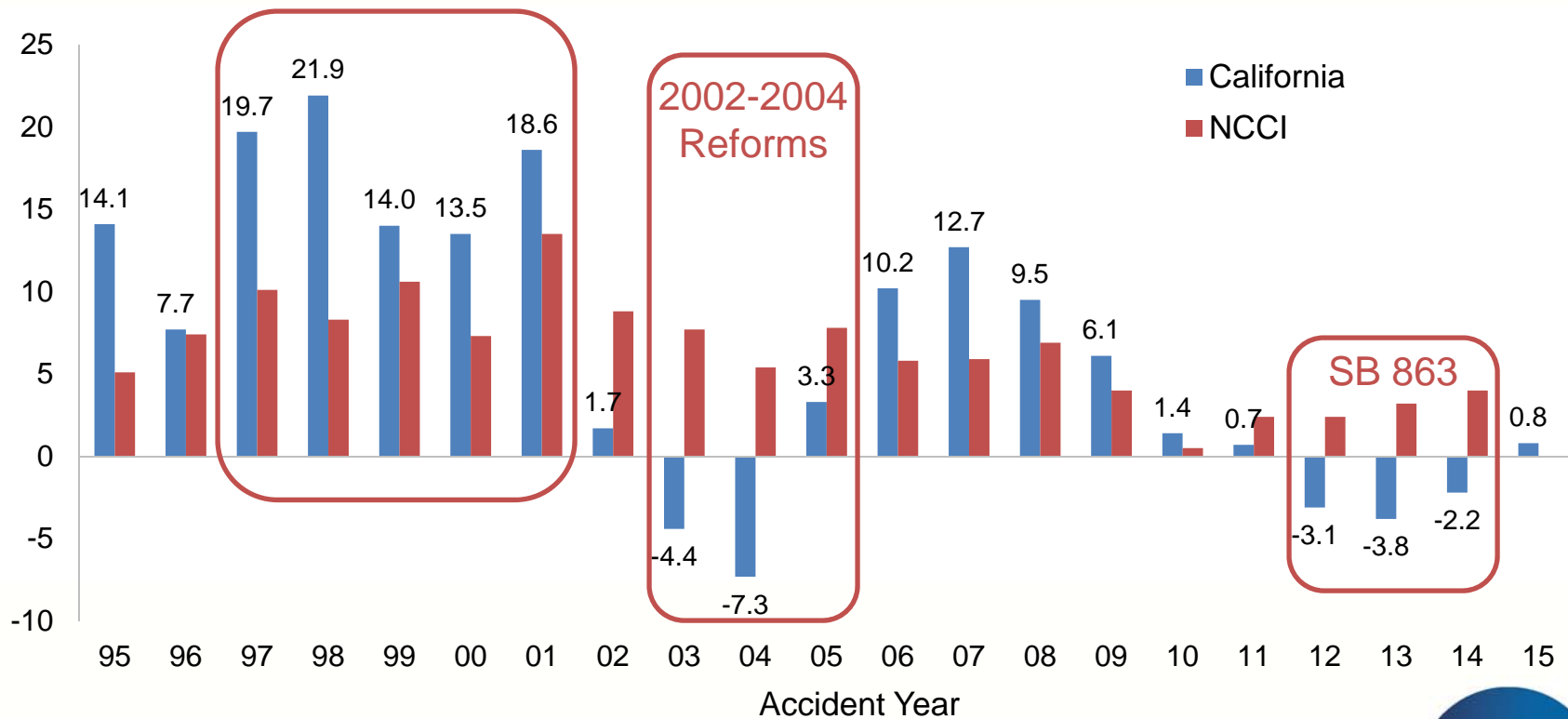


Source: California data from WCIRB unit statistical reports. NCCI data from the May 14, 2015 State of the Line presentation.



# Periods of Signif. Medical Inflation Followed by Periods of Decline

Annual % Change in Ultimate Medical per Indemnity Claim



Source: California data from WCIRB aggregate data calls and actuarial projections as of 12/31/2015. NCCI data from the May 14, 2015 State of the Line presentation.



