HOW ACCURATE ARE YOUR UNPAID CLAIMS ESTIMATES?

As Helmuth Karl Bernhard Graf von Moltke (German Field Marshal from the 18th century) noted, 'no plan survives contact with the enemy'.

In P&C actuarial speak, the equivalent is … 'no reserving method survives contact with the future'.

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Contributors: Timothy J Pratt, Andy Moriarty
CLRS, San Diego, Sept 16th 2014

AGENDA

- Introduction
- Approach Outline
- Reserving has no* impact on Profit
- Stochastic Claim Model
- Reserving Methods
- Measures
- Results
- Questions?

Note: The views expressed during this presentation are our views and do not represent the views of our current (or prior) employers

INTRODUCTION

INTRODUCTION

- We* got to thinking about this this subject by comparing and contrasting …
  - claim volatility;
  - reserve volatility and;
  - the non-dynamic nature of the existing reserving methods
- Due to the volatile nature of P&C claims …
  - We know that the current unpaid claims estimate is going to be wrong
  - We know that the final value will likely fall within a range of $X to $Y
- Is there a reserving approach that will help us smooth out the claims volatility?

* Contributors: Timothy J Pratt, Andy Moriarty

INTRODUCTION

Has something similar every happened to you?

- You have a moderate size excess liability book
- Quarter after quarter, nothing happened on the claim front (typical for excess)
- You use the Bornhuetter-Ferguson method
- Each Quarter, the BF IBNR reduces by $2m
- This happens for (say) 8 quarters in a row
- Then a $15m claim is reported

- Management remembers the $15m hit …
- … but didn't remember the $16m release

INTRODUCTION

- At a recent CAGNY meeting, Lela Patrick & Timothy Landick presented a paper / discussion on reserve variability *

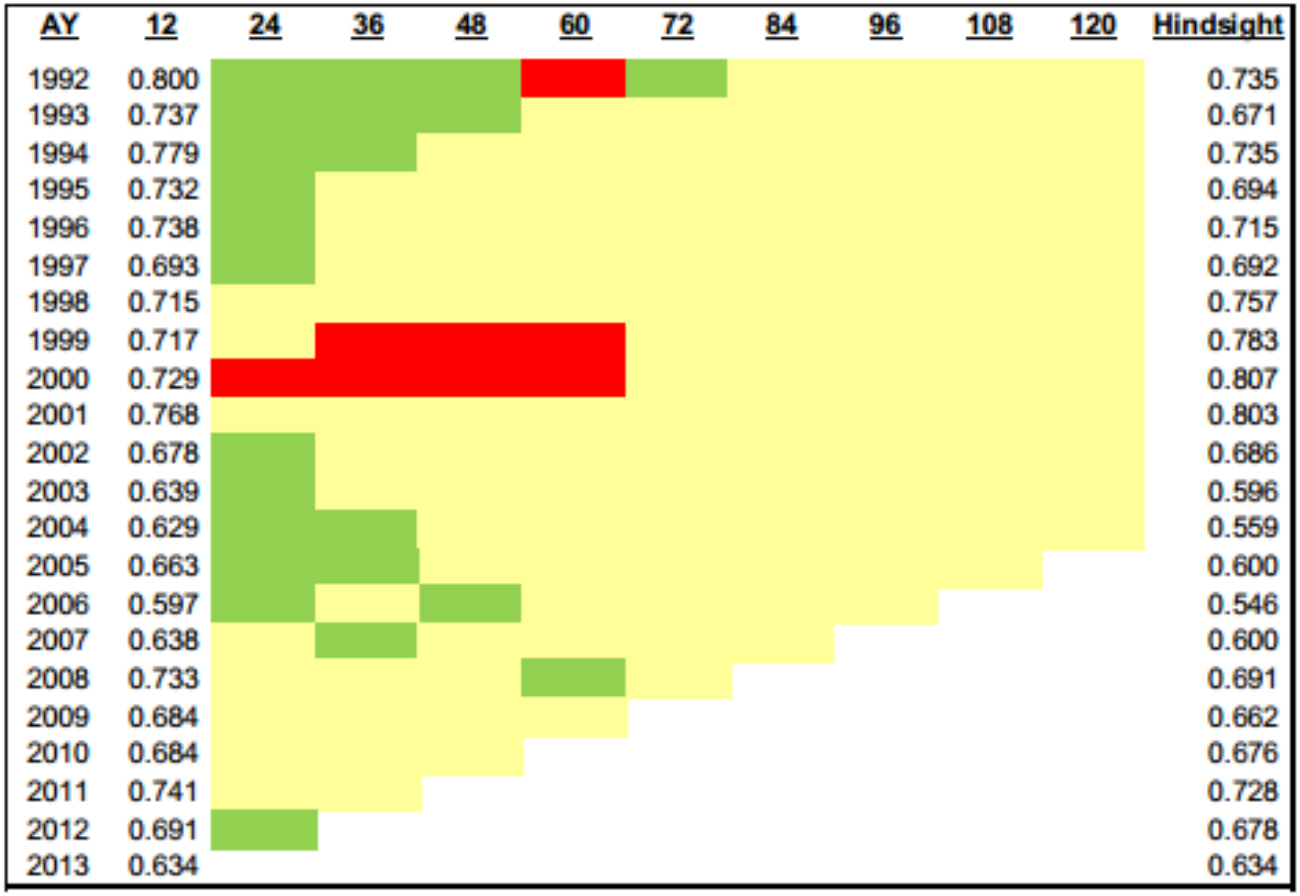
- One slide showed a ‘heat map’ of reserve increases (red) or decreases (green) outside a certain threshold

* http://www.casact.org/community/affiliates/cagny/0614/Res_Var.pdf

INTRODUCTION

Accident year loss ratio development

All Lines of Business Combined – heat map



AY	12	24	36	48	60	72	84	96	108	120	Hindsight
1992	0.800										0.735
1993	0.737										0.671
1994	0.779										0.735
1995	0.732										0.694
1996	0.738										0.715
1997	0.693										0.692
1998	0.715										0.757
1999	0.717										0.783
2000	0.729										0.807
2001	0.768										0.803
2002	0.678										0.686
2003	0.639										0.596
2004	0.629										0.559
2005	0.663										0.600
2006	0.597										0.546
2007	0.638										0.600
2008	0.733										0.691
2009	0.684										0.662
2010	0.684										0.676
2011	0.741										0.728
2012	0.691										0.678
2013	0.634										0.634

Source: SNL, 2013, Individual Company Statutory Statements

pwc

Slide 15

INTRODUCTION

- There was some discussion regarding the ‘runs’ of red and green that were observed in the heat map
  - One of the observations was this is an artifact of using the Bornhuetter-Ferguson method
- Does the BF method contain a bias?

INTRODUCTION

- Another goal that came up during our model development phase was that we wanted to assist actuaries with the following situation …
  - You've just completed your analysis in record time (15 days post quarter close)
  - Claims manager comes to you and says … "*We've just received notification of a claim with an accident date of 6 months ago … is it covered by the IBNR?*"
  - Your first question is … "*How big is it?*"

INTRODUCTION

- How big is it?
  - $2
  - $20
  - $200
  - $2,000
  - …
  - …
  - $2m
  - $2b
  - $2t

- Is it covered?
  - Yes
  - Yes
  - Yes
  - Should be
  - …
  - …
  - Could be
  - No
  - No

INTRODUCTION

- Summary …
  - Is there a reserving approach that will help us smooth out the claims volatility?
  - Does the BF method contained a bias?
  - Can we provide some assistance in answering '*Is this claim covered by IBNR?*'

- Finally …
  - Can we help with management's memory issues?
    - Management remembers the $15m hit …
      … but didn't remember the $16m release

APPROACH OUTLINE

APPROACH OUTLINE

- Construct a per-claim simulation model
- Simulate a bunch of claims
- Observe the mean claim reporting pattern
  - Use this as input into the various actuarial unpaid claims estimation methods
- Simulate a bunch of claims (again)
- Calculate the unpaid claims estimate using various reserving methods
- Review the impact of these methods on profitability and accuracy

RESERVING HAS NO* IMPACT ON PROFIT

RESERVING HAS NO* IMPACT ON PROFIT

- When considering a cohort of policies …
  - Reserving has a profit impact (short term)
    - Reserves go up, profit in the year goes down
  - However, once all claims from this cohort have been settled and paid, reserving has no profit impact

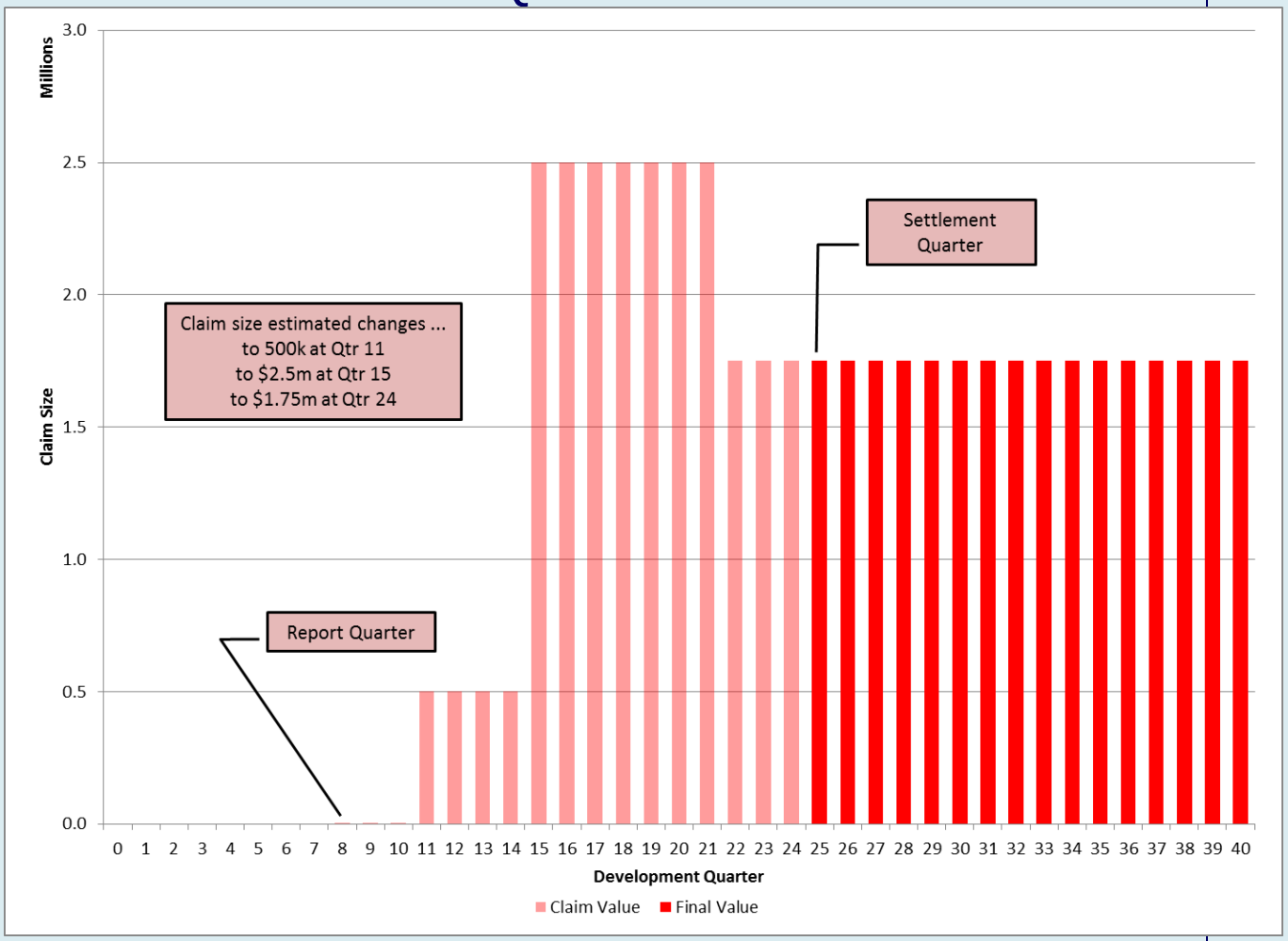
RESERVING HAS NO* IMPACT ON PROFIT

- But ...
  - Reserving has a huge impact on the view of profitability
  - And can lead to management 'mistakes' ...
    - i.e. Writing lots of unprofitable business because you thought it was profitable
    - Or ... Exiting a profitable line because you thought it was unprofitable

STOCHASTIC CLAIM MODEL

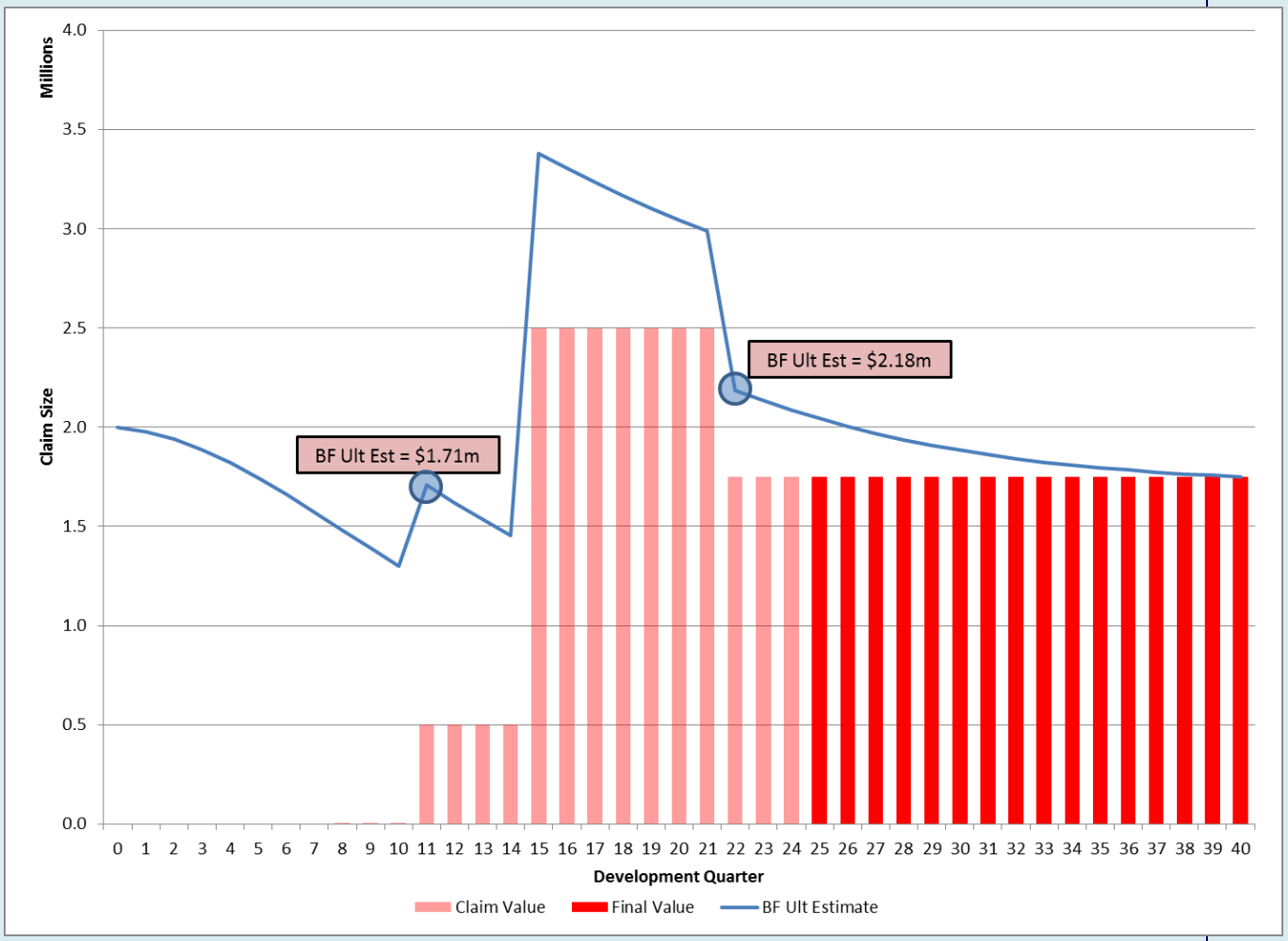
STOCHASTIC CLAIM MODEL

- Below is the 'life cycle' of a particular simulated claim
- Simulate Report and Settlement Quarter
- Simulate possibility and size of claim change movement between report and settlement quarters



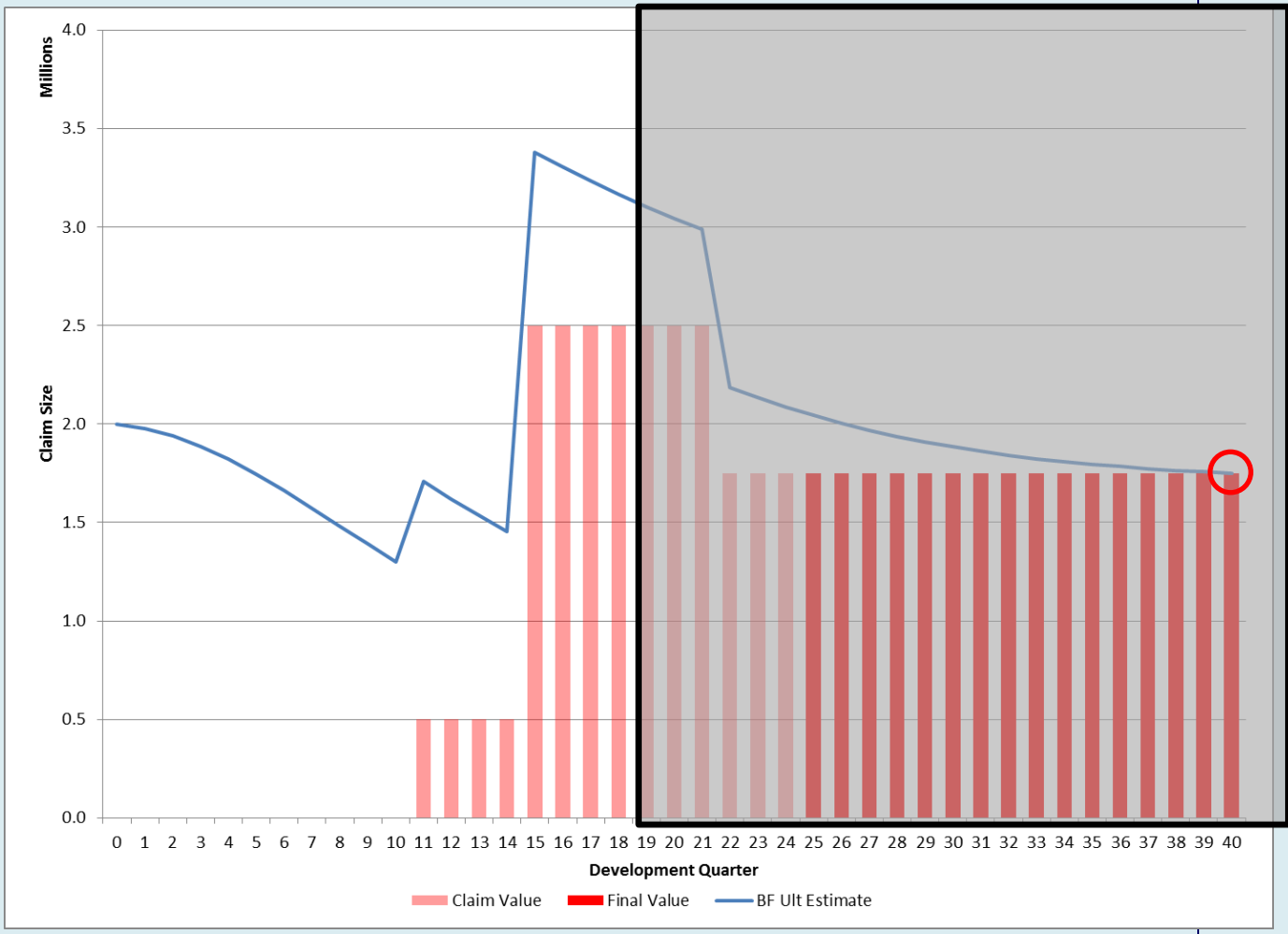
STOCHASTIC CLAIM MODEL

- Illustration of a BF Ultimate Estimate using an initial expected of $2m for the previous claim



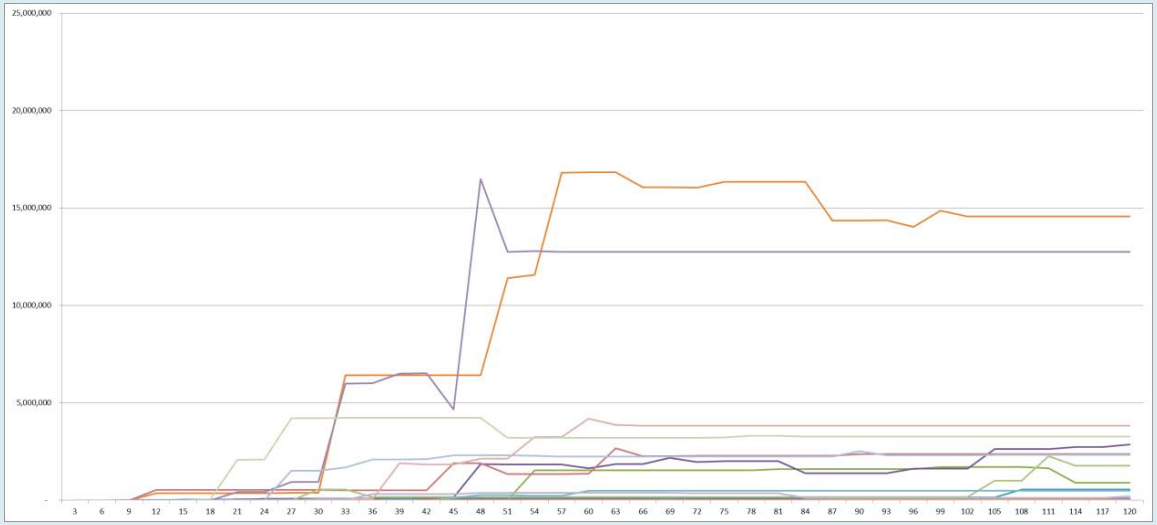
STOCHASTIC CLAIM MODEL

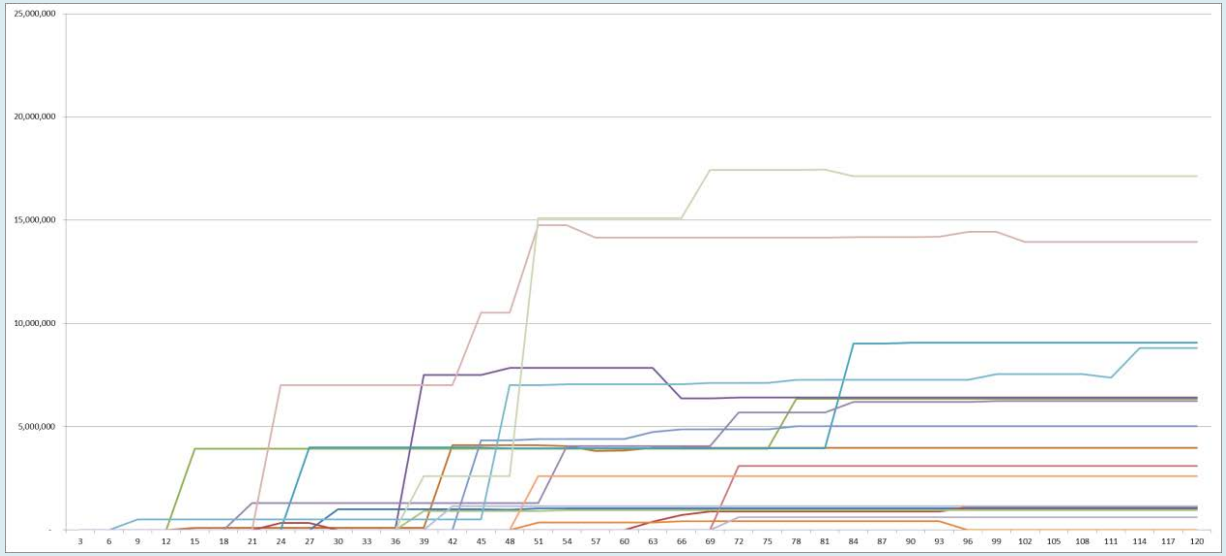
- Benefit of stochastic model
  - it can peer through the 'fog of war'



STOCHASTIC CLAIM MODEL

Which chart of cumulative loss lines is observed and which is modeled?





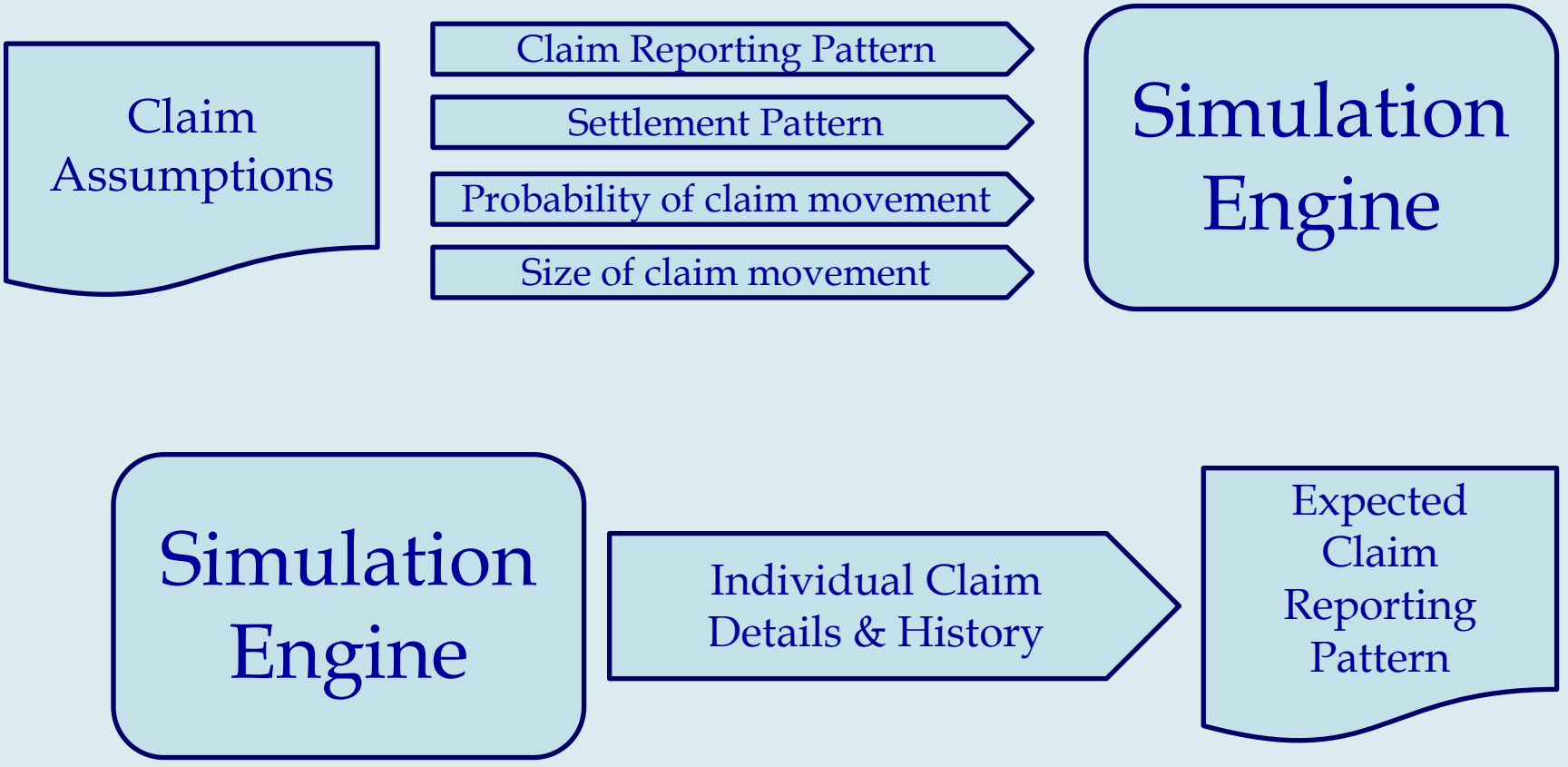
STOCHASTIC CLAIM MODEL

Model Process Steps

1. Review experience and select required assumptions
2. Run model (1m simulations)
   - Extract mean dollar reporting pattern
3. Use reporting pattern to calculate Age to Ultimate LDFs
4. Hard code LDFs into reserving methods
5. Rerun model
   - Extract results to test profit impact and reserve accuracy

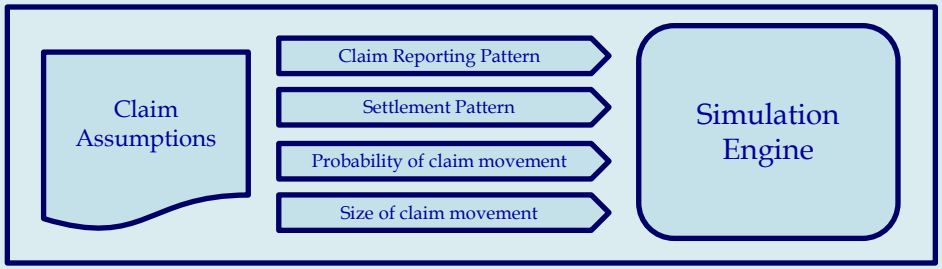
STOCHASTIC CLAIM MODEL

Step 1 – Determine the expected reporting pattern



STOCHASTIC CLAIM MODEL

Step 2 – Calculate the unpaid claims estimates



Expected Claim Reporting Pattern

Simulation Engine

Individual Claim Details, History & Unpaid Claims Estimates

40 Qtrs of Profit & unpaid claims estimates

RESERVING METHODS

RESERVING METHODS

The Usual Suspects	Additional Methods
▣ Fixed Estimate / Initial Expected ▣ Bornhuetter-Ferguson ▣ Loss Development / Chain Ladder	▣ Bounded Bornhuetter-Ferguson ▣ Mixed / blended

RESERVING METHODS

Bounded Bornhuetter-Ferguson (BBF)

- Reserve approach is ...
  - Current Ultimate Estimate is equal to the prior review's Ultimate Estimate
  - Unless ...
    - the calculated ultimate estimate breaches an upper or lower limit

- Effectively means that the ultimate is 'sticky' and doesn't move until the weight of information moves it

RESERVING METHODS (BBF)

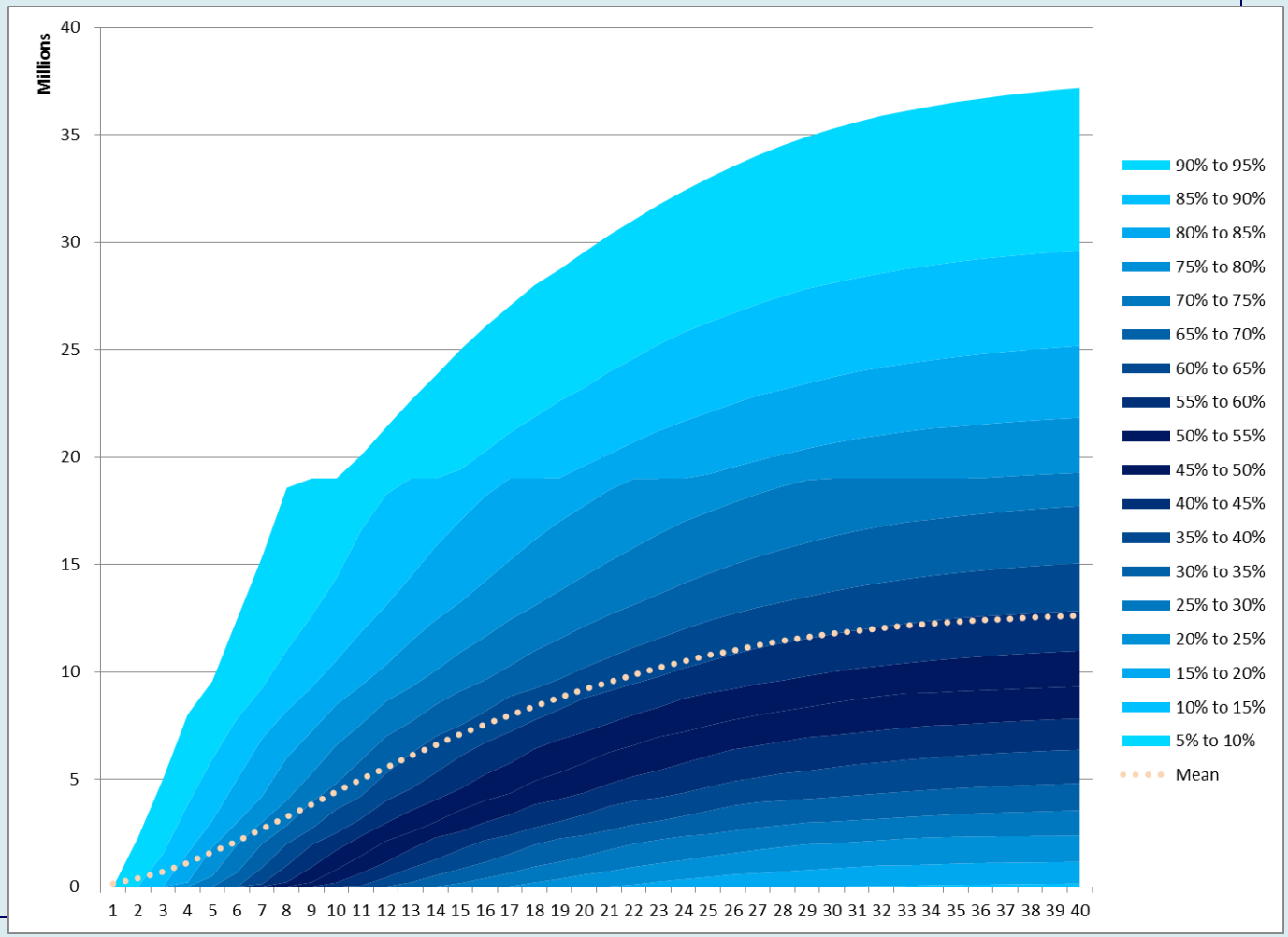
- Approach used here is two (2) related Bornhuetter-Ferguson estimates
- One BF gives the upper bound
- One BF gives the lower bound

- Q: How do you determine the upper and lower bounds?
  - Modify the IELR?
  - Modify the expected reporting pattern?

  - *We only used the latter*

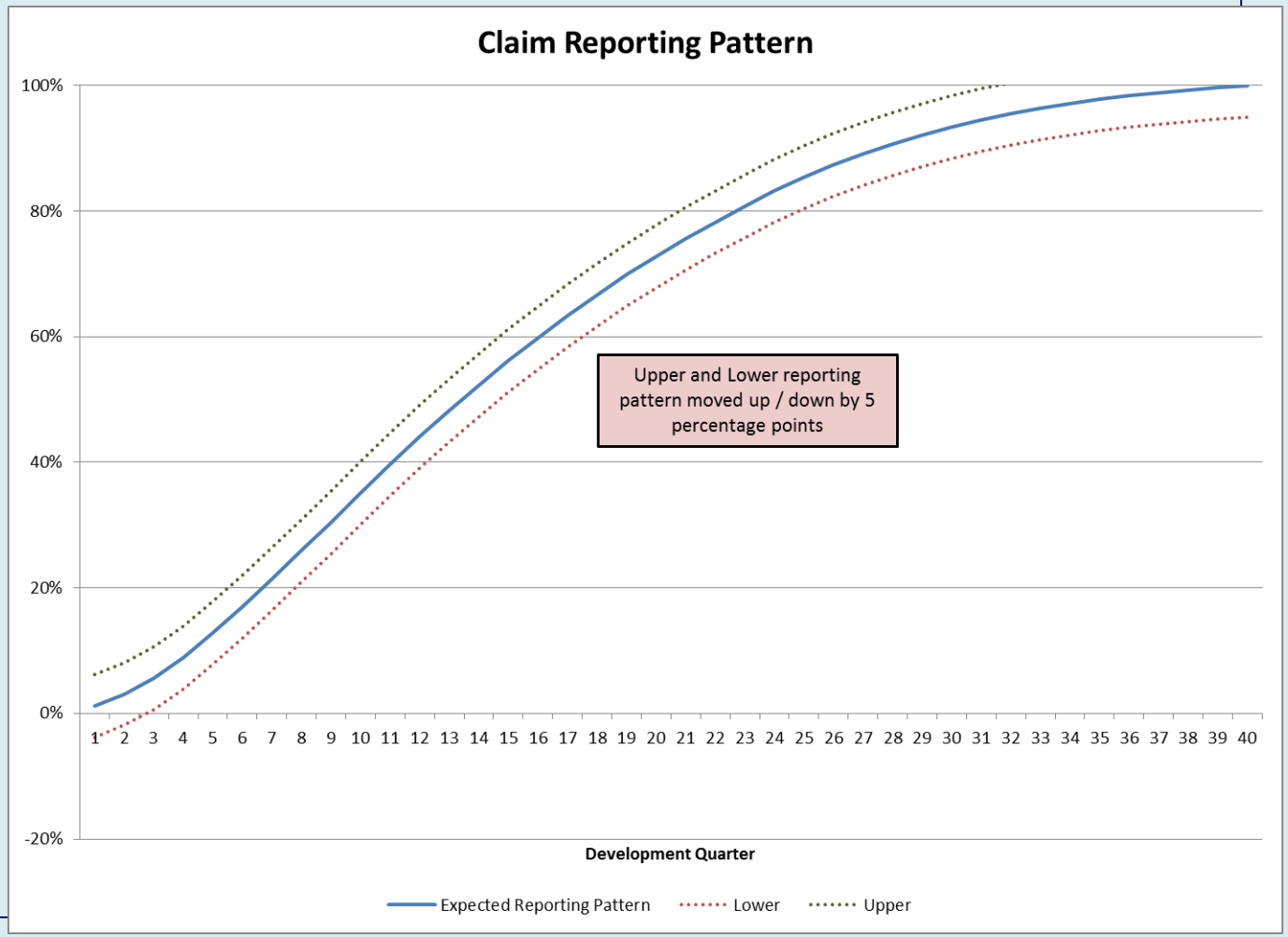
RESERVING METHODS (BBF)

- How do you select the upper and lower bounds?
  - Option 1 – Use stochastic or bootstrapping results



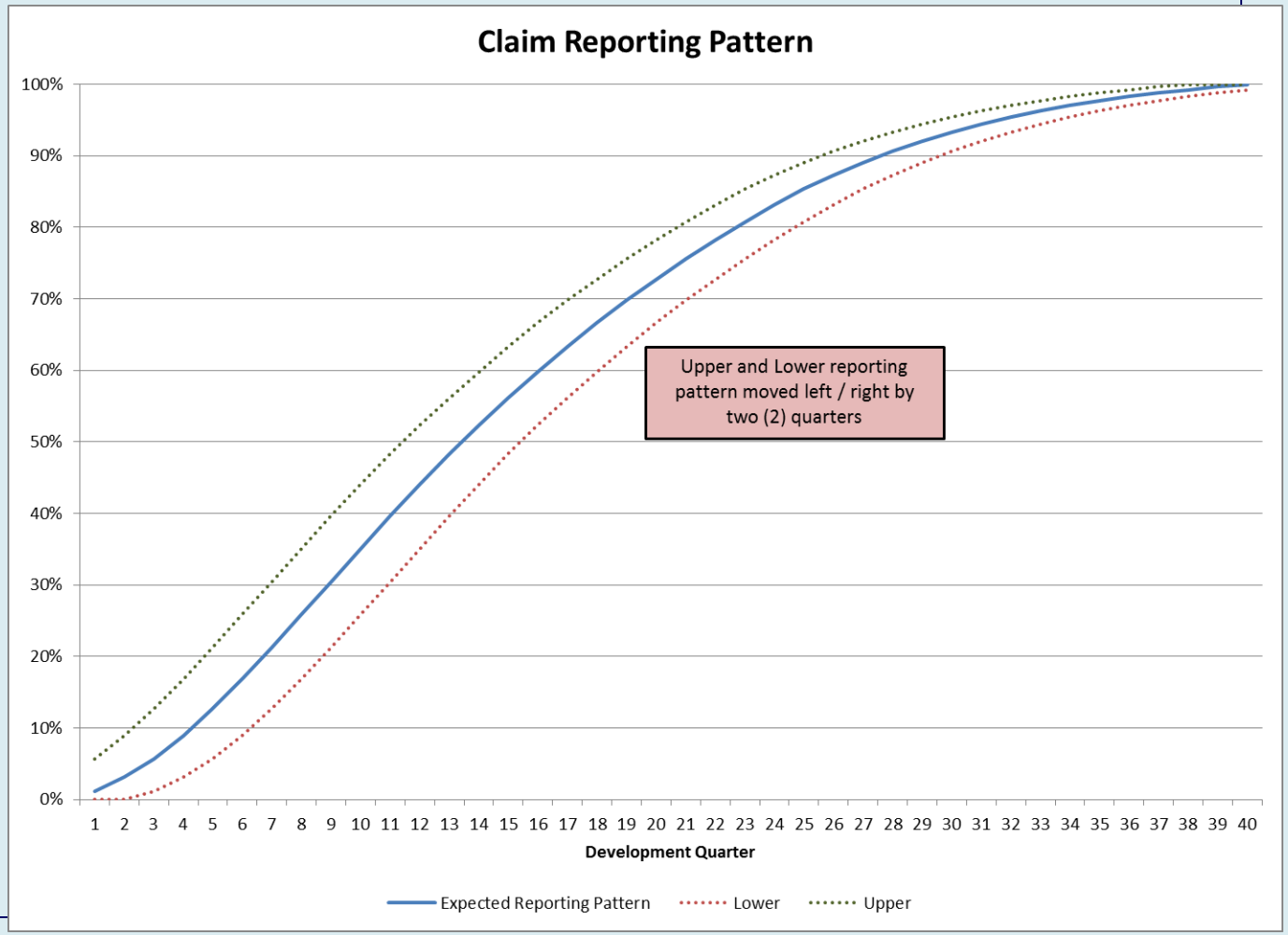
RESERVING METHODS (BBF)

- How do you select the upper and lower bounds?
  - Option 2 – Adjust the expected reporting pattern up and down



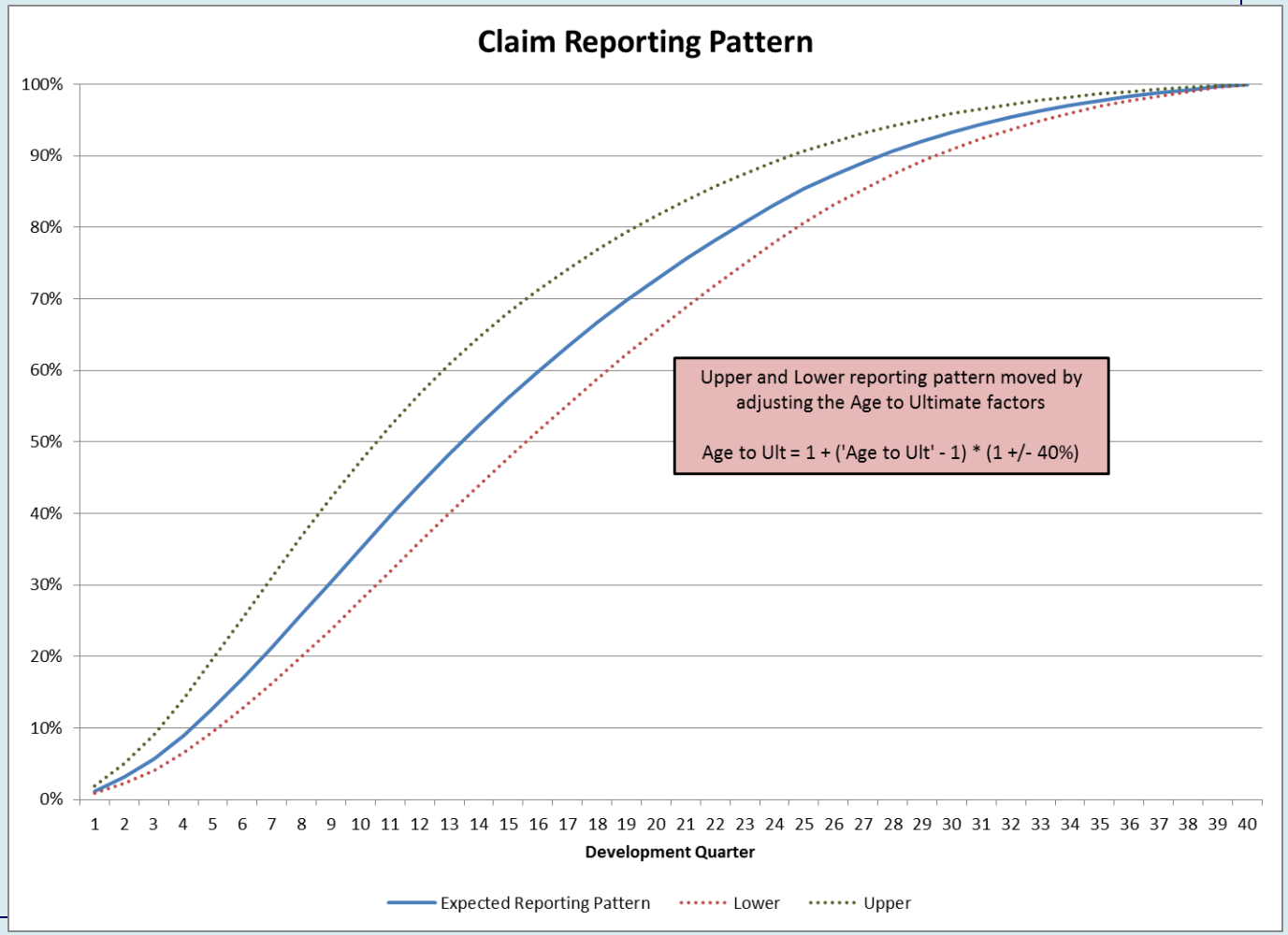
RESERVING METHODS (BBF)

- How do you select the upper and lower bounds?
  - Option 3 – Adjust the expected reporting pattern left and right