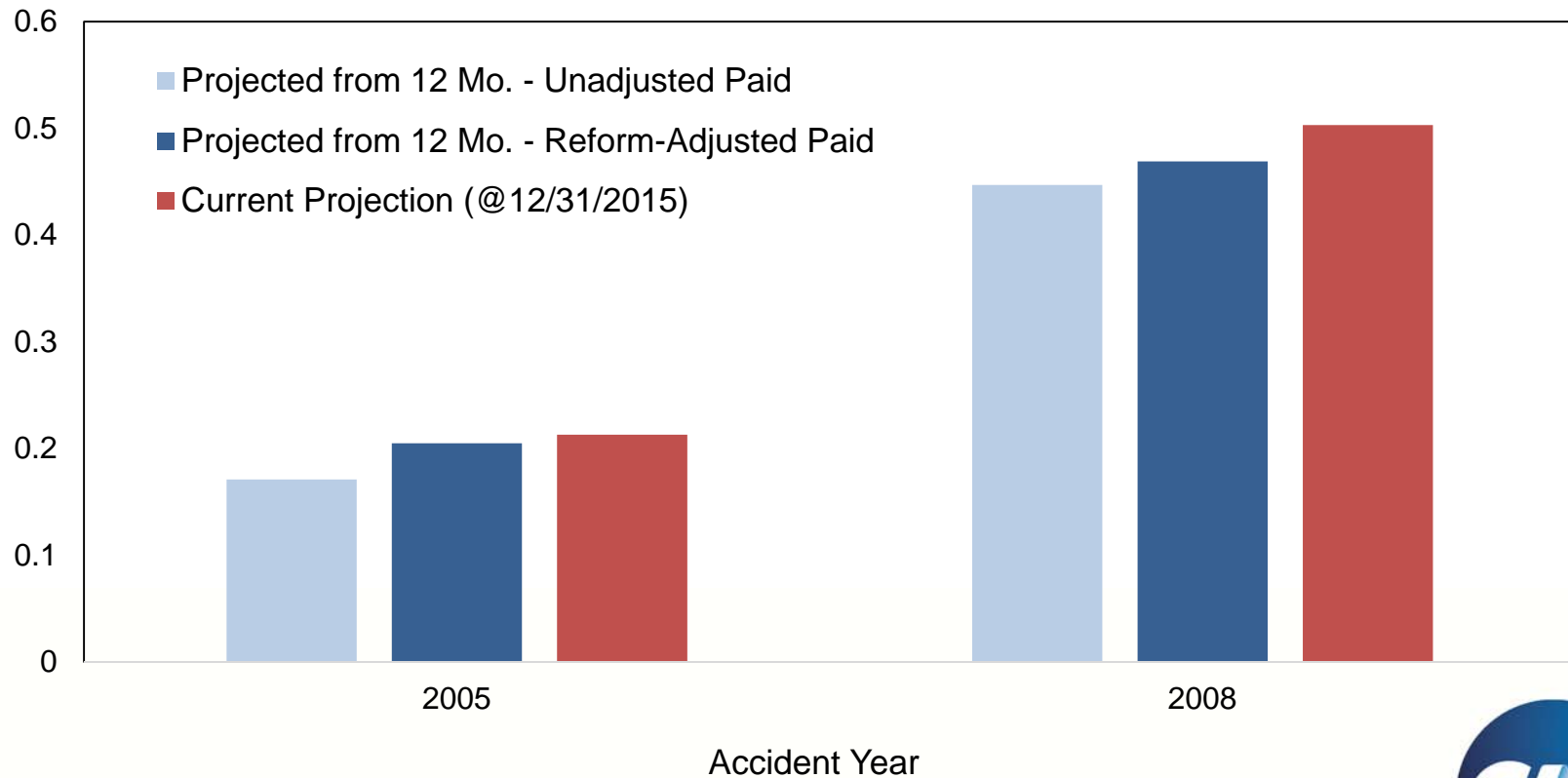
# Developing in a Changing Environment

- Reforms Distort Historical LDF Triangles
  - Mix of pre & post-reform data
- WCIRB Solution: Adjust LDFs for Major Changes
  - Indemnity – analyze changes by type of benefit and timing of benefit payments
  - Medical – “on-level” pre-reform payments in LDF
- Adjusted Triangles Now at Comparable Level