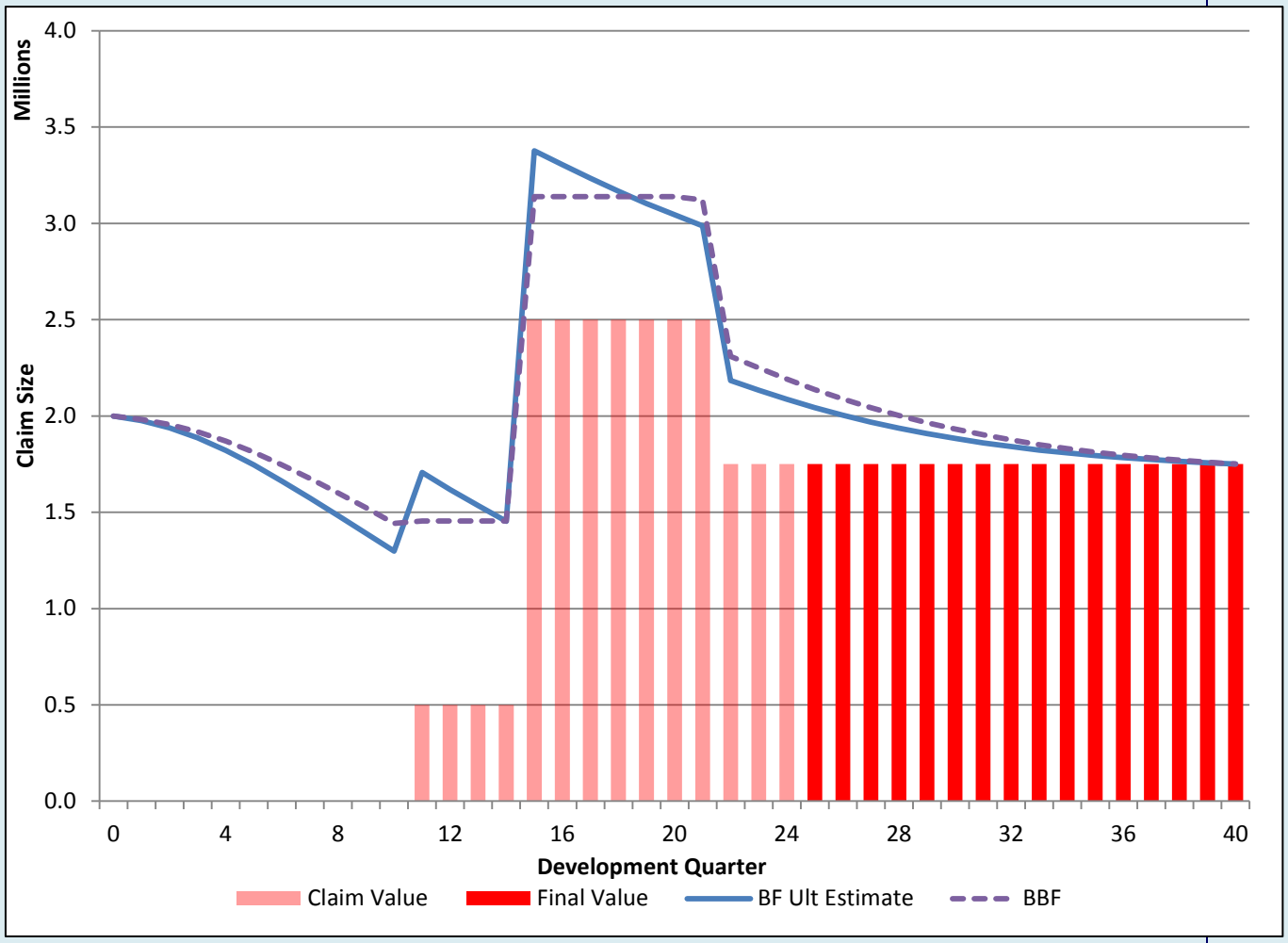
RESERVING METHODS (BBF)

- How do you select the upper and lower bounds?
  - Option 4 – Modify the reported Age to Ult factors to get two new patterns



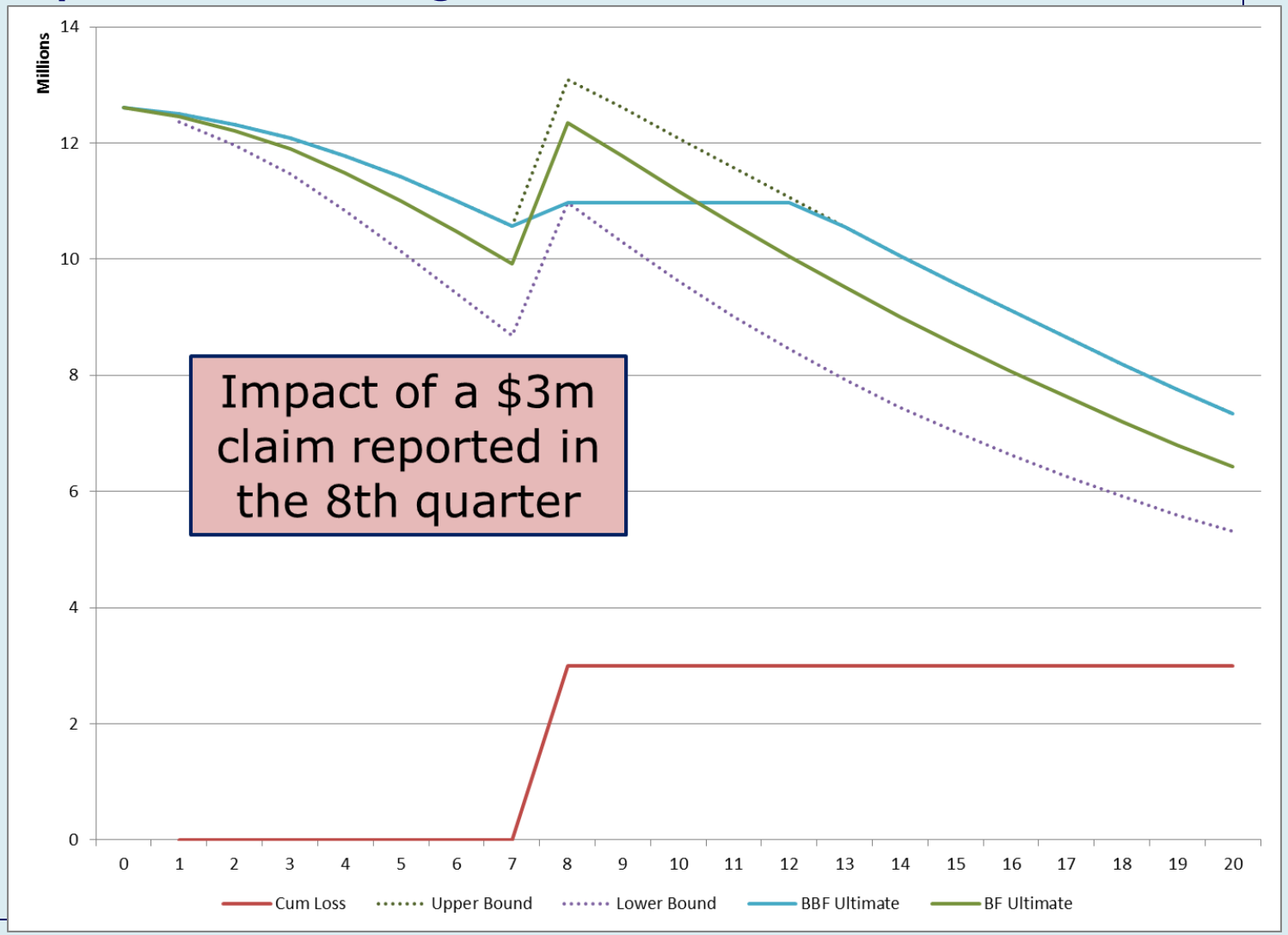
RESERVING METHODS (BBF)

- Illustration of a BBF Ultimate Estimate using an initial expected of $2m



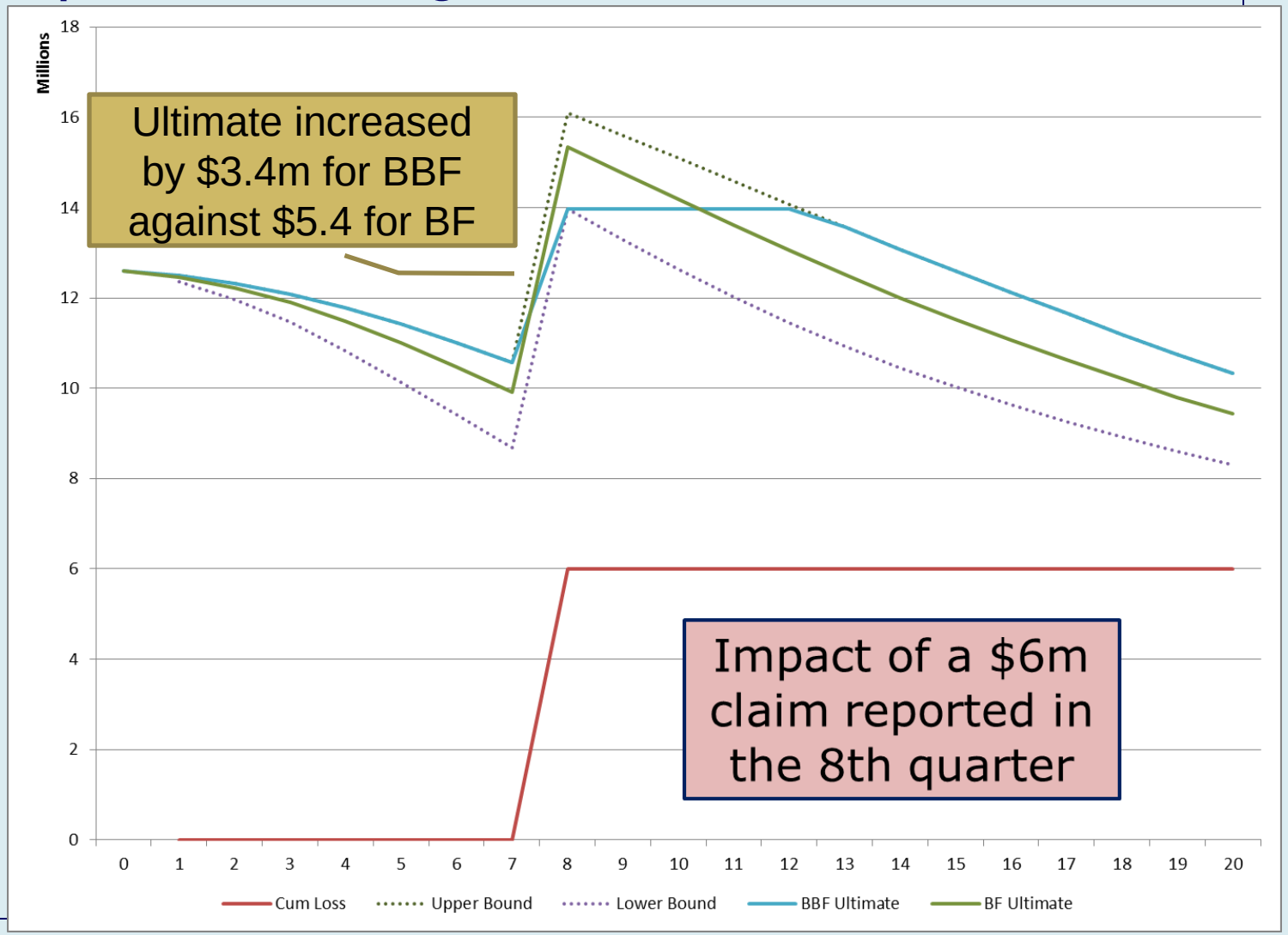
RESERVING METHODS (BBF)

- Examples of using the BBF method



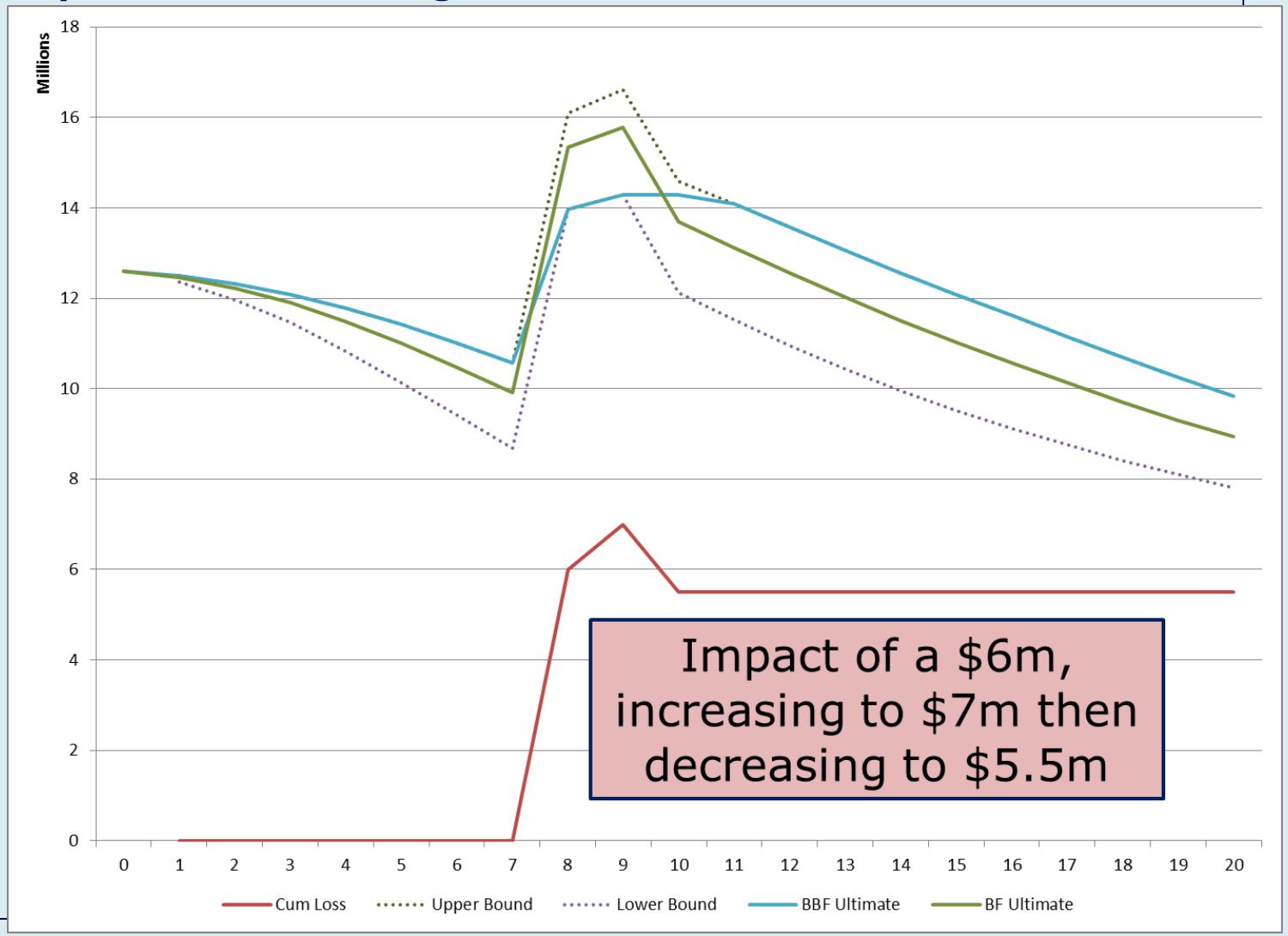
RESERVING METHODS (BBF)

- Examples of using the BBF method



RESERVING METHODS (BBF)

- Examples of using the BBF method



RESERVING METHODS

Mixed / Blended Approach

- The mixed / blended approach calculates the ultimate estimate by combining the ultimate estimate from the following:
  - Initial Expected (IE)
  - Bornhuetter-Ferguson (BF)
  - Loss Development Method (LDM)

- The blending rules we used are:
  - Qtrs 0-3: 100% IE
  - Qtrs 11-19: 100% BF
  - Qtrs 27+: 100% LDM
  - Linear interpolation for other Qtrs

- The blending rules we used are:
  - Qtrs 0-3: 100% IE
  - Qtr 4: 87½% IE + 12½% BF
  - Qtr 5: 75% IE + 25% BF
  - ...
  - Qtr 9: 25% IE + 75% BF
  - Qtr 10: 12½% IE + 87½% BF
  - Qtrs 11-19: 100% BF
  - Qtr 20: 87½% BF + 12½% LDM
  - Qtr 21: 75% BF + 25% LDM
  - ...
  - Qtr 25: 25% BF + 75% LDM
  - Qtr 26: 12½% BF + 87½% LDM
  - Qtrs 27+: 100% LDM

MEASURES

MEASURES

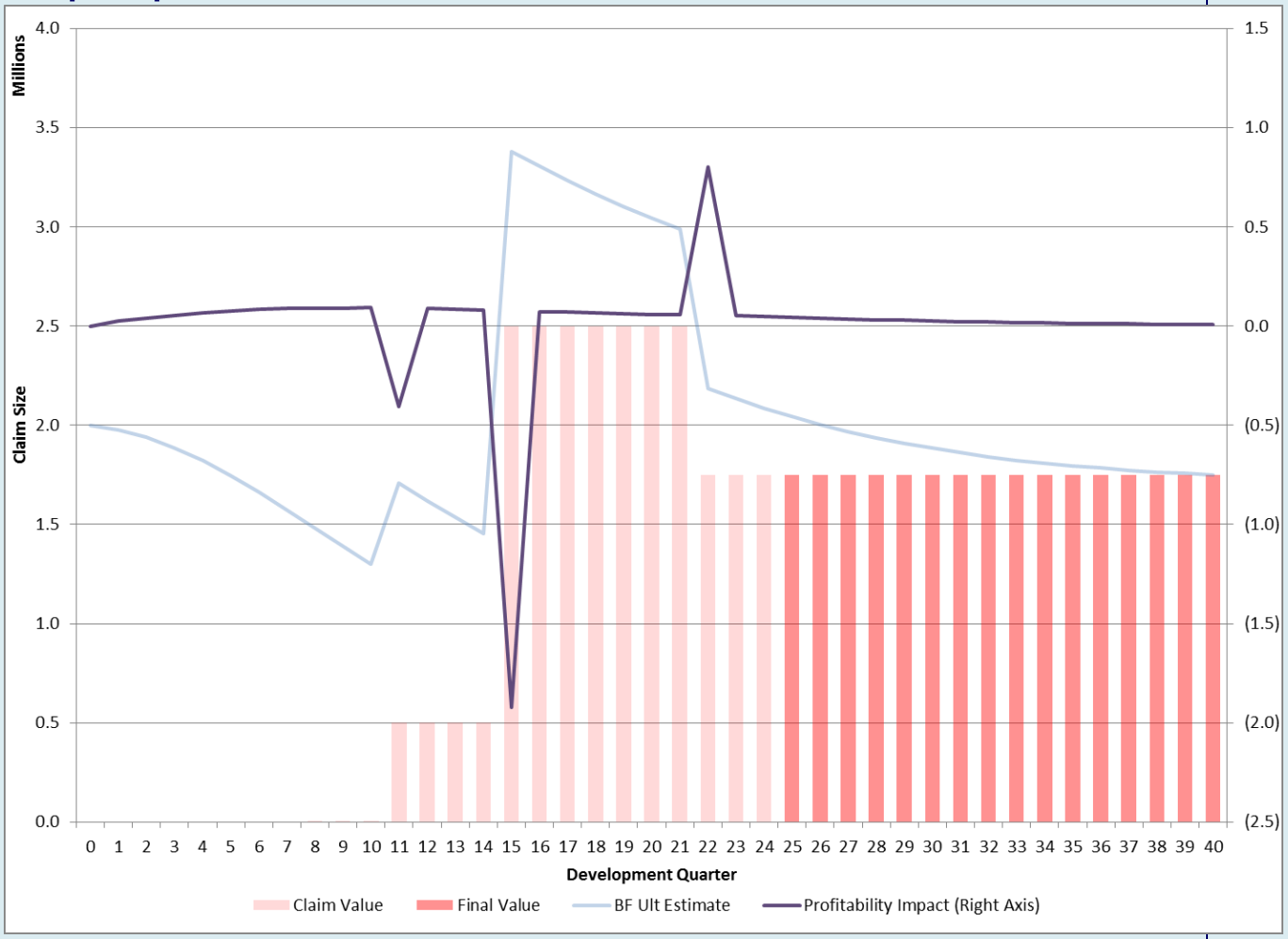
- There are two measures that we are using to gauge each reserving approach
- These measures are:
  - Impact on Profitability
  - Accuracy

MEASURES: IMPACT ON PROFITABILITY

- The ‘Impact on Profitability’ measure looks at the quarter on quarter change in the ultimate estimate
- For Example: The quarter on quarter change in the profitability for the Initial Expected method is zero for all quarters except the last quarter
  - The final ultimate estimate for the Initial Expected method is what was actually paid

MEASURES: IMPACT ON PROFITABILITY

- Profitability impact using the prior illustrated claim
- Total under the purple lines sums to $250k

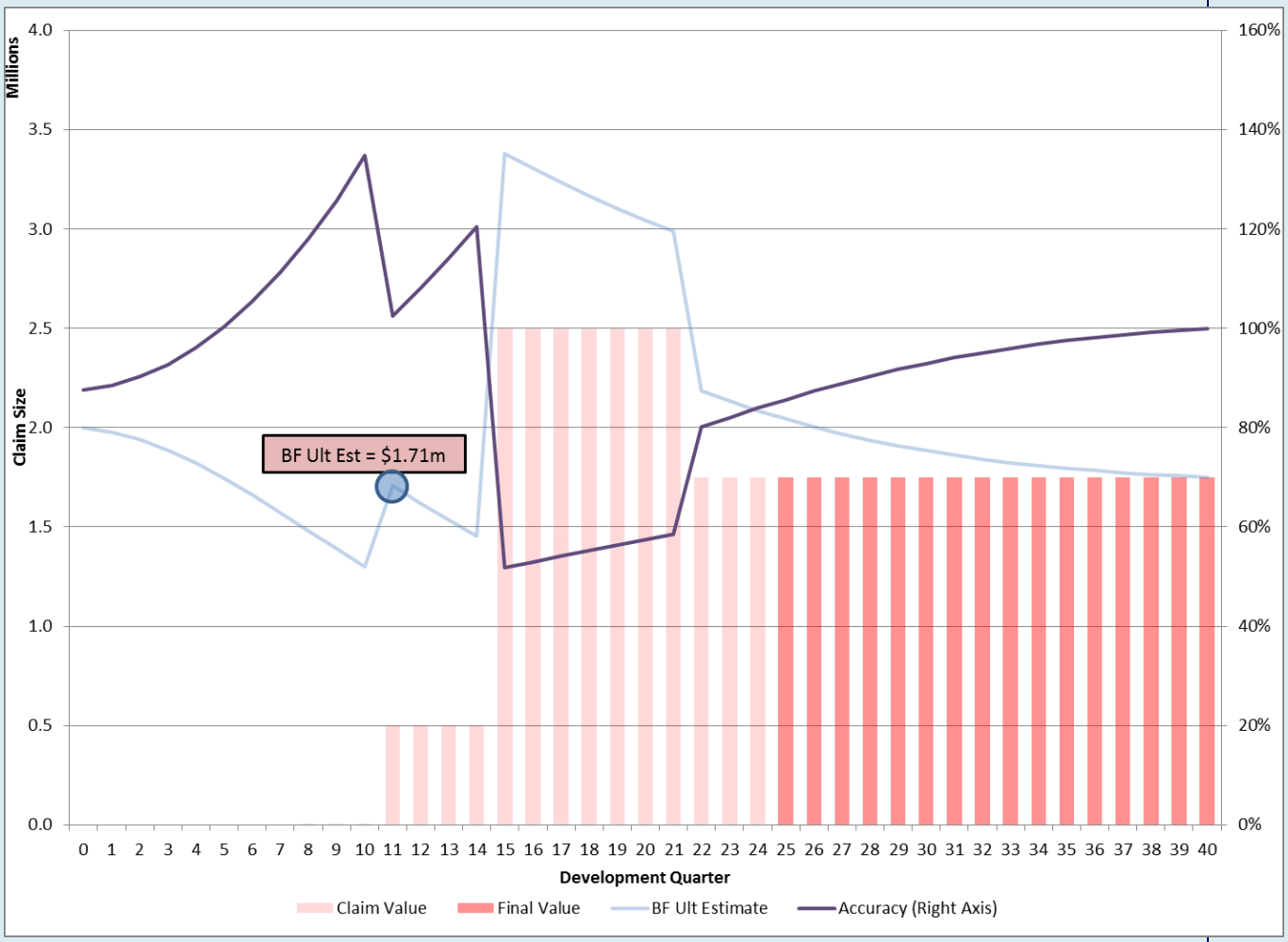


MEASURES: ACCURACY

- The 'Accuracy' measure examines how accurate the estimate is at each quarter compared to the final result
  - A stochastic model 'knows' the final result
- The actual measure we are using is ...
  - *Final Value / Estimate*
- So –
  - A value of 50% means that the current estimate is twice the final value (i.e. too high)
  - A value of 100% means that the current estimate is equal to the final value (i.e. just right)
  - A value of 200% means that the current estimate is half the final value (i.e. too low)