# Reform Adjustments Have Increased Accuracy of Projection

**Projected Ultimate Medical Loss Ratios**



Source: WCIRB rate filings and Actuarial Committee agendas

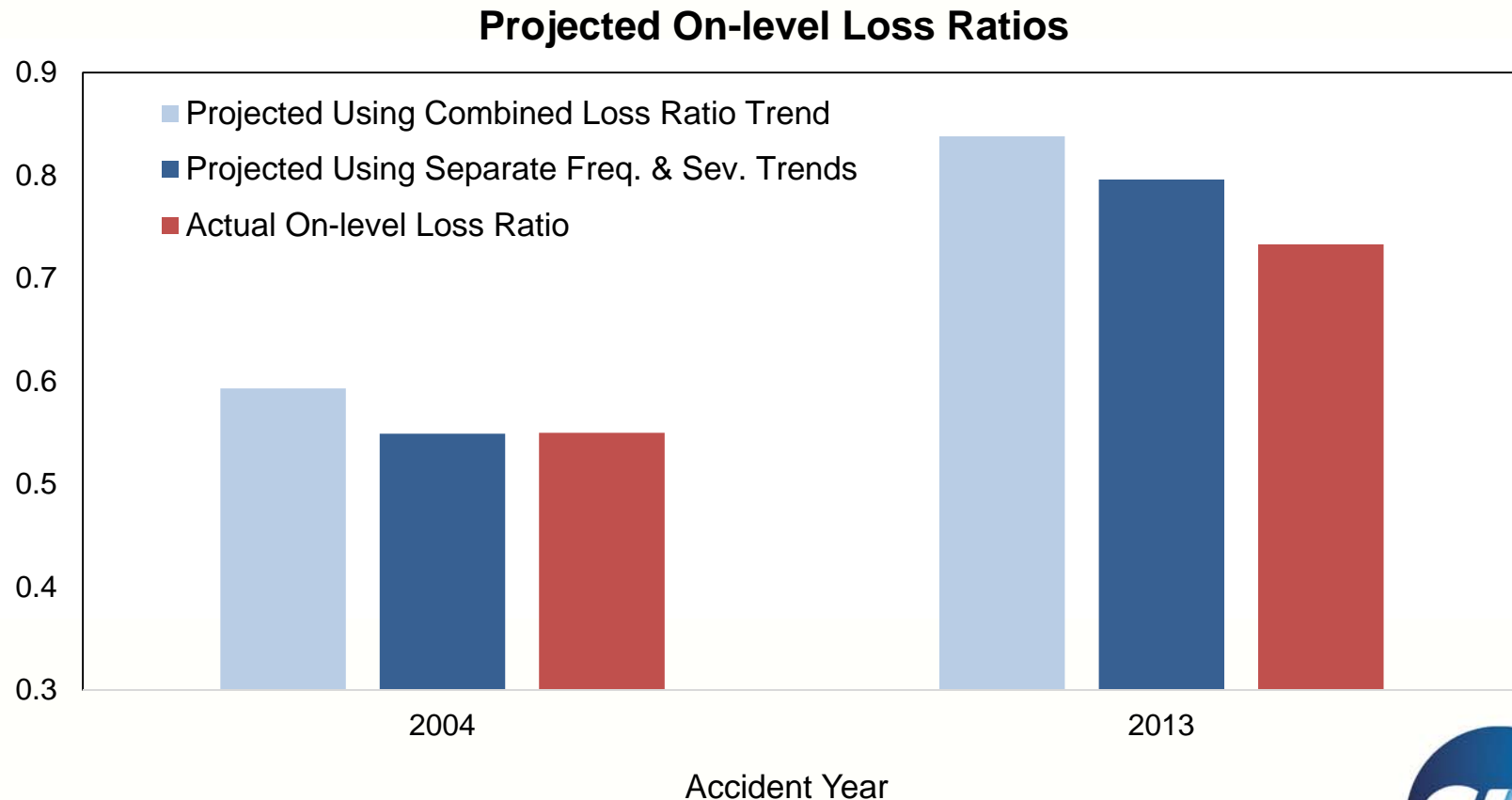


# Trending in a Changing Environment

- Volatility Affects Historical Loss Ratio Trend
  - Trends reversing direction!
- WCIRB Solution: Project Separate Frequency & Severity Trends
- Frequency Model Projection
  - Modeled with benefit changes & economic conditions
- Severity Projections
  - Analysis of short and long-term rates
- Always Important to Consider Environment



# Separate Freq./Sev. Trends Improve Projection During Periods of Change



Source: WCIRB 2012 & 2015 studies of trending methodology. Projections are based on the average of the latest two years' ultimate on-level loss ratios.



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# California WC vs Argentina Auto

## ● Differences

- The US is more regulated than Latin America
- The US doesn't have high economic inflation
- WC is longer tail than auto
- Difference in claimants, different incentives. WC originated to waive the employee's right to sue his employer

## ● Similarities

- Both jurisdictions are subject to inflation: California has high social inflation, while Argentina has high economic inflation
- Both lines of business are casualty (rather than property)
- Both jurisdiction is subject to frequent changes in regulation (e.g. 2002 to 2004 reforms and litigious Culture in Argentina Growing since ~2007)
- Economic status of claimant plays is a big driver of filing for the claim





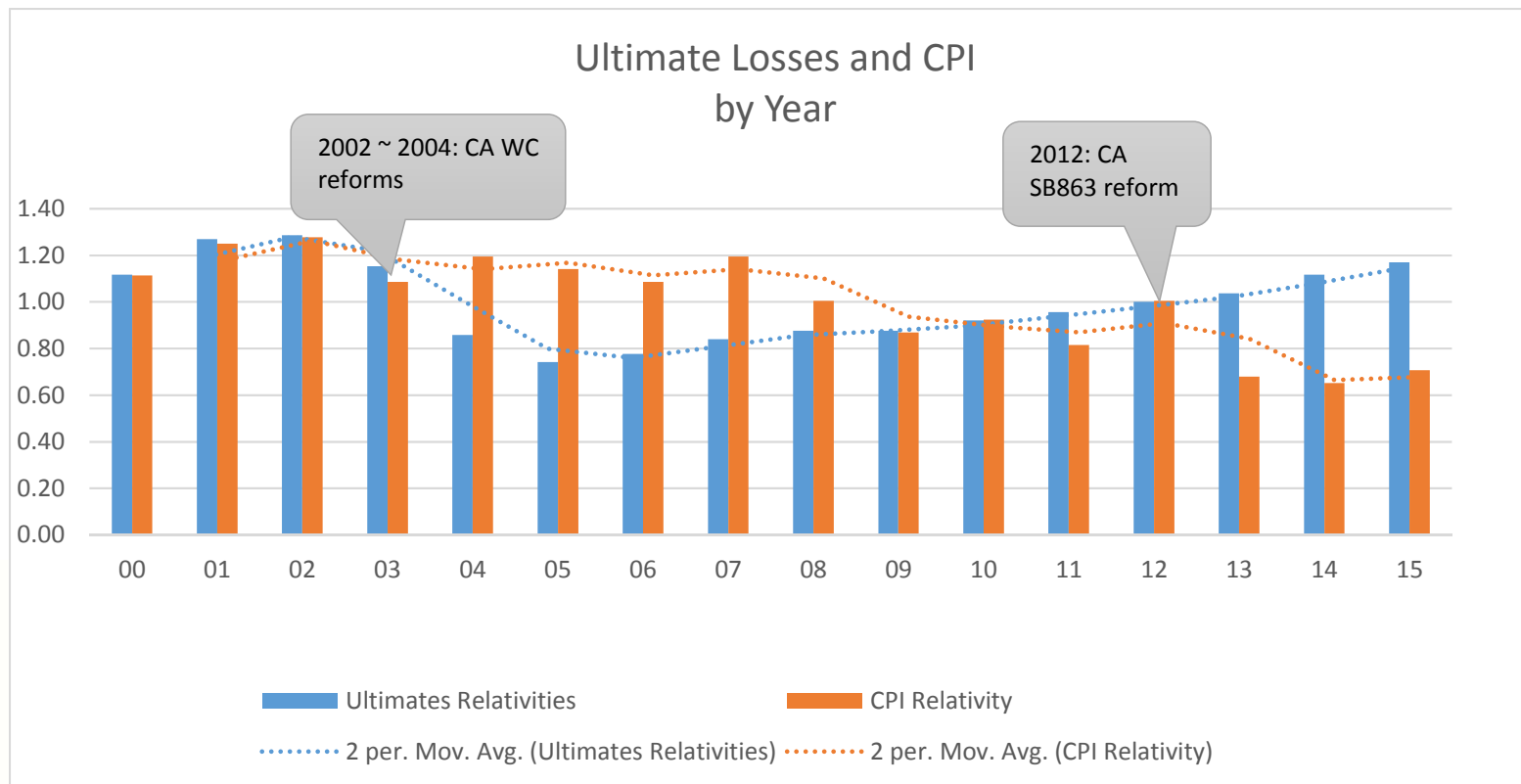
# Why traditional Methods fail

- Assumptions of Chain ladder Thomas Mack
  1. Expected Incremental Losses are proportional to losses Reported to Date