MEASURES: ACCURACY

- Accuracy illustration using the prior illustrated claim
  - At Qtr 11, est = $1.71m, final value is $1.75m, accuracy is 102.5%



RESULTS

TYPES OF PRODUCTS

- Product 1 – Excess Liability Product
  - High Severity
  - Low Frequency
  - Low volume, hence very low claim count
  - All policies have $20m limit
- Product 2 – Excess Liability Product
  - Same as Product 1 but more volume
- Product 3 – General Liability
  - Higher Frequency
  - Different reporting / settlement assumptions
  - All policies have $1m limit

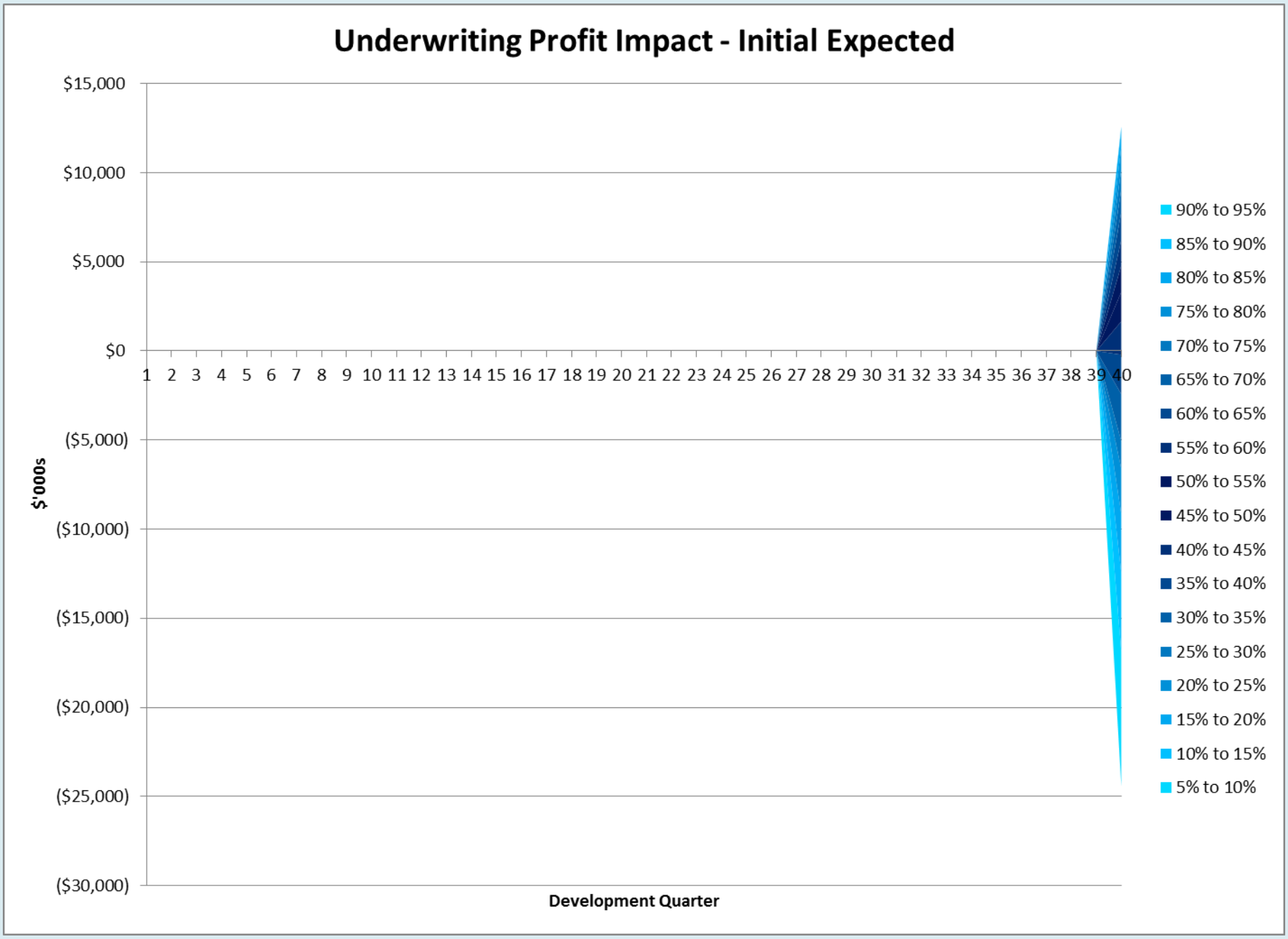
RESULTS: PROFITABILITY IMPACT

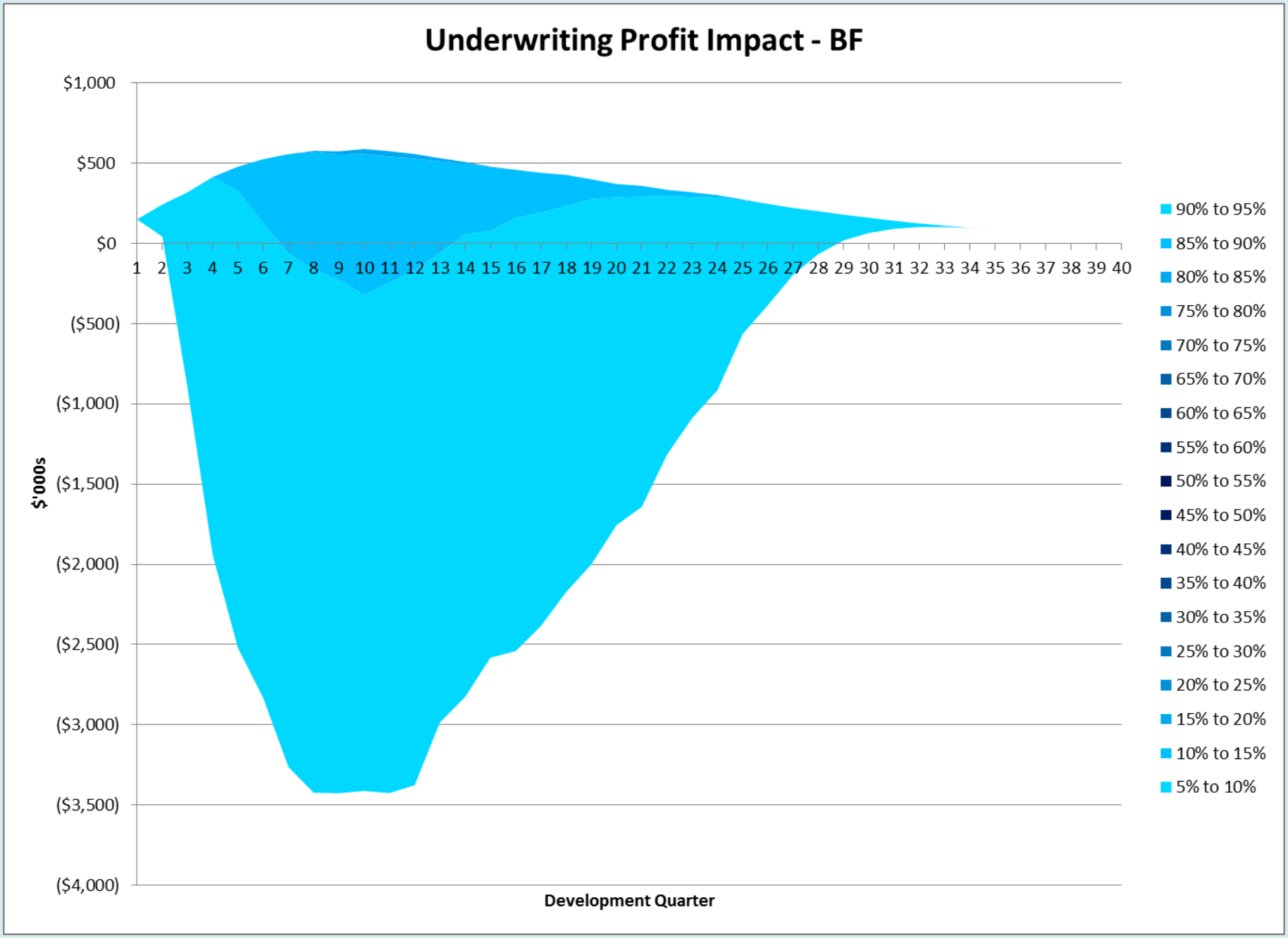
Product 1 – Excess Liability Product

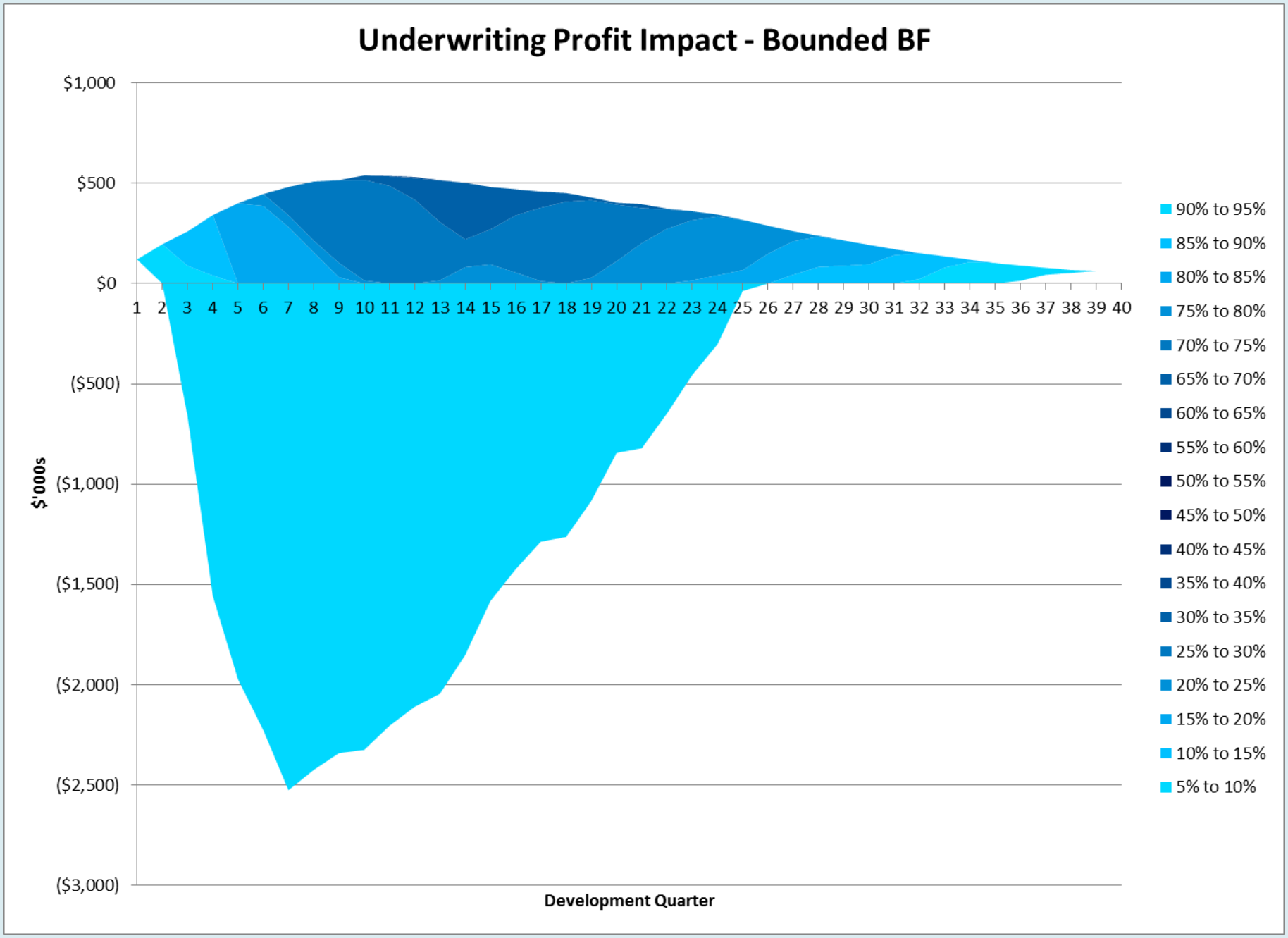
High Severity

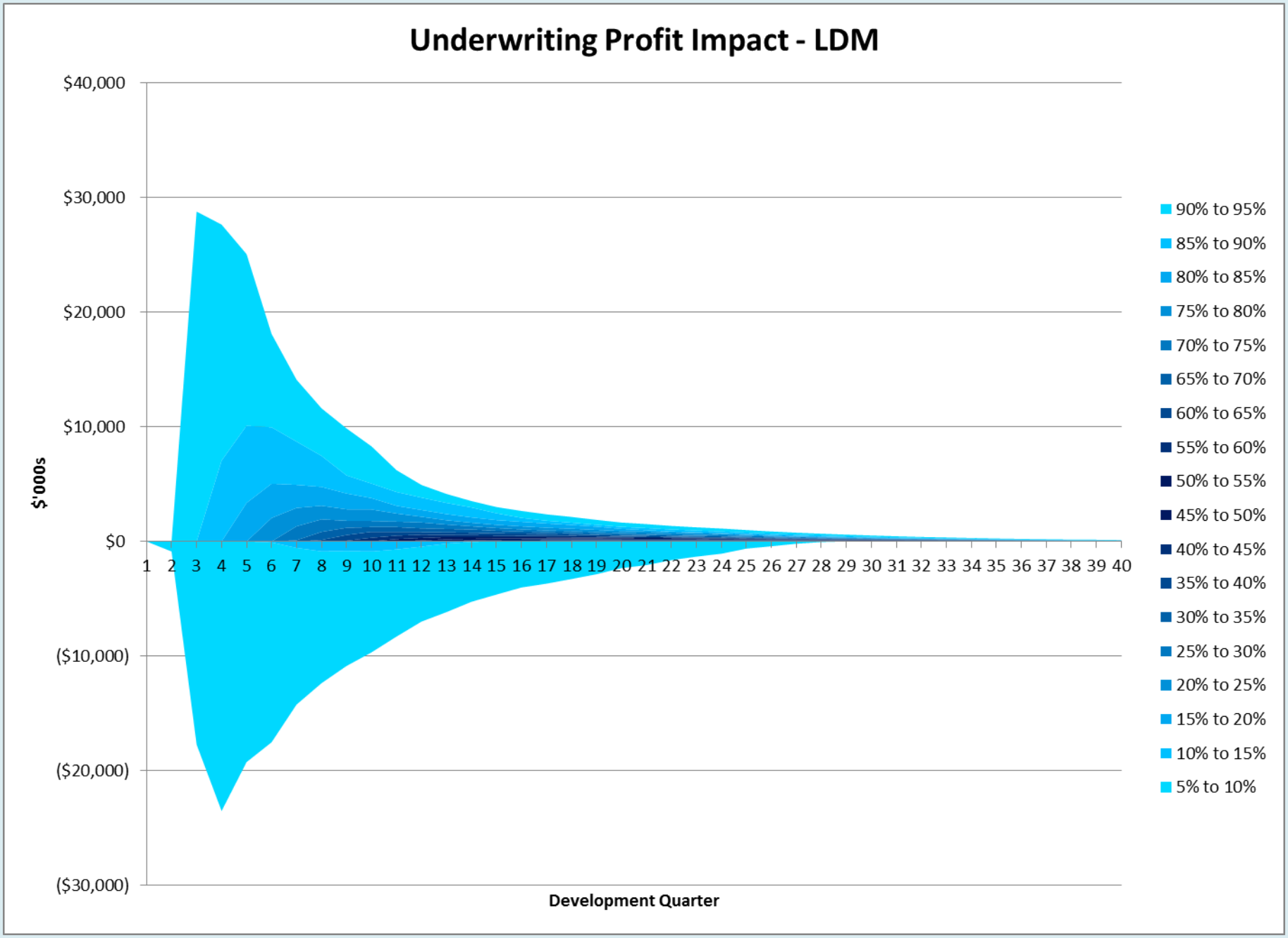
Low Frequency

Very low claim count


Underwriting Profit Impact - Initial Expected
$15,000
$10,000
$5,000
$0
($5,000)
($10,000)
($15,000)
($20,000)
($25,000)
($30,000)
$'000s
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40
Development Quarter
90% to 95%
85% to 90%
80% to 85%
75% to 80%
70% to 75%
65% to 70%
60% to 65%
55% to 60%
50% to 55%
45% to 50%
40% to 45%
35% to 40%
30% to 35%
25% to 30%
20% to 25%
15% to 20%
10% to 15%
5% to 10%


Underwriting Profit Impact - BF
$1,000
$500
$0
($500)
($1,000)
($1,500)
($2,000)
($2,500)
($3,000)
($3,500)
($4,000)
$'000s
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40
Development Quarter
90% to 95%
85% to 90%
80% to 85%
75% to 80%
70% to 75%
65% to 70%
60% to 65%
55% to 60%
50% to 55%
45% to 50%
40% to 45%
35% to 40%
30% to 35%
25% to 30%
20% to 25%
15% to 20%
10% to 15%
5% to 10%


Underwriting Profit Impact - Bounded BF
$1,000
$500
$0
($500)
($1,000)
($1,500)
($2,000)
($2,500)
($3,000)
$'000s
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40
Development Quarter
90% to 95%
85% to 90%
80% to 85%
75% to 80%
70% to 75%
65% to 70%
60% to 65%
55% to 60%
50% to 55%
45% to 50%
40% to 45%
35% to 40%
30% to 35%
25% to 30%
20% to 25%
15% to 20%
10% to 15%
5% to 10%


Underwriting Profit Impact - LDM
$40,000
$30,000
$20,000
$10,000
$0
($10,000)
($20,000)
($30,000)
$'000s
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40
Development Quarter
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80% to 85%
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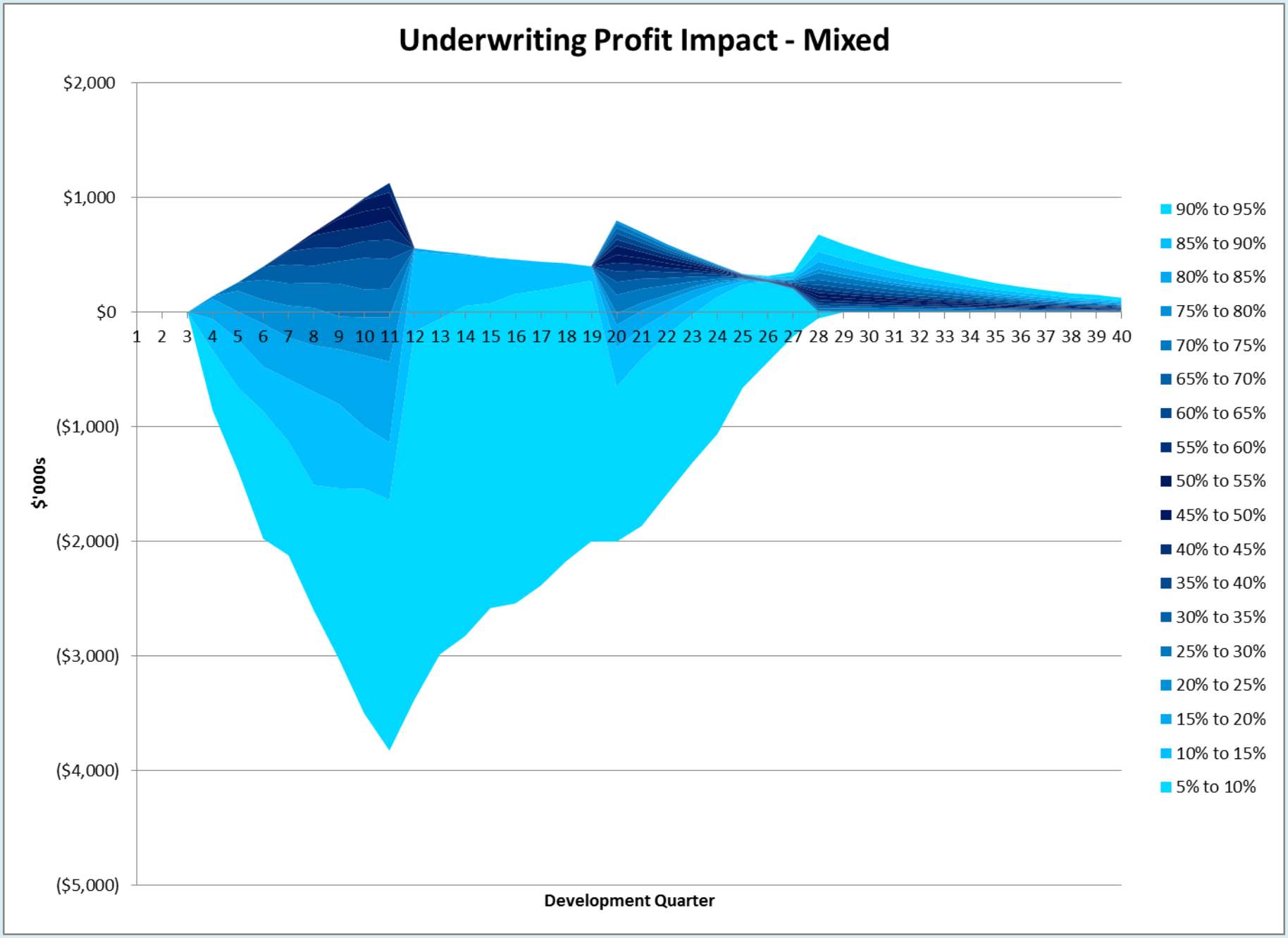
50% to 55%
45% to 50%
40% to 45%
35% to 40%
30% to 35%
25% to 30%
20% to 25%
15% to 20%
10% to 15%
5% to 10%