  2. Losses in AY are independent of losses in other accident years
  3. Variance of incremental losses is proportional to losses reported to date
- High and Changing Inflation produces Calendar Year Effect
- Litigious Growth also a CY Effect
- Assumptions 1 & 2 are violated



# California WC example

- Relationship between inflation and WC Reserve movement:



# The Calendar Year Effect

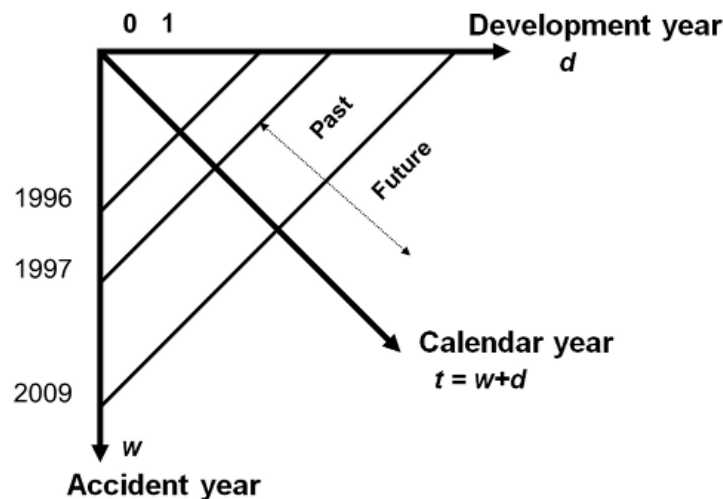
The Chain Ladder link *ratio*  $y(i)/x(i)$  is the slope of a line passing through the origin (a slope but no intercept).

$$y(i) = bx(i) + \varepsilon(i), \quad \text{Var}[\varepsilon(i)] = \sigma^2 x(i)^\delta$$

But mix changes appear on a calendar year basis and predicting losses as lognormal (skewed to the right) makes more sense. We assume there are 3 directions with arguments  $d$ ,  $w$ , and  $t$ .

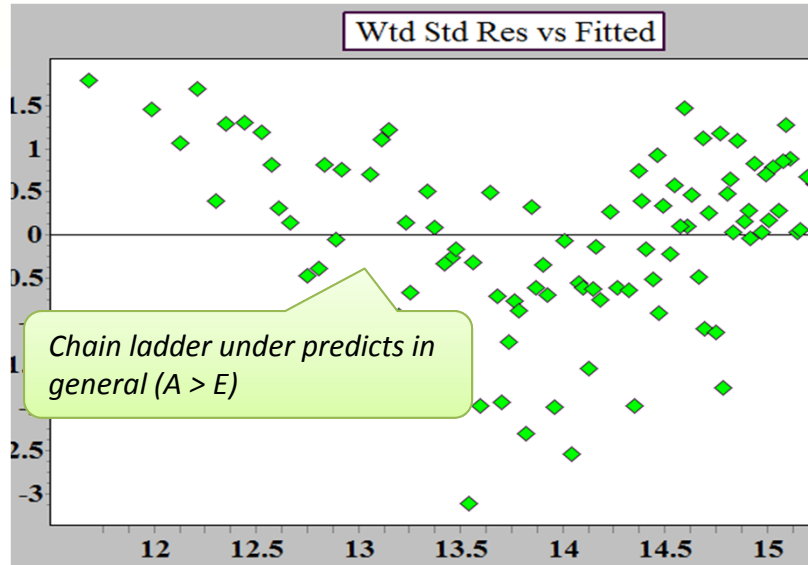
$$\text{Ln(Incremental Payments)} = \alpha_i + \sum_{k=1}^j \gamma_k + \sum_{l=1}^{i+j} \lambda_l + \varepsilon_{i,j}$$