Underwriting Profit Impact - Mixed
$2,000
$1,000
$0
($1,000)
($2,000)
($3,000)
($4,000)
($5,000)
$'000s
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40
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85% to 90%
80% to 85%
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50% to 55%
45% to 50%
40% to 45%
35% to 40%
30% to 35%
25% to 30%
20% to 25%
15% to 20%
10% to 15%
5% to 10%

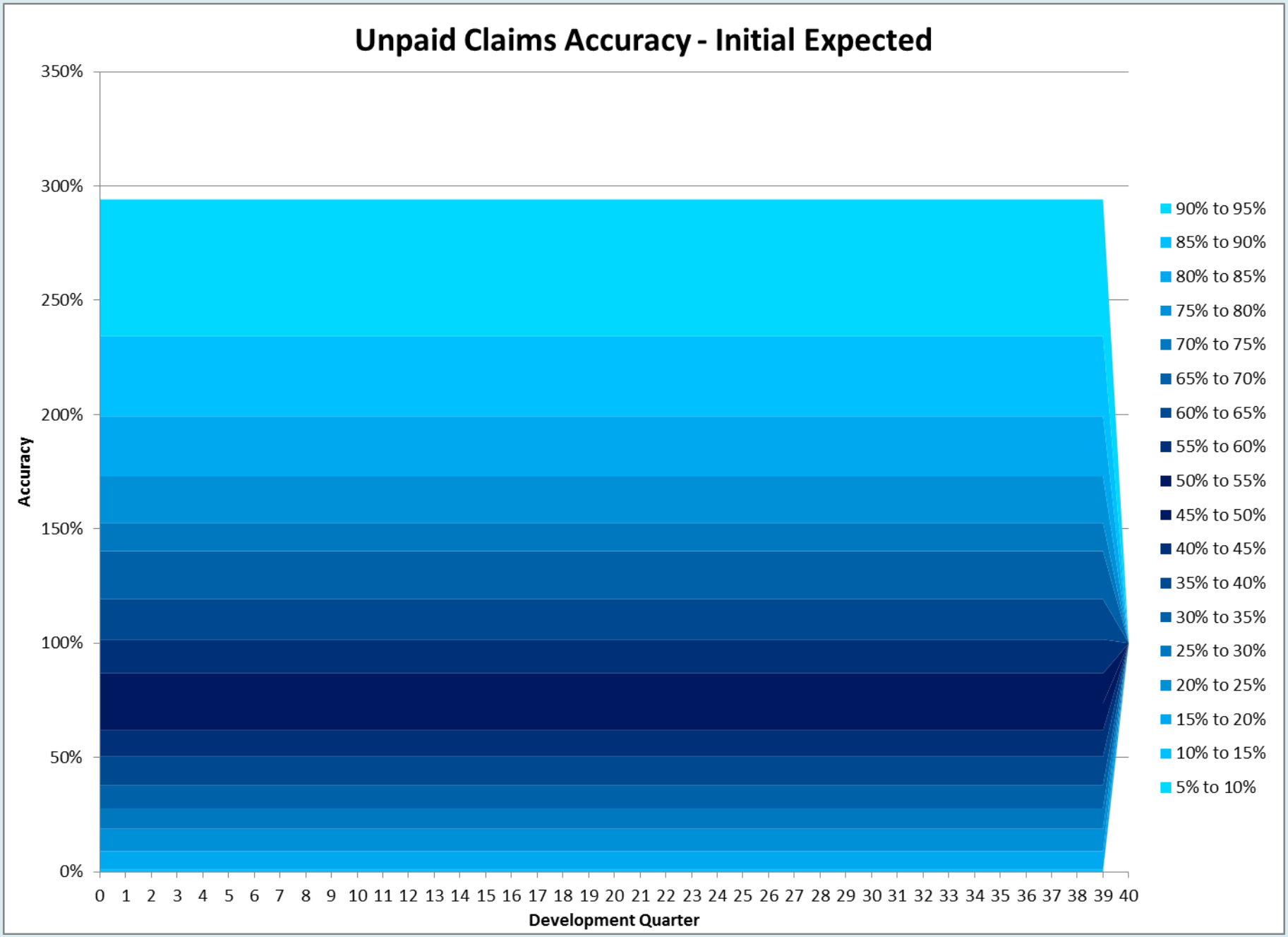
RESULTS: RESERVE ACCURACY

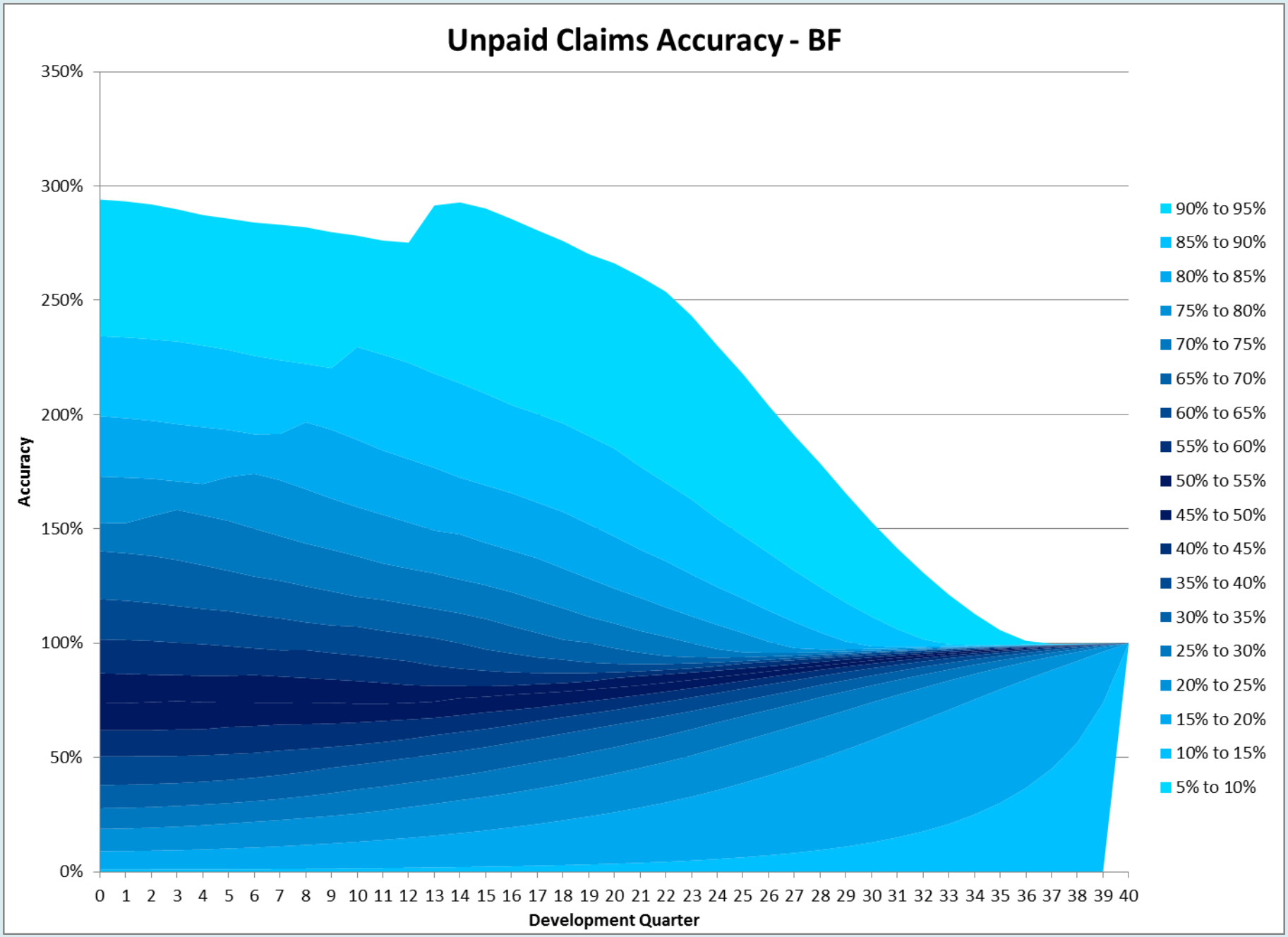
Product 1 – Excess Liability Product

High Severity

Low Frequency

Very low claim count


Unpaid Claims Accuracy - Initial Expected
350%
300%
250%
200%
150%
100%
50%
0%
Accuracy
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40
Development Quarter
90% to 95%
85% to 90%
80% to 85%
75% to 80%
70% to 75%
65% to 70%
60% to 65%
55% to 60%
50% to 55%
45% to 50%
40% to 45%
35% to 40%
30% to 35%
25% to 30%
20% to 25%
15% to 20%
10% to 15%
5% to 10%


Unpaid Claims Accuracy - BF
350%
300%
250%
200%
150%
100%
50%
0%
Accuracy
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40
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70% to 75%
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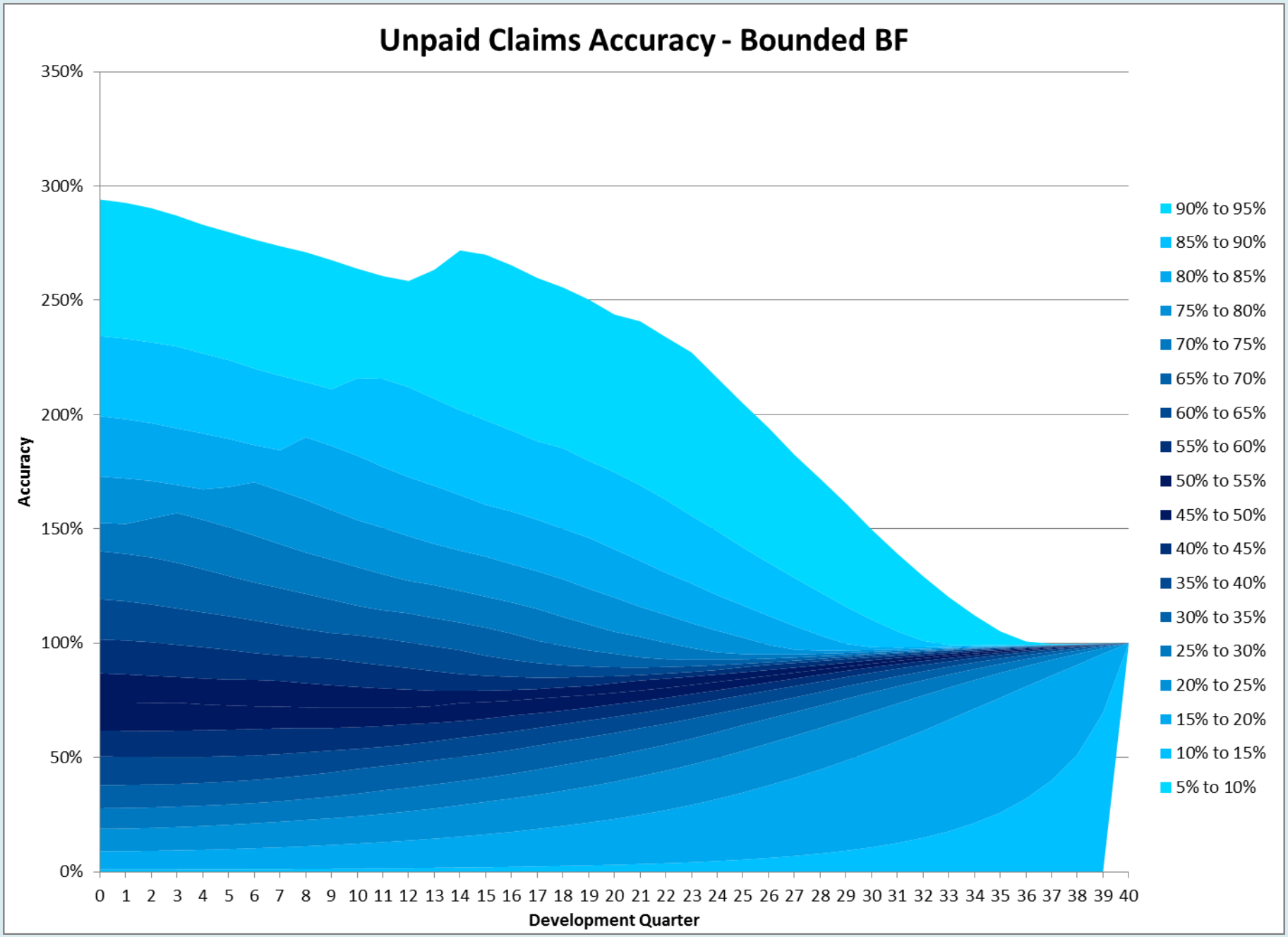
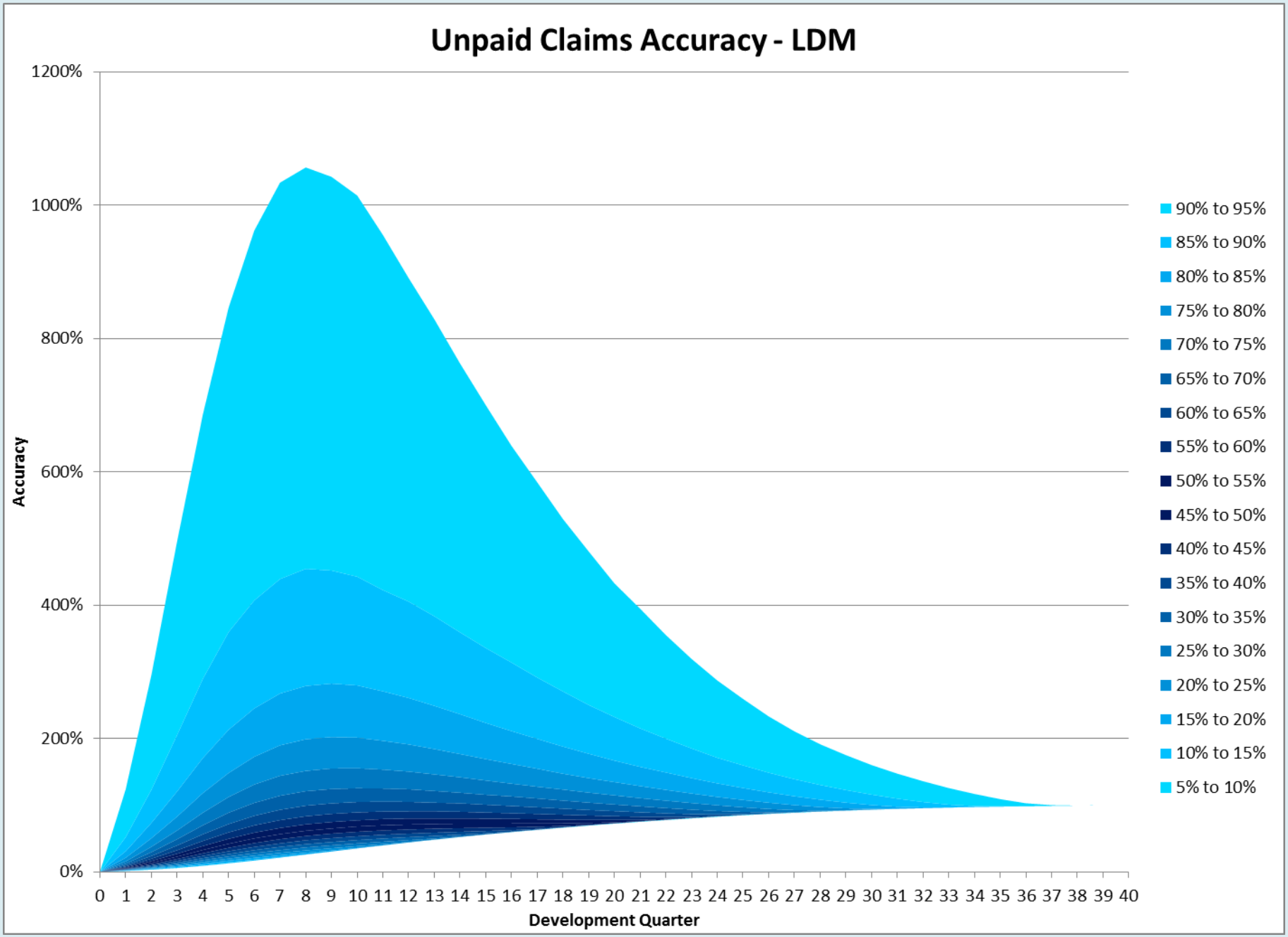
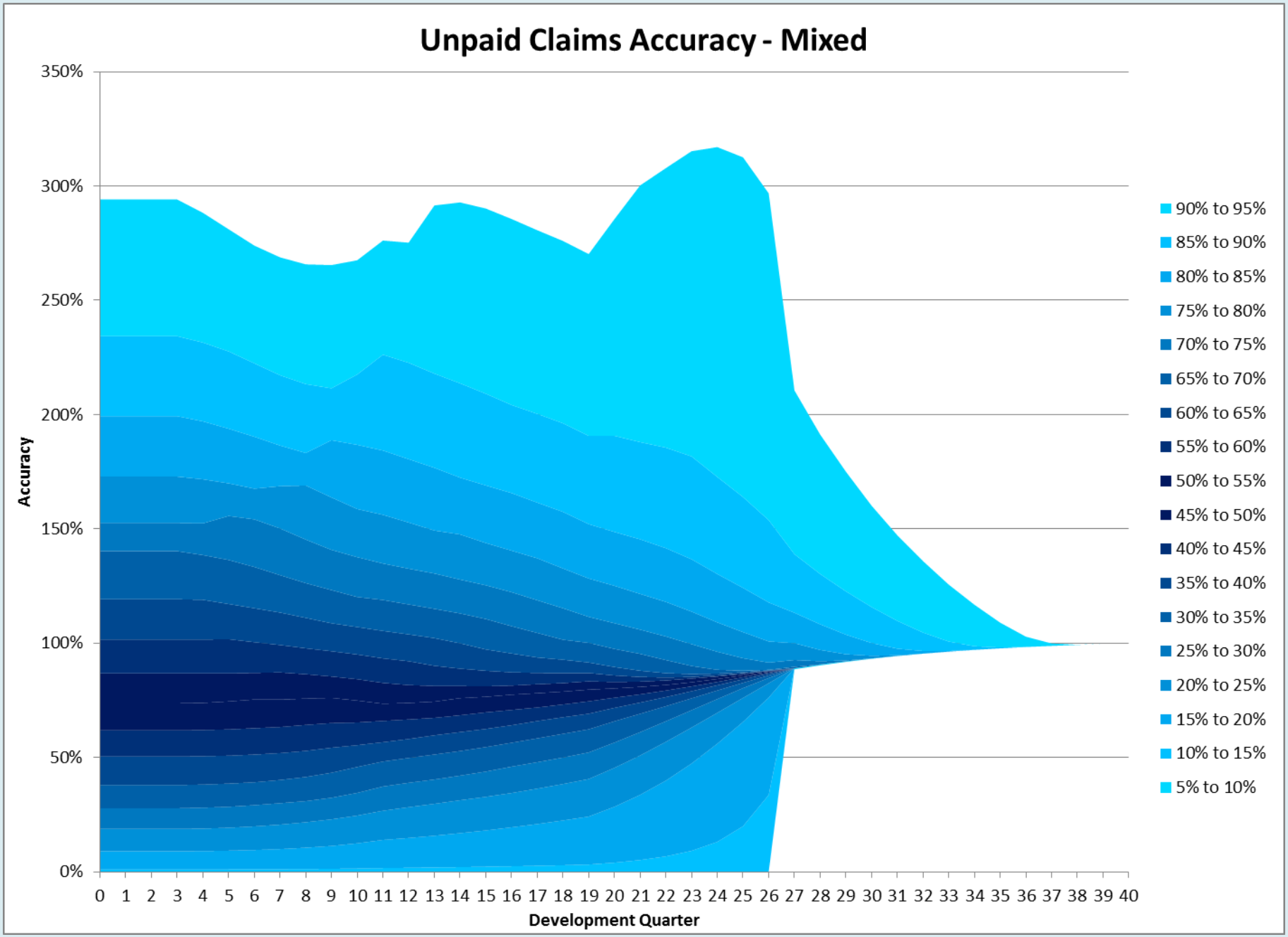
60% to 65%
55% to 60%
50% to 55%
45% to 50%
40% to 45%
35% to 40%
30% to 35%
25% to 30%
20% to 25%
15% to 20%
10% to 15%
5% to 10%


Unpaid Claims Accuracy - Bounded BF
350%
300%
250%
200%
150%
100%
50%
0%
Accuracy
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40
Development Quarter
90% to 95%
85% to 90%
80% to 85%
75% to 80%
70% to 75%
65% to 70%
60% to 65%
55% to 60%
50% to 55%
45% to 50%
40% to 45%
35% to 40%
30% to 35%
25% to 30%
20% to 25%
15% to 20%
10% to 15%
5% to 10%


Unpaid Claims Accuracy - LDM
1200%
1000%
800%
600%
400%
200%
0%
Accuracy
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40
Development Quarter
90% to 95%
85% to 90%
80% to 85%
75% to 80%
70% to 75%
65% to 70%
60% to 65%
55% to 60%
50% to 55%
45% to 50%
40% to 45%
35% to 40%
30% to 35%
25% to 30%
20% to 25%
15% to 20%
10% to 15%
5% to 10%


Unpaid Claims Accuracy - Mixed
350%
300%
250%
200%
150%
100%
50%
0%
Accuracy
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40
Development Quarter
90% to 95%
85% to 90%
80% to 85%
75% to 80%
70% to 75%
65% to 70%
60% to 65%
55% to 60%
50% to 55%
45% to 50%
40% to 45%
35% to 40%
30% to 35%
25% to 30%
20% to 25%
15% to 20%
10% to 15%
5% to 10%