$$\text{Incremental Payments} = e^{\text{intercept}} * e^{\sum \text{development trend}} * e^{\sum \text{calendar trend}}$$



# Problems with Chain Ladder in changing environment

Chain ladder can lead to big errors depending on where you are in the cycle



Calendar Year			
Actual vs Estimated (in \$M)			
Year	Actual	Estimated	% Diff = (A-E)/E
2001	8	8	0%
2002	33	24	38%
2003	46	31	46%
2004	48	37	31%
2005	25	34	-26%
2006	17	29	-41%
2007	21	25	-15%
2008	15	20	-25%
2009	15	17	-16%
2010	17	17	-3%
2011	18	17	3%
2012	18	18	-2%
2013	18	19	-4%
2014	22	18	20%
2015	19	17	13%
<b>Total</b>	<b>339</b>	<b>331</b>	<b>2%</b>

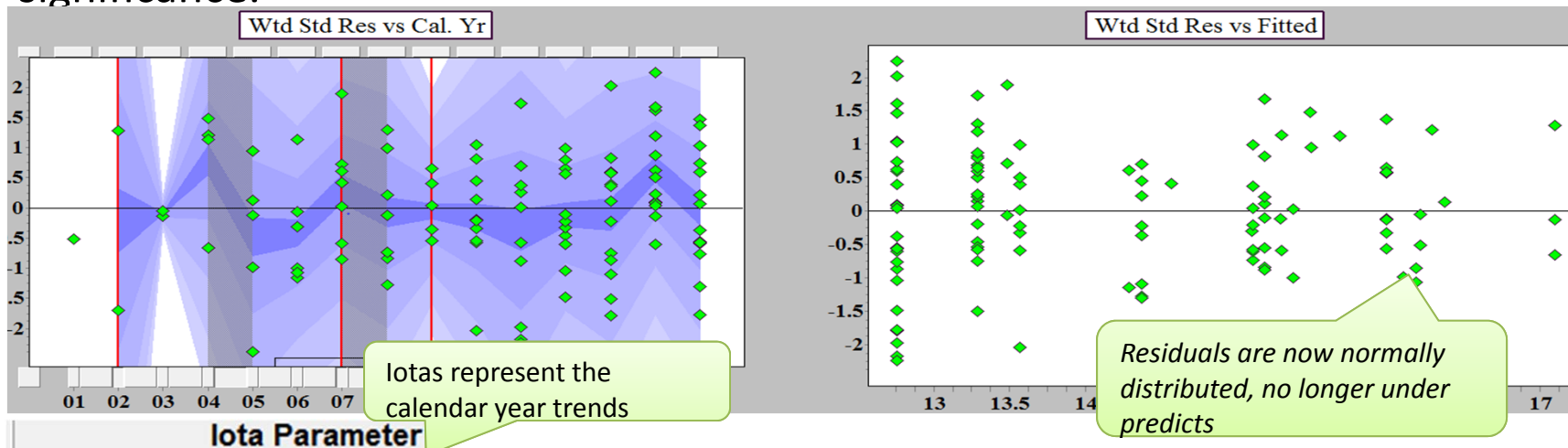
From 2001 - 2004, chain ladder will under predict by 35%

AY/DY	1	2	3	4	5	6
2005	2.34	1.32	1.04	1.05	1.01	1.00
2006	2.63	1.23	1.08	1.01	1.00	1.01
2007	3.19	1.28	1.15	1.04	1.01	1.08
2008	4.20	1.35	1.16	1.03	1.02	1.02
2009	3.25	1.28	1.10	1.04	1.02	1.03
2010	3.26	1.34	1.05	1.07	1.01	
2011	3.52	1.29	1.12	1.03		
2012	3.23	1.38	1.03			
2013	3.19	1.33				
2014	4.60					
Sel LDF	3.24	1.31	1.12	1.03	1.01	1.01



# What does ICRFS do differently?

Each trend parameter (in each of the trend directions) is tested for significance.