RESULTS: PROFITABILITY IMPACT

Product 2 – Excess Liability Product

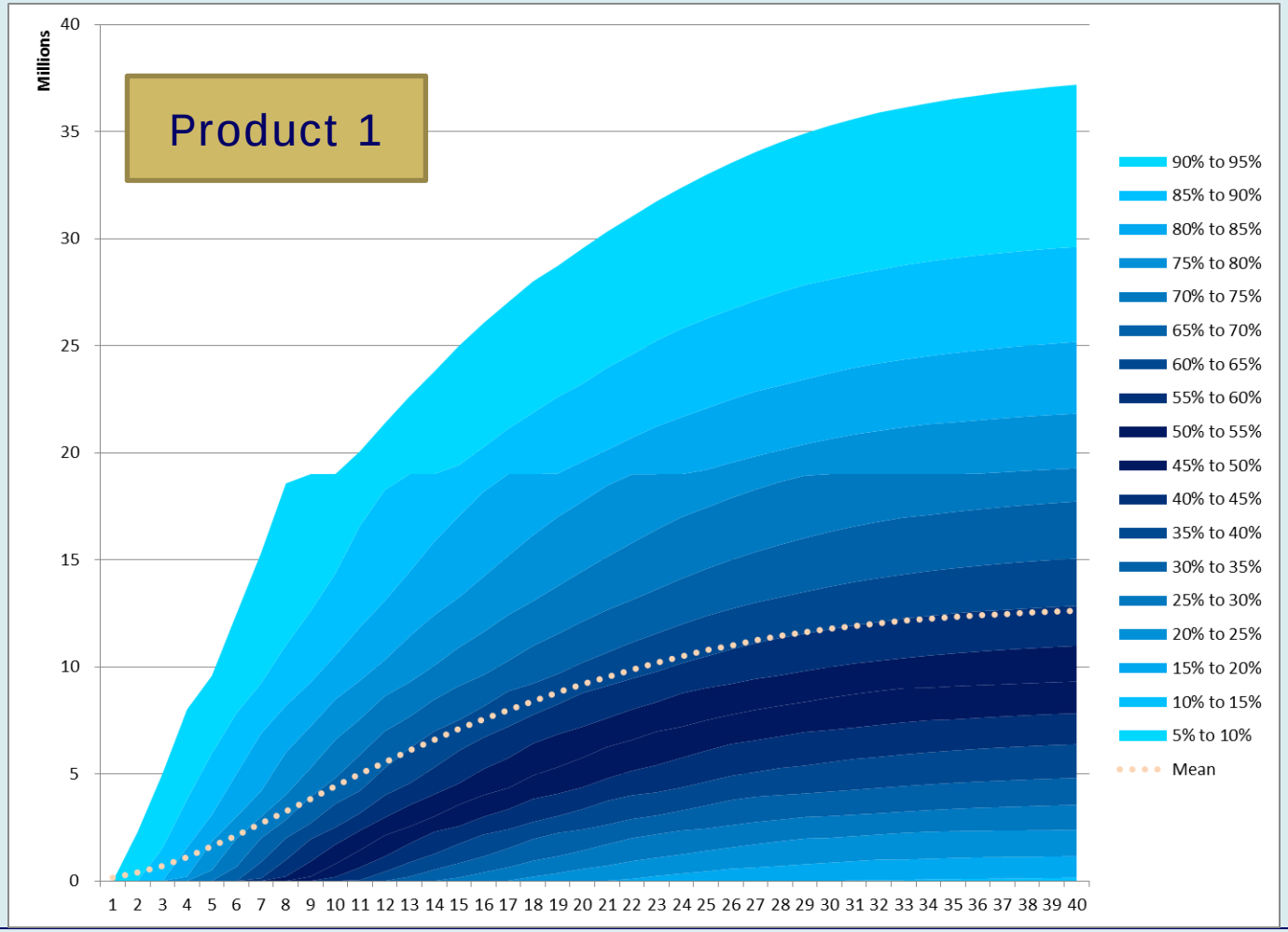
High Severity

Low Frequency

More Volume, more claims

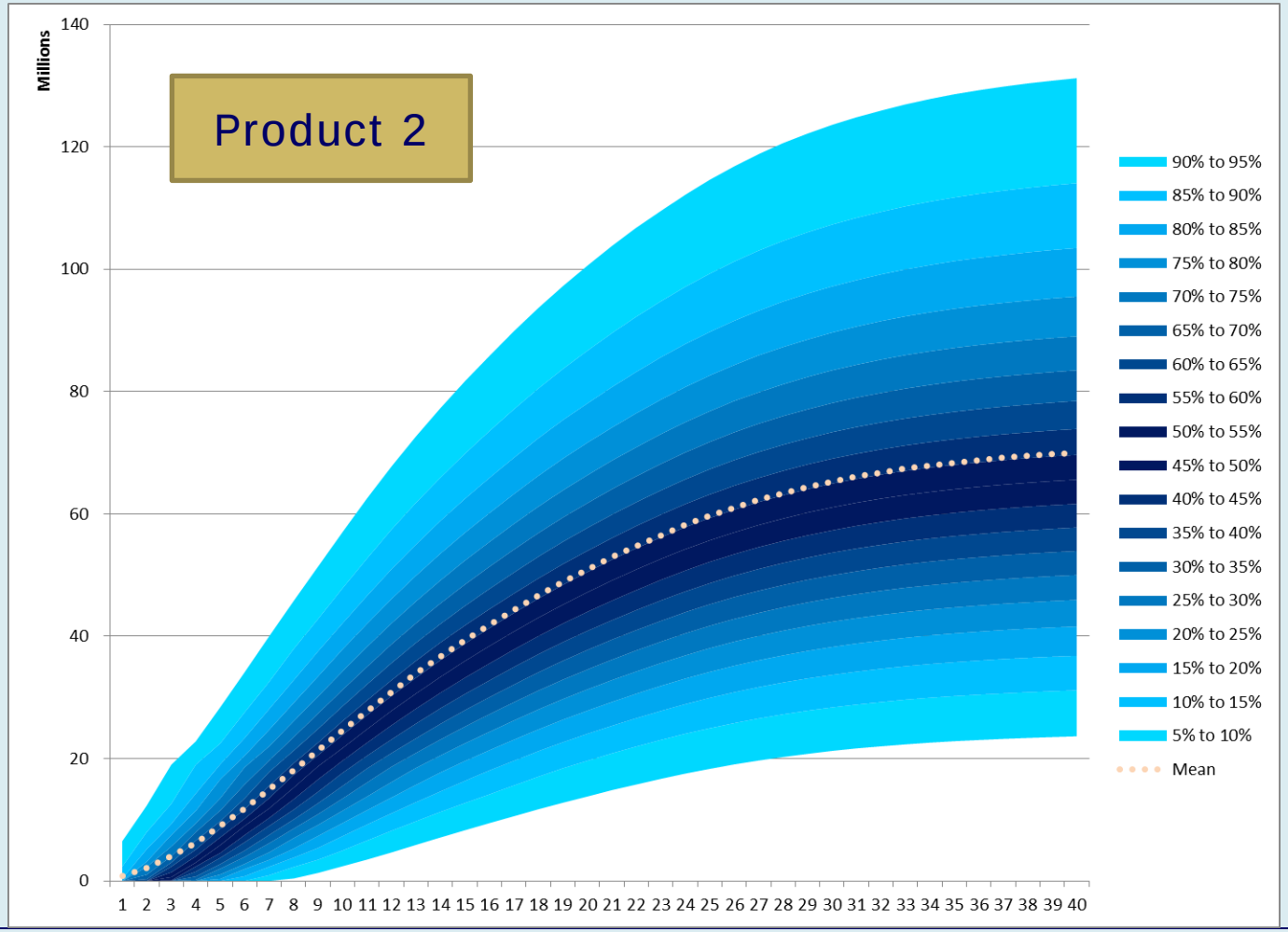
PRODUCT 2 – MORE VOLUME

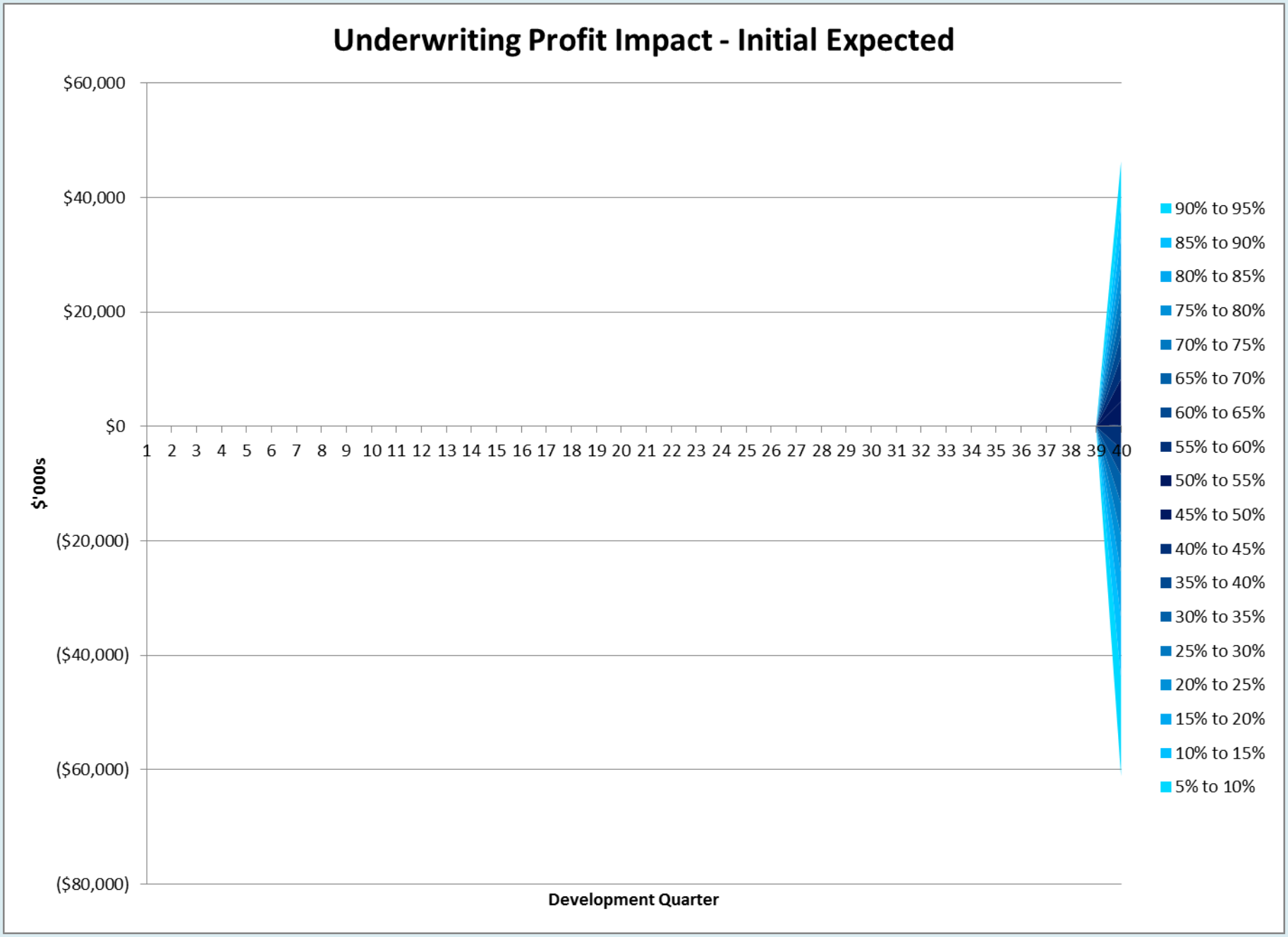
- The 2nd product we looked at is identical to the first except it has higher volume

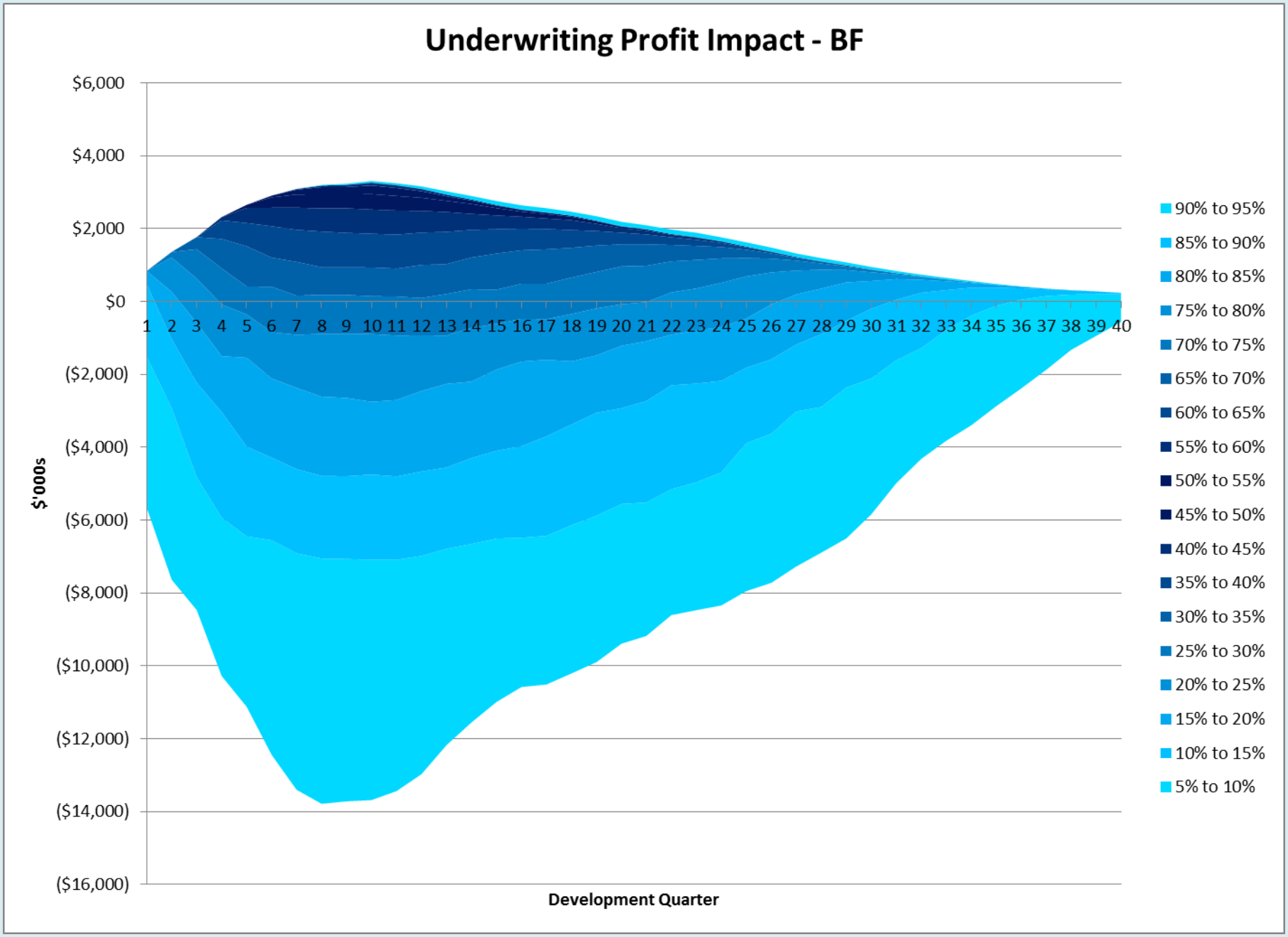


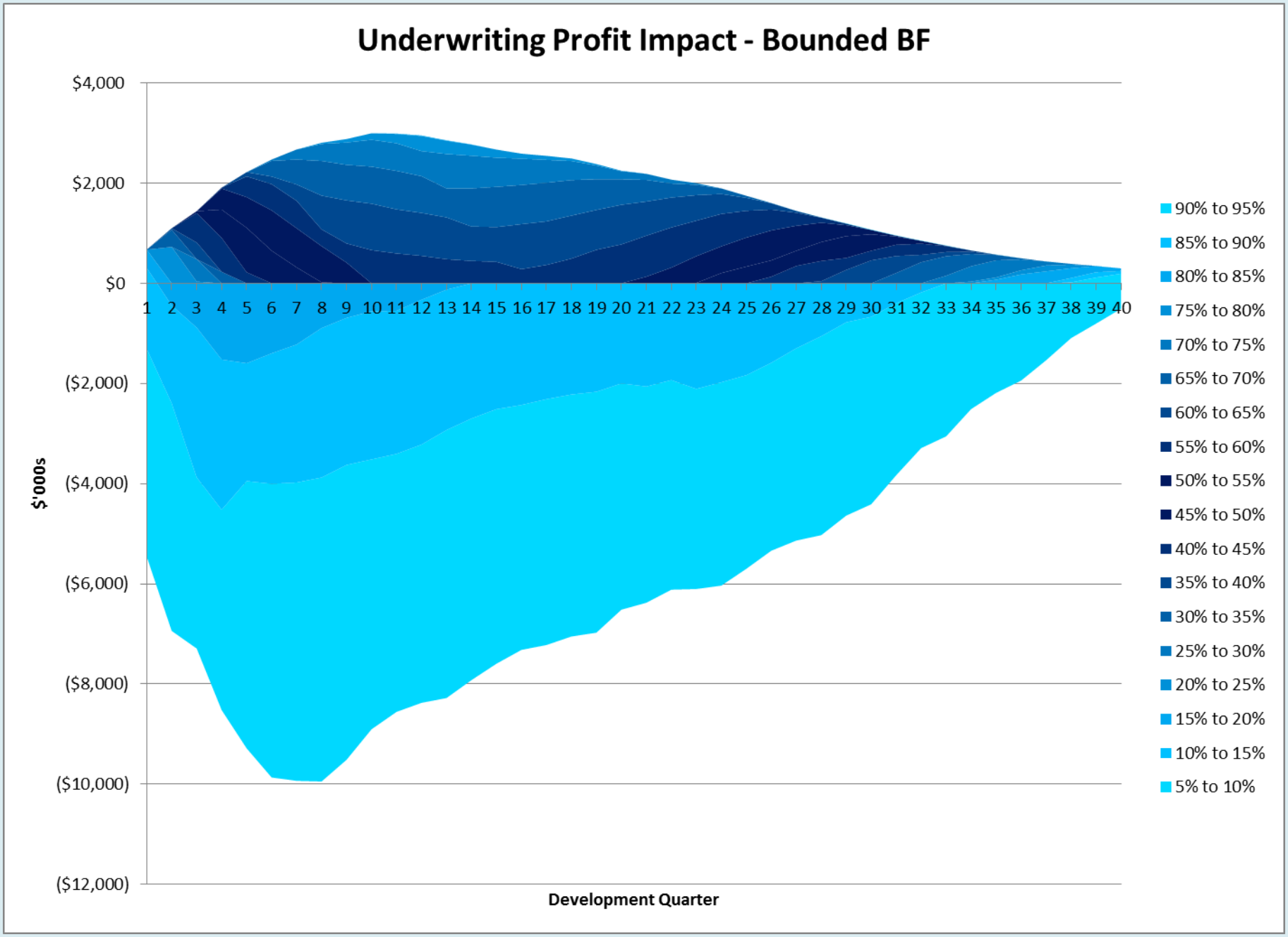
PRODUCT 2 – MORE VOLUME

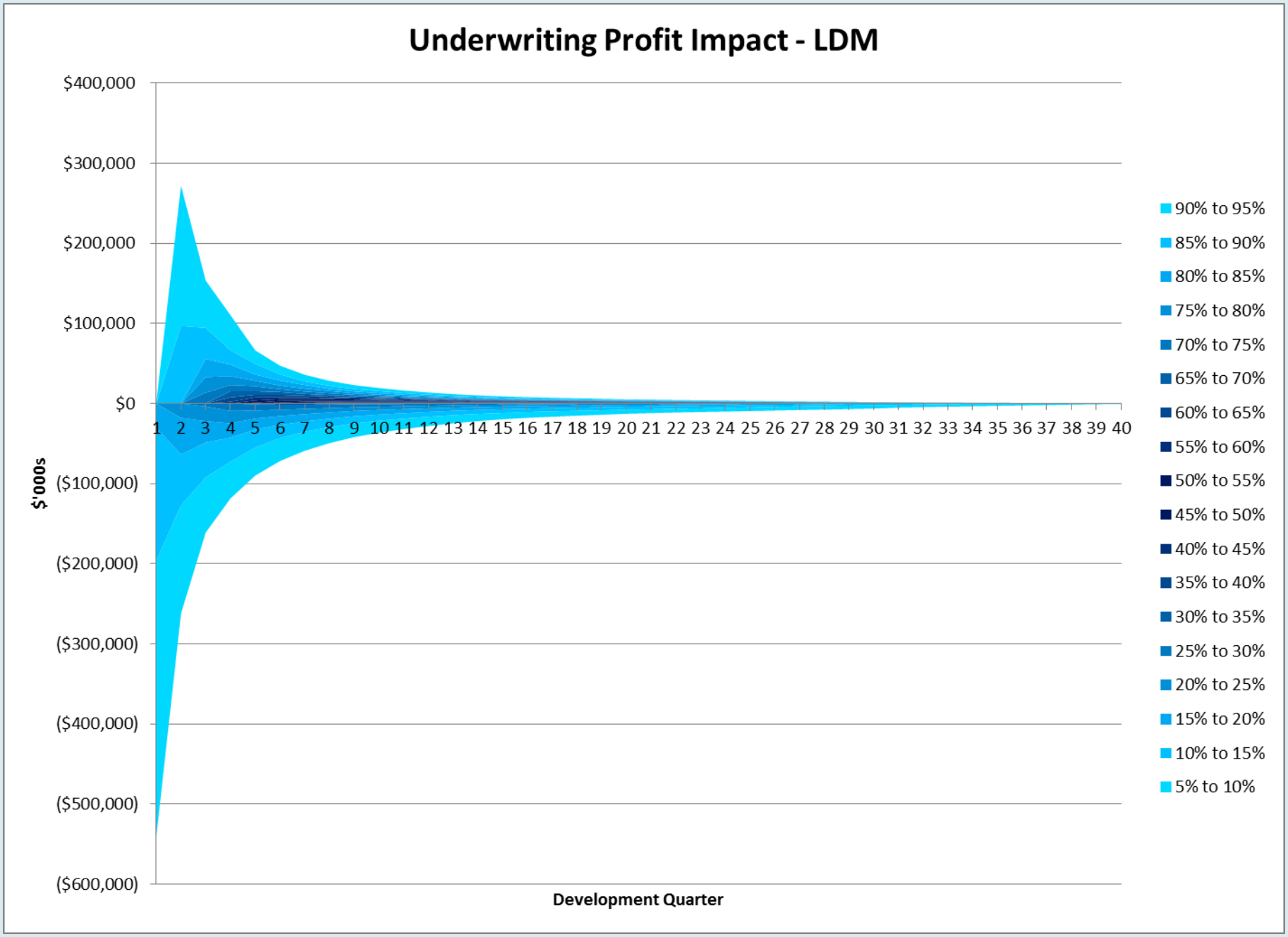
- The 2nd product we looked at is identical to the first except it has higher volume