Calendar Year	lota	S.E.	t-Ratio
2001~2002	0.0000	0.0000	0.00
2002~2003	0.0000	0.0000	0.00
2003~2004	0.0000	0.0000	0.00
2004~2005	-0.1923	0.0413	-4.66
2005~2006	-0.1923	0.0413	-4.66
2006~2007	0.0000	0.0000	0.00
2007~2008	-0.1923	0.0413	-4.66
2008~2009	0.0000	0.0000	0.00

$$t_{\hat{\beta}} = \frac{\hat{\beta} - \beta_0}{\text{s.e.}(\hat{\beta})}$$



# Comparison of Chain Ladder vs Model

ICRFS provides better estimates in aggregate and by year

*The model tested against past data is an improvement against observed losses*

Calendar Year Results (using Chain Ladder) Actual vs Estimated (in \$M)			
Year	Actual	Estimated	% Diff
2001	8	8	0%
2002	33	24	38%
2003	46	31	46%
2004	48	37	31%
2005	25	34	-26%
2006	17	29	-41%
2007	21	25	-15%
2008	15	20	-25%
2009	15	17	-16%
2010	17	17	-3%
2011	18	17	3%
2012	18	18	-2%
2013	18	19	-4%
2014	22	18	20%
2015	19	17	13%
<b>Total</b>	<b>339</b>	<b>331</b>	<b>2%</b>

Calendar Year Results (Using ICRFS) Actual vs Estimated (in \$M)			
Year	Actual	Estimated	% Diff
2001	8	9	-12%
2002	33	30	10%
2003	46	39	16%
2004	48	41	17%
2005	25	29	-13%
2006	17	22	-20%
2007	21	21	1%
2008	15	17	-12%
2009	15	18	-16%
2010	17	18	-7%
2011	18	18	-4%
2012	18	19	-4%
2013	18	19	-3%
2014	22	19	14%
2015	19	20	-4%
<b>Total</b>	<b>339</b>	<b>339</b>	<b>0%</b>



# Comparison of Chain Ladder vs Model

Chain ladder results in understating the reserves by \$11M, which is 20% lower than ICRFS results

Accident Year Results (Using Chain Ladder)		
Actual vs Estimated (in \$M)		
Year	Mean	
	Reserves	Ultimate
2001	0	69
2002	0	49
2003	0	40
2004	1	25
2005	1	19
2006	1	18
2007	1	19
2008	2	19
2009	2	17
2010	3	16
2011	4	20
2012	5	21
2013	6	19
2014	8	19
2015	10	12
<b>Total</b>	<b>44</b>	<b>383</b>

Accident Year Results (using ICRFS)		
Actual vs Estimated (in \$M)		
Year	Mean	
	Reserves	Ultimate
2001	0	69
2002	1	50
2003	1	41
2004	1	26
2005	1	20
2006	2	19
2007	2	19
2008	2	20
2009	3	17
2010	3	16
2011	3	19
2012	4	20
2013	6	19
2014	9	21
2015	16	19
<b>Total</b>	<b>55</b>	<b>394</b>



# Conclusions

- Three different solutions to solve the same problem
  1. Using a modified Fisher Lange method that predicts frequency and severity separately
  2. Adjusting LDFs for Major changes on indemnity and medical
  3. Using models (regression, GLMs, Mack, Bootstrap) to supplement traditional actuarial techniques
- The three solutions suggest separating the trends, data and results by frequency and severity





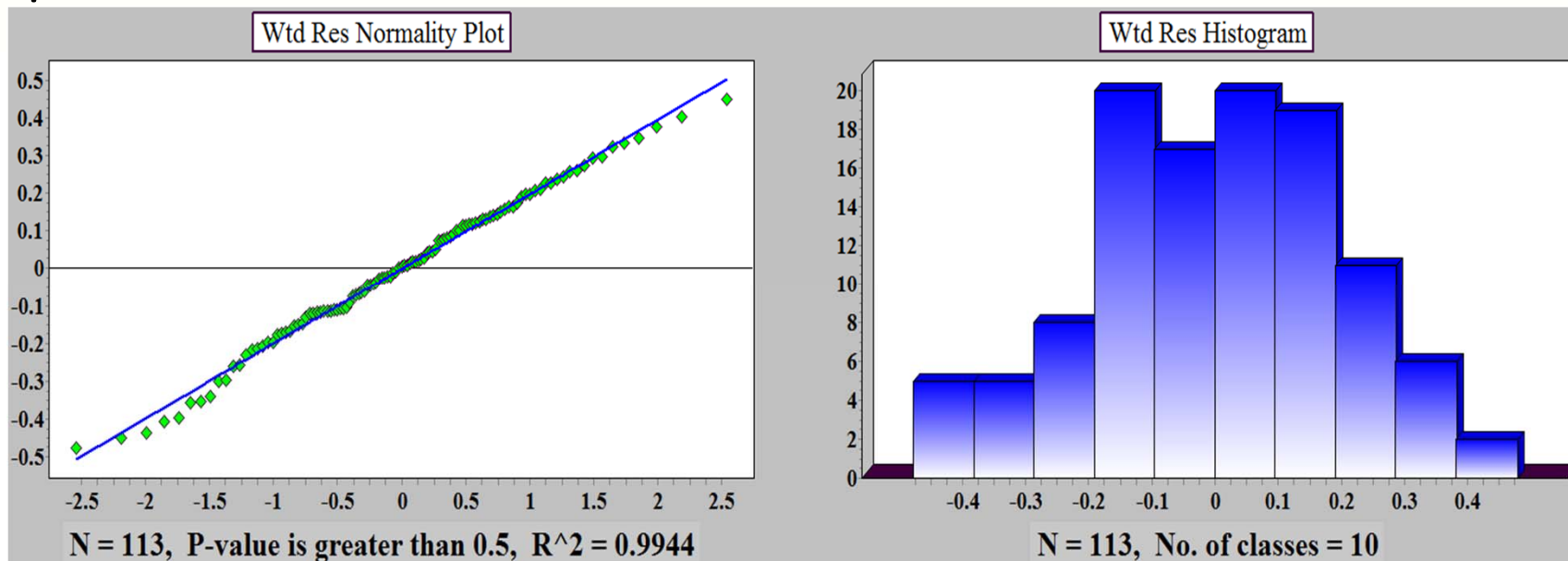


# Conclusions

- The three solutions suggest separating the trends, data and results by coverage to link them to economic drivers
  1. For WC California, trends are different between medical and indemnity and interact with different economic drivers (inflation for medical and unemployment for indemnity)
  2. For Argentina Motor, trends are different between Judicials and Mediations coverages
- Allows input from CFO or Business into the Inflation Assumptions



# Testing the Model Assumptions



Run	N	MSave	MRetr	P	R2(%)	S2(B)	SSPE	WSSPE	AIC	BIC	Sg	Out	Norm
1	113		M6	5.0	90.8	0.0399	87.290	8.072	145.6	159.2	Y	0	>0.50





# Discussion



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# Appendix Slides



# CA WC Reforms – 2002 through 2004

- AB 749 (2002)
  - Increased indemnity benefits
  - Repeal of presumption of correctness given to primary treating physician (Minniear)
- AB 227 & SB 228 (2003)
  - Changes to voc rehab benefits
  - Reductions to medical fee schedules
  - Established Medical Treatment Utilization Schedule
  - Limited # of chiropractic or PT visits
- SB 899 (2004)
  - Limited duration of TD
  - New PDRS & changes to PD benefits
  - Established medical provider networks





# CA WC Reforms – SB 863

- SB 863 (2012)
  - Increased PD benefits
  - Changes to PD ratings
  - Reductions in some medical fees
  - Established lien filing fee & statute of limitations
  - Established independent medical review and independent bill review processes
  - New physician fee schedule based on RBRVS