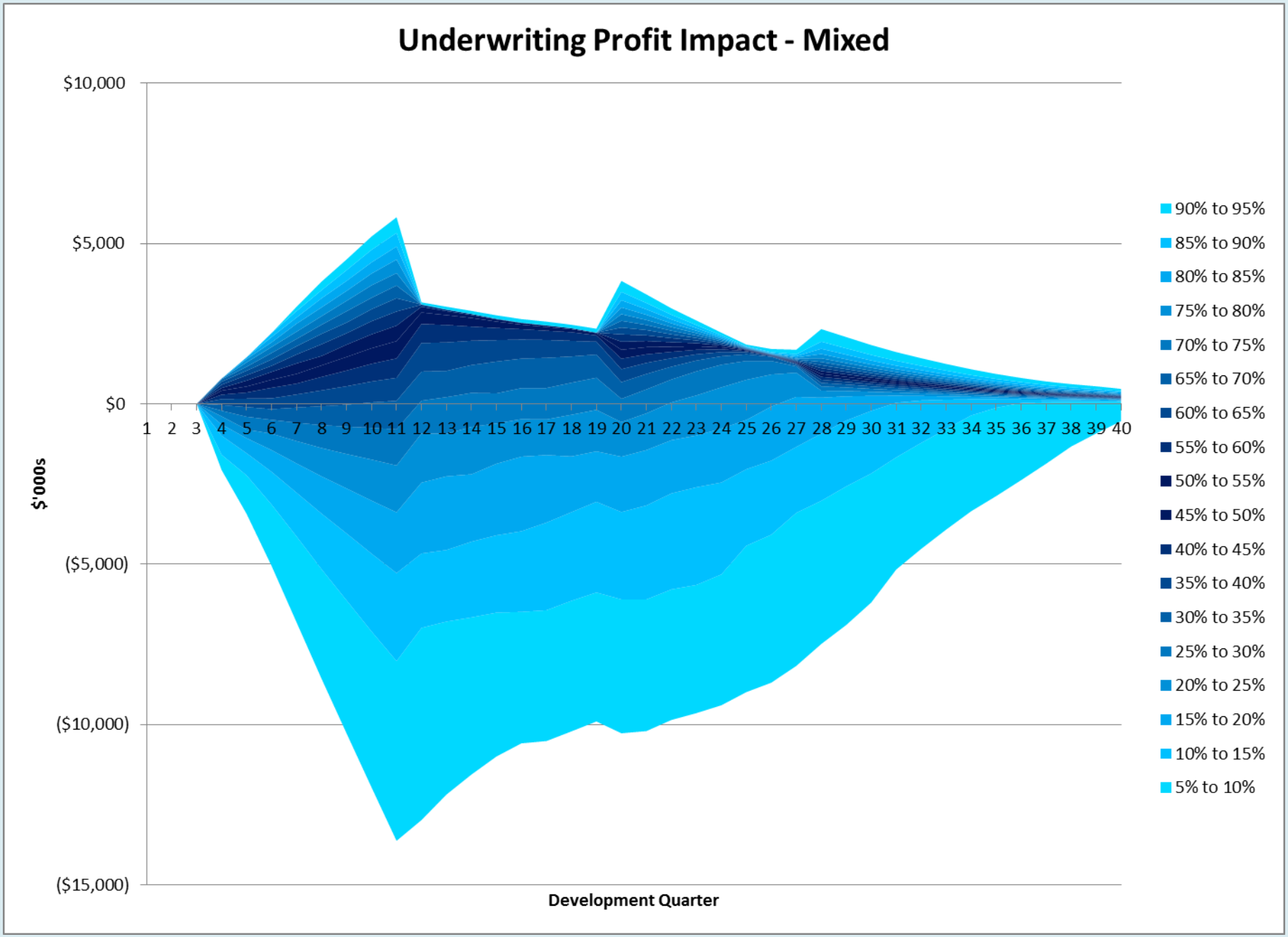



Underwriting Profit Impact - Initial Expected
$60,000
$40,000
$20,000
$0
($20,000)
($40,000)
($60,000)
($80,000)
$'000s
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40
Development Quarter
90% to 95%
85% to 90%
80% to 85%
75% to 80%
70% to 75%
65% to 70%
60% to 65%
55% to 60%
50% to 55%
45% to 50%
40% to 45%
35% to 40%
30% to 35%
25% to 30%
20% to 25%
15% to 20%
10% to 15%
5% to 10%


Underwriting Profit Impact - BF
$6,000
$4,000
$2,000
$0
($2,000)
($4,000)
($6,000)
($8,000)
($10,000)
($12,000)
($14,000)
($16,000)
$'000s
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40
Development Quarter
90% to 95%
85% to 90%
80% to 85%
75% to 80%
70% to 75%
65% to 70%
60% to 65%
55% to 60%
50% to 55%
45% to 50%
40% to 45%
35% to 40%
30% to 35%
25% to 30%
20% to 25%
15% to 20%
10% to 15%
5% to 10%


Underwriting Profit Impact - Bounded BF
$4,000
$2,000
$0
($2,000)
($4,000)
($6,000)
($8,000)
($10,000)
($12,000)
$'000s
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40
Development Quarter
90% to 95%
85% to 90%
80% to 85%
75% to 80%
70% to 75%
65% to 70%
60% to 65%
55% to 60%
50% to 55%
45% to 50%
40% to 45%
35% to 40%
30% to 35%
25% to 30%
20% to 25%
15% to 20%
10% to 15%
5% to 10%


Underwriting Profit Impact - LDM
$400,000
$300,000
$200,000
$100,000
$0
($100,000)
($200,000)
($300,000)
($400,000)
($500,000)
($600,000)
$'000s
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40
Development Quarter
90% to 95%
85% to 90%
80% to 85%
75% to 80%
70% to 75%
65% to 70%
60% to 65%
55% to 60%
50% to 55%
45% to 50%
40% to 45%
35% to 40%
30% to 35%
25% to 30%
20% to 25%
15% to 20%
10% to 15%
5% to 10%


Underwriting Profit Impact - Mixed
$10,000
$5,000
$0
($5,000)
($10,000)
($15,000)
$'000s
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40
Development Quarter
90% to 95%
85% to 90%
80% to 85%
75% to 80%
70% to 75%
65% to 70%
60% to 65%
55% to 60%
50% to 55%
45% to 50%
40% to 45%
35% to 40%
30% to 35%
25% to 30%
20% to 25%
15% to 20%
10% to 15%
5% to 10%

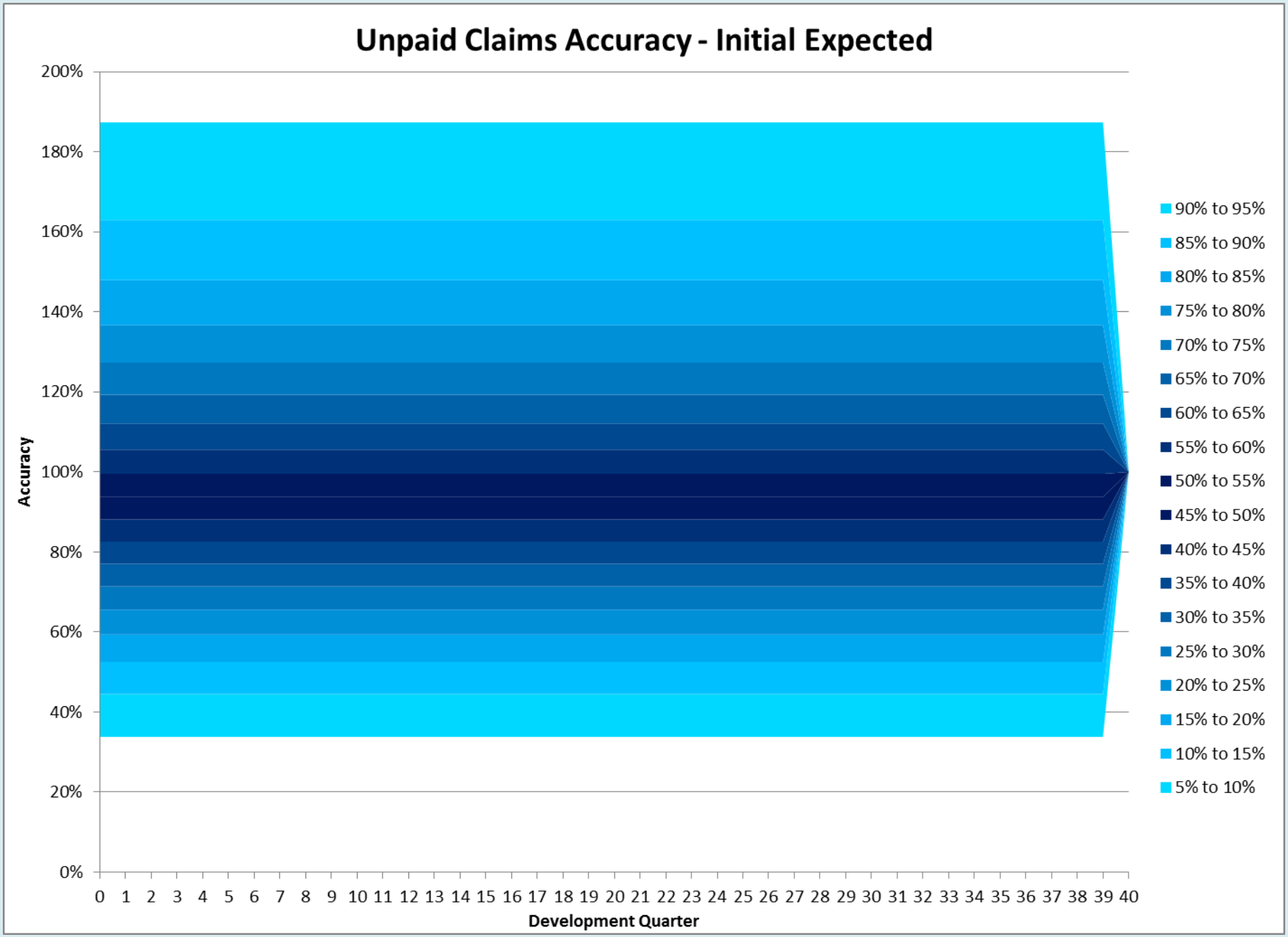
RESULTS: RESERVE ACCURACY

Product 2 – Excess Liability Product

High Severity

Low Frequency

More Volume, more claims


Unpaid Claims Accuracy - Initial Expected
Accuracy
200%
180%
160%
140%
120%
100%
80%
60%
40%
20%
0%
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40
Development Quarter
90% to 95%
85% to 90%
80% to 85%
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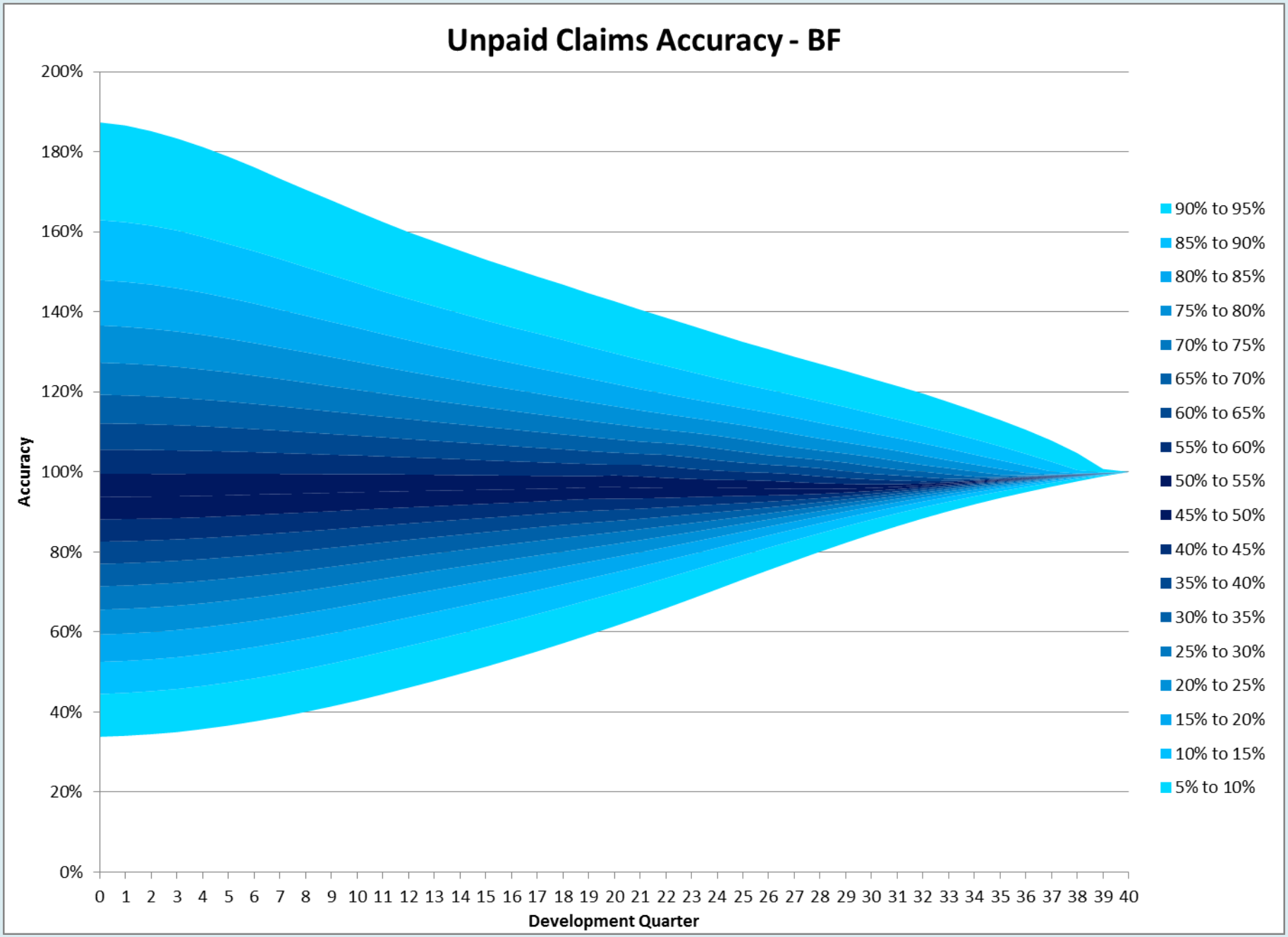
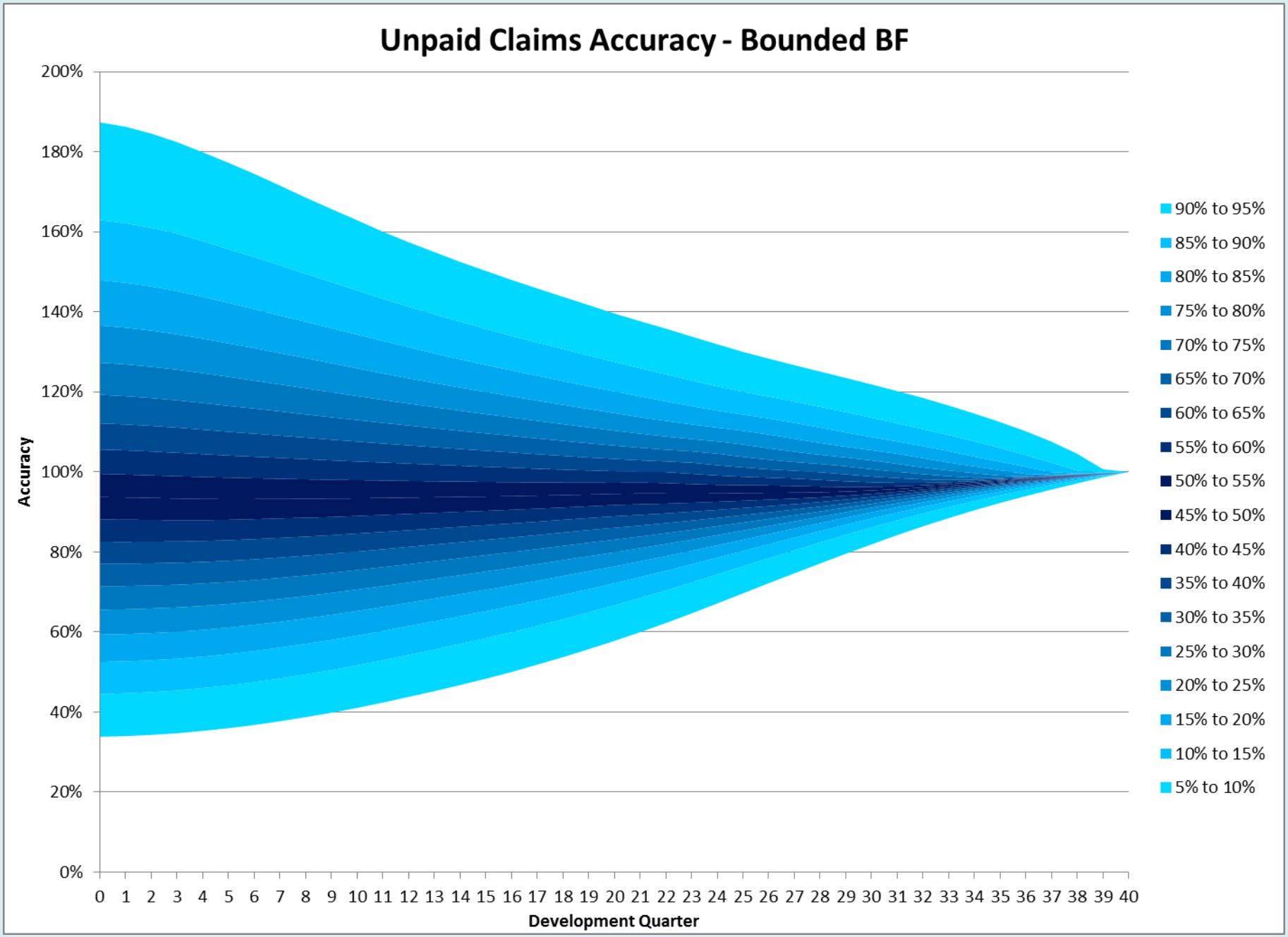
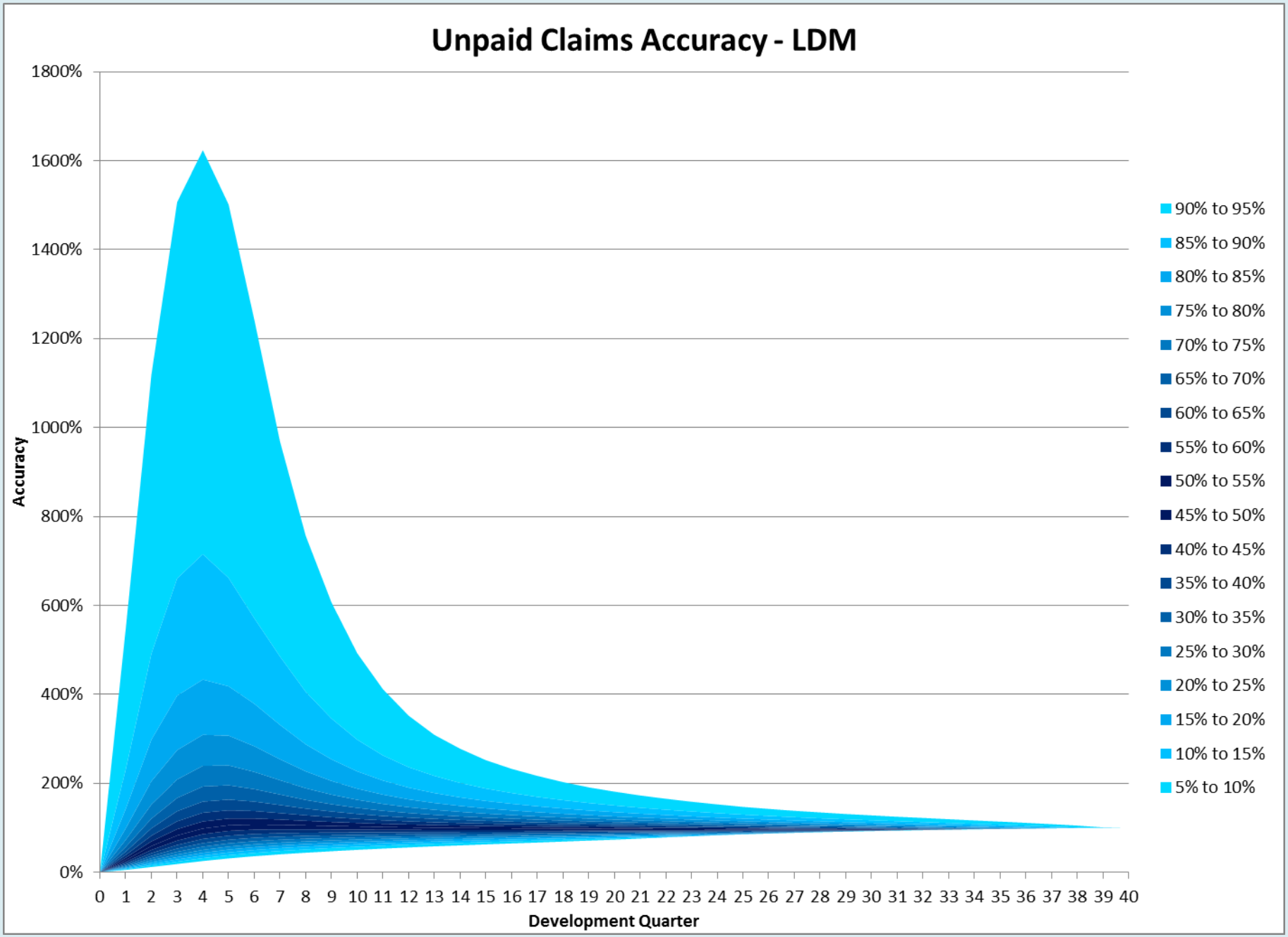
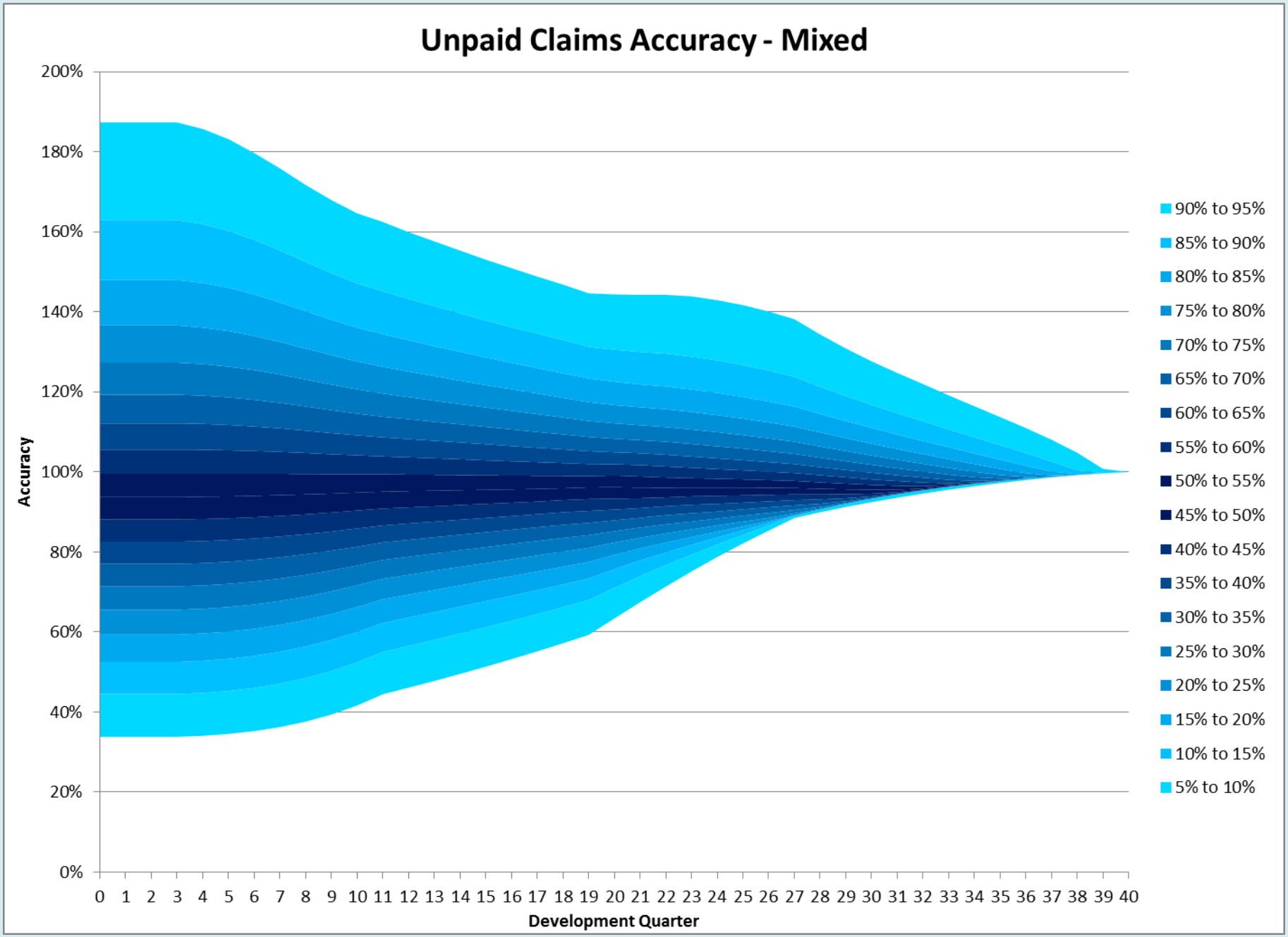
65% to 70%
60% to 65%
55% to 60%
50% to 55%
45% to 50%
40% to 45%
35% to 40%
30% to 35%
25% to 30%
20% to 25%
15% to 20%
10% to 15%
5% to 10%


Unpaid Claims Accuracy - BF
200%
180%
160%
140%
120%
100%
80%
60%
40%
20%
0%
Accuracy
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40
Development Quarter
90% to 95%
85% to 90%
80% to 85%
75% to 80%
70% to 75%
65% to 70%
60% to 65%
55% to 60%
50% to 55%
45% to 50%
40% to 45%
35% to 40%
30% to 35%
25% to 30%
20% to 25%
15% to 20%
10% to 15%
5% to 10%


Unpaid Claims Accuracy - Bounded BF
200%
180%
160%
140%
120%
100%
80%
60%
40%
20%
0%
Accuracy
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40
Development Quarter
90% to 95%
85% to 90%
80% to 85%
75% to 80%
70% to 75%
65% to 70%
60% to 65%
55% to 60%
50% to 55%
45% to 50%
40% to 45%
35% to 40%
30% to 35%
25% to 30%
20% to 25%
15% to 20%
10% to 15%
5% to 10%


Unpaid Claims Accuracy - LDM
1800%
1600%
1400%
1200%
1000%
800%
600%
400%
200%
0%
Accuracy
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40
Development Quarter
90% to 95%
85% to 90%
80% to 85%
75% to 80%
70% to 75%
65% to 70%
60% to 65%
55% to 60%
50% to 55%
45% to 50%
40% to 45%
35% to 40%
30% to 35%
25% to 30%
20% to 25%
15% to 20%
10% to 15%
5% to 10%

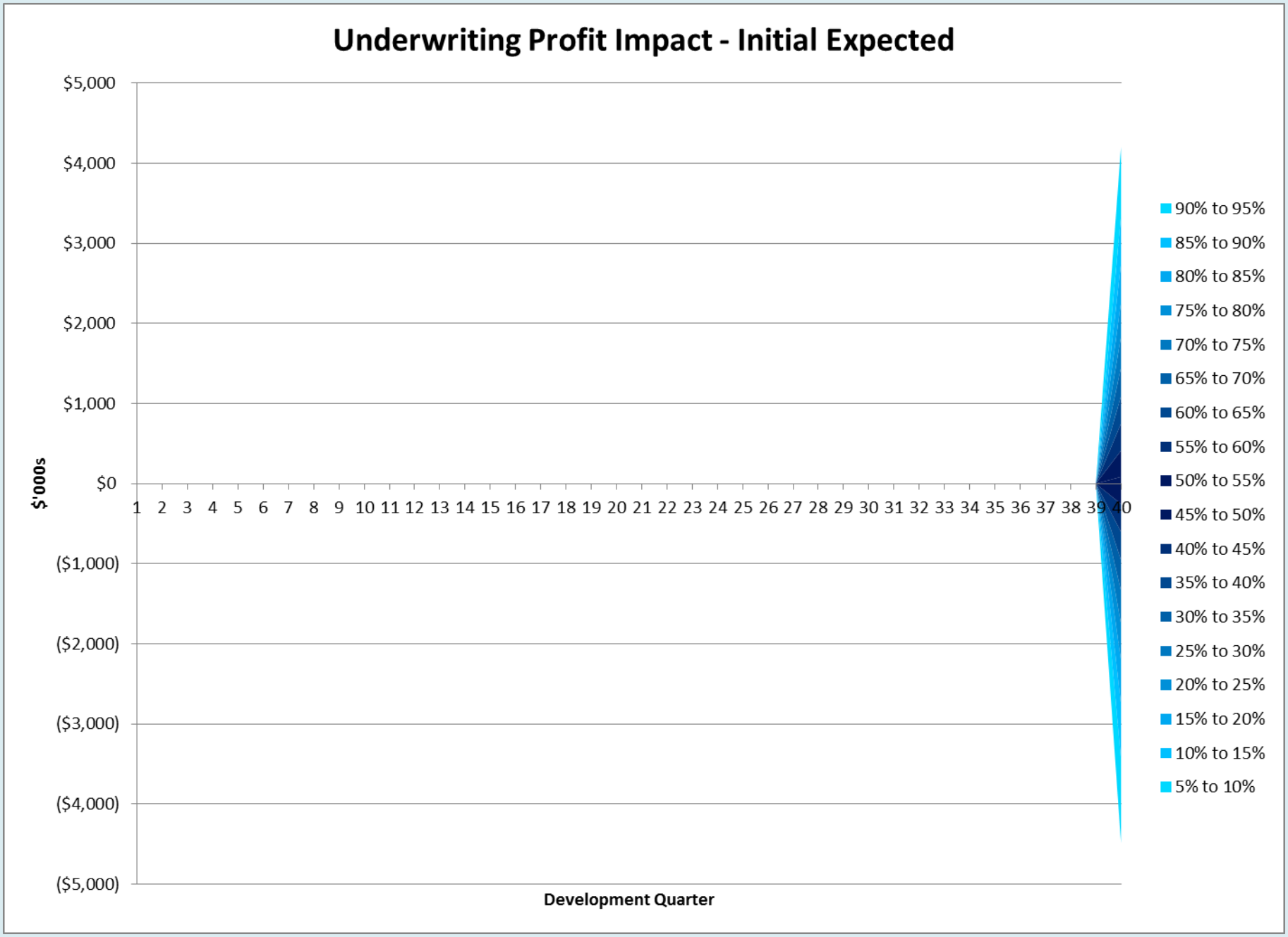

Unpaid Claims Accuracy - Mixed
200%
180%
160%
140%
120%
100%
80%
60%
40%
20%
0%
Accuracy
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40
Development Quarter
90% to 95%
85% to 90%
80% to 85%
75% to 80%
70% to 75%
65% to 70%
60% to 65%
55% to 60%
50% to 55%
45% to 50%
40% to 45%
35% to 40%
30% to 35%
25% to 30%
20% to 25%
15% to 20%
10% to 15%
5% to 10%

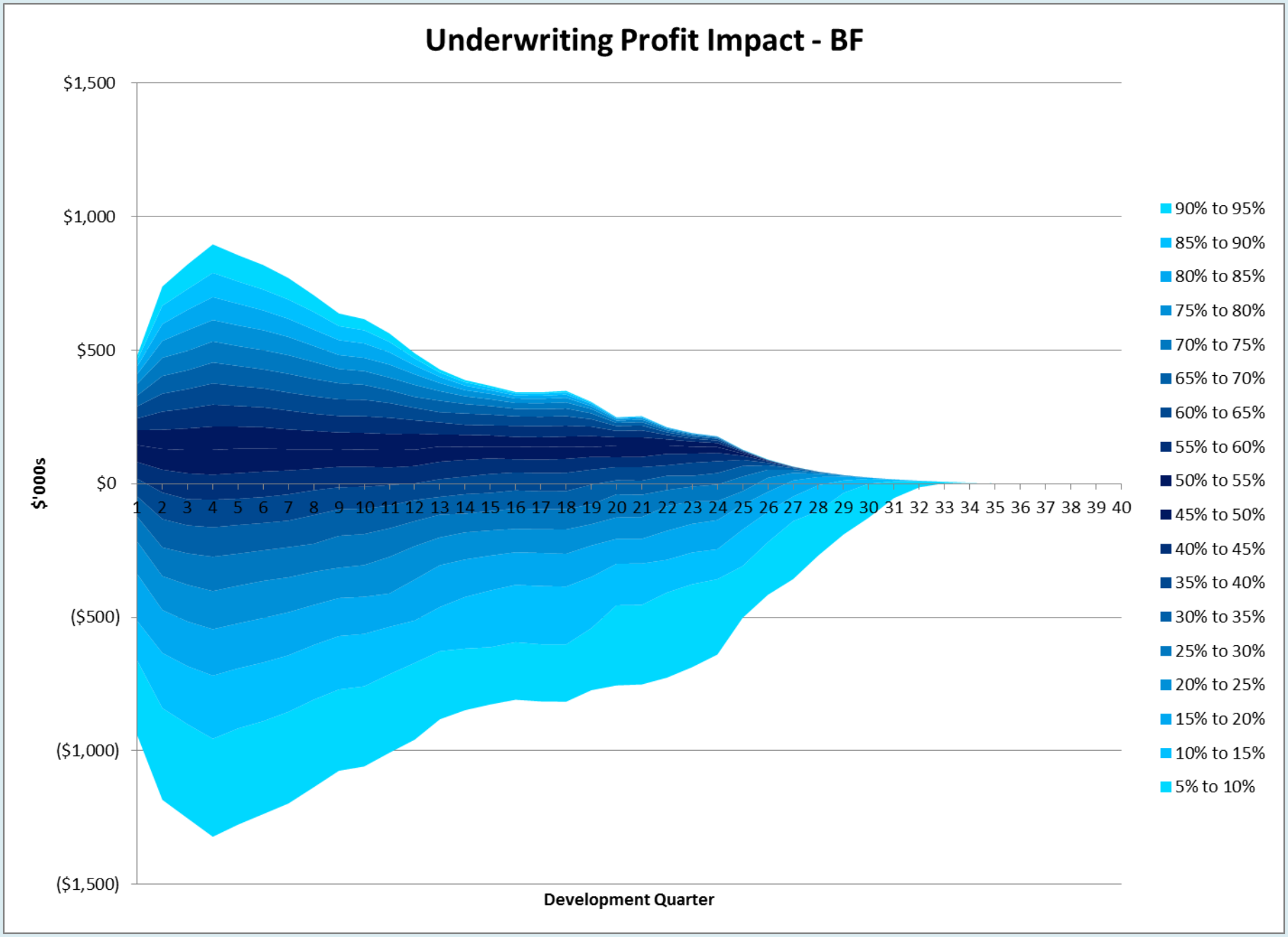
RESULTS: PROFITABILITY IMPACT

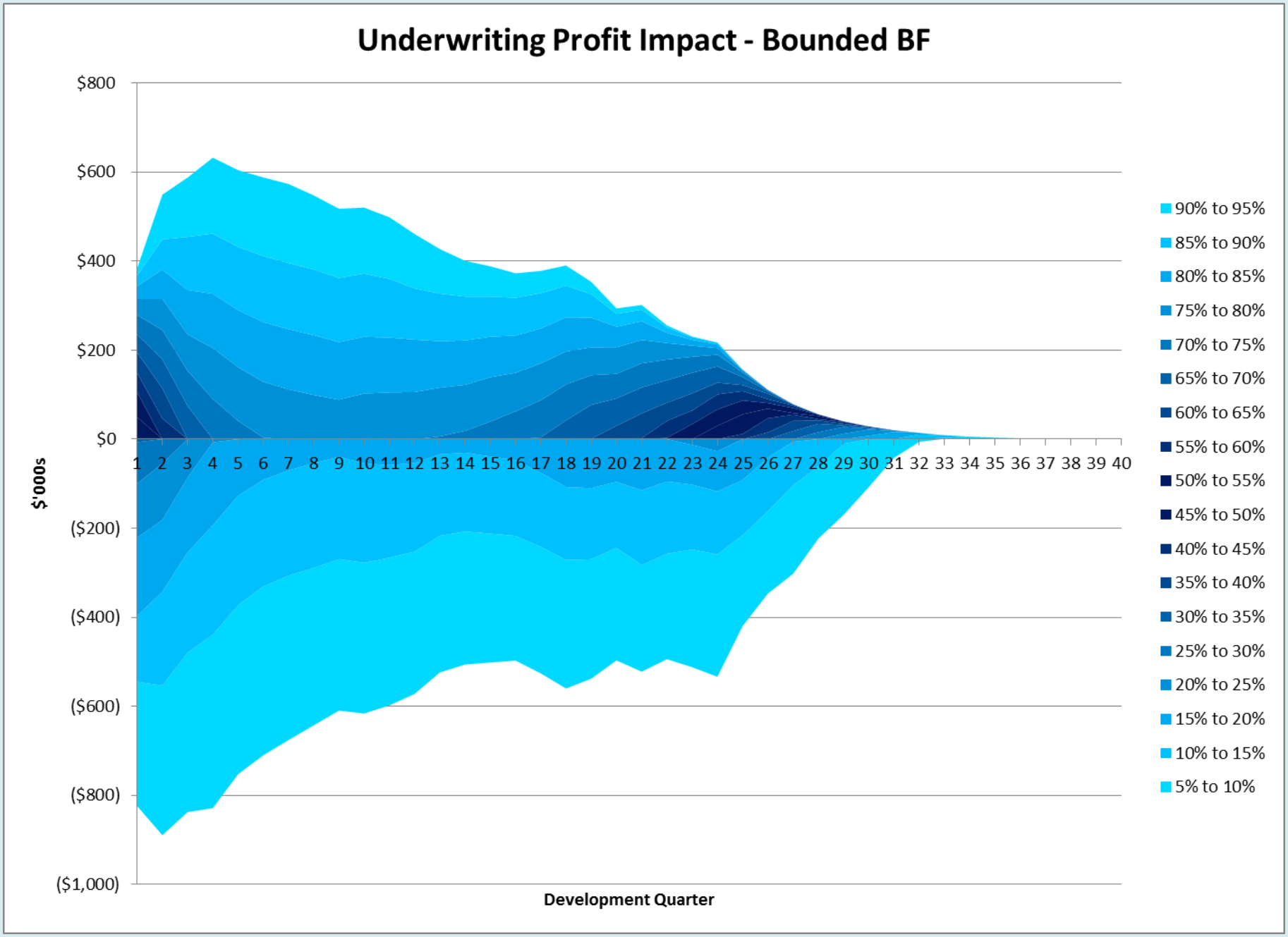
Product 3 – General Liability

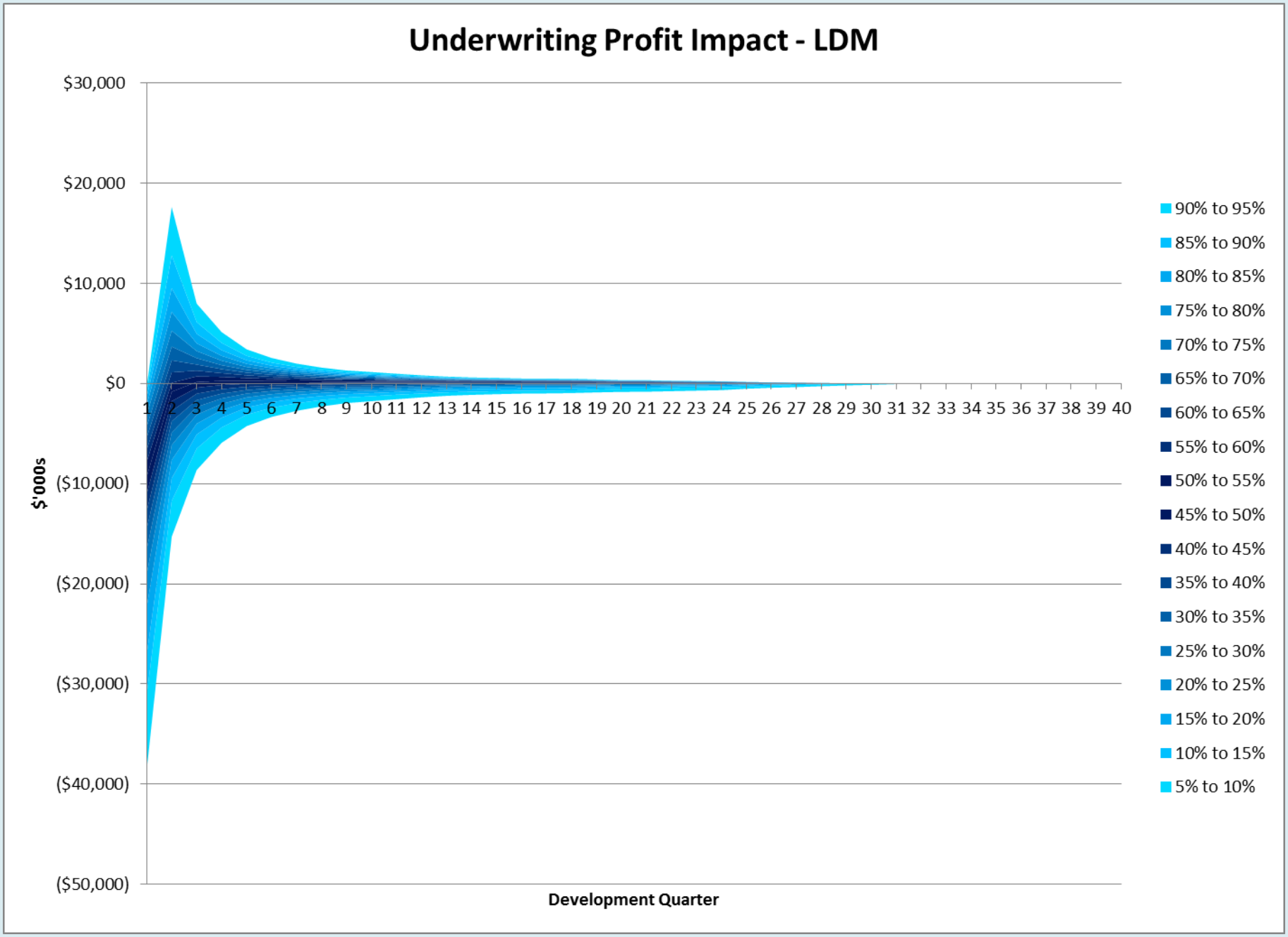
Slightly higher Frequency

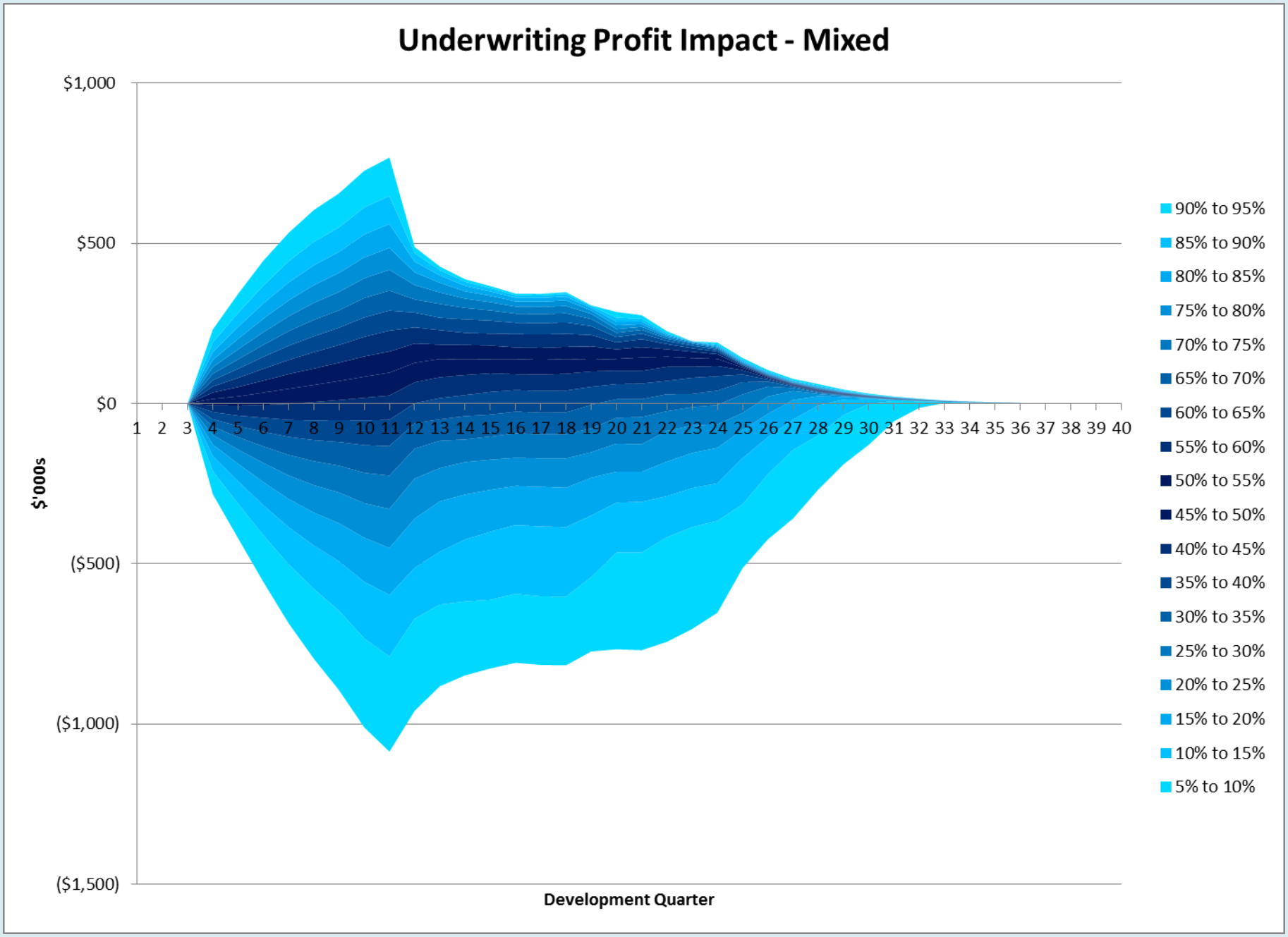
Lower Severity


Underwriting Profit Impact - Initial Expected
$5,000
$4,000
$3,000
$2,000
$1,000
$0
($1,000)
($2,000)
($3,000)
($4,000)
($5,000)
$'000s
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40
Development Quarter
90% to 95%
85% to 90%
80% to 85%
75% to 80%
70% to 75%
65% to 70%
60% to 65%
55% to 60%
50% to 55%
45% to 50%
40% to 45%
35% to 40%
30% to 35%
25% to 30%
20% to 25%
15% to 20%
10% to 15%
5% to 10%


Underwriting Profit Impact - BF
$1,500
$1,000
$500
$0
($500)
($1,000)
($1,500)
$'000s
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40
Development Quarter
90% to 95%
85% to 90%
80% to 85%
75% to 80%
70% to 75%
65% to 70%
60% to 65%
55% to 60%
50% to 55%
45% to 50%
40% to 45%
35% to 40%
30% to 35%
25% to 30%
20% to 25%
15% to 20%
10% to 15%
5% to 10%


Underwriting Profit Impact - Bounded BF
$800
$600
$400
$200
$0
($200)
($400)
($600)
($800)
($1,000)
$'000s
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40
Development Quarter
90% to 95%
85% to 90%
80% to 85%
75% to 80%
70% to 75%
65% to 70%
60% to 65%
55% to 60%
50% to 55%
45% to 50%
40% to 45%
35% to 40%
30% to 35%
25% to 30%
20% to 25%
15% to 20%
10% to 15%
5% to 10%


Underwriting Profit Impact - LDM
$30,000
$20,000
$10,000
$0
($10,000)
($20,000)
($30,000)
($40,000)
($50,000)
$'000s
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40
Development Quarter
90% to 95%
85% to 90%
80% to 85%
75% to 80%
70% to 75%
65% to 70%
60% to 65%
55% to 60%
50% to 55%
45% to 50%
40% to 45%
35% to 40%
30% to 35%
25% to 30%
20% to 25%
15% to 20%
10% to 15%
5% to 10%

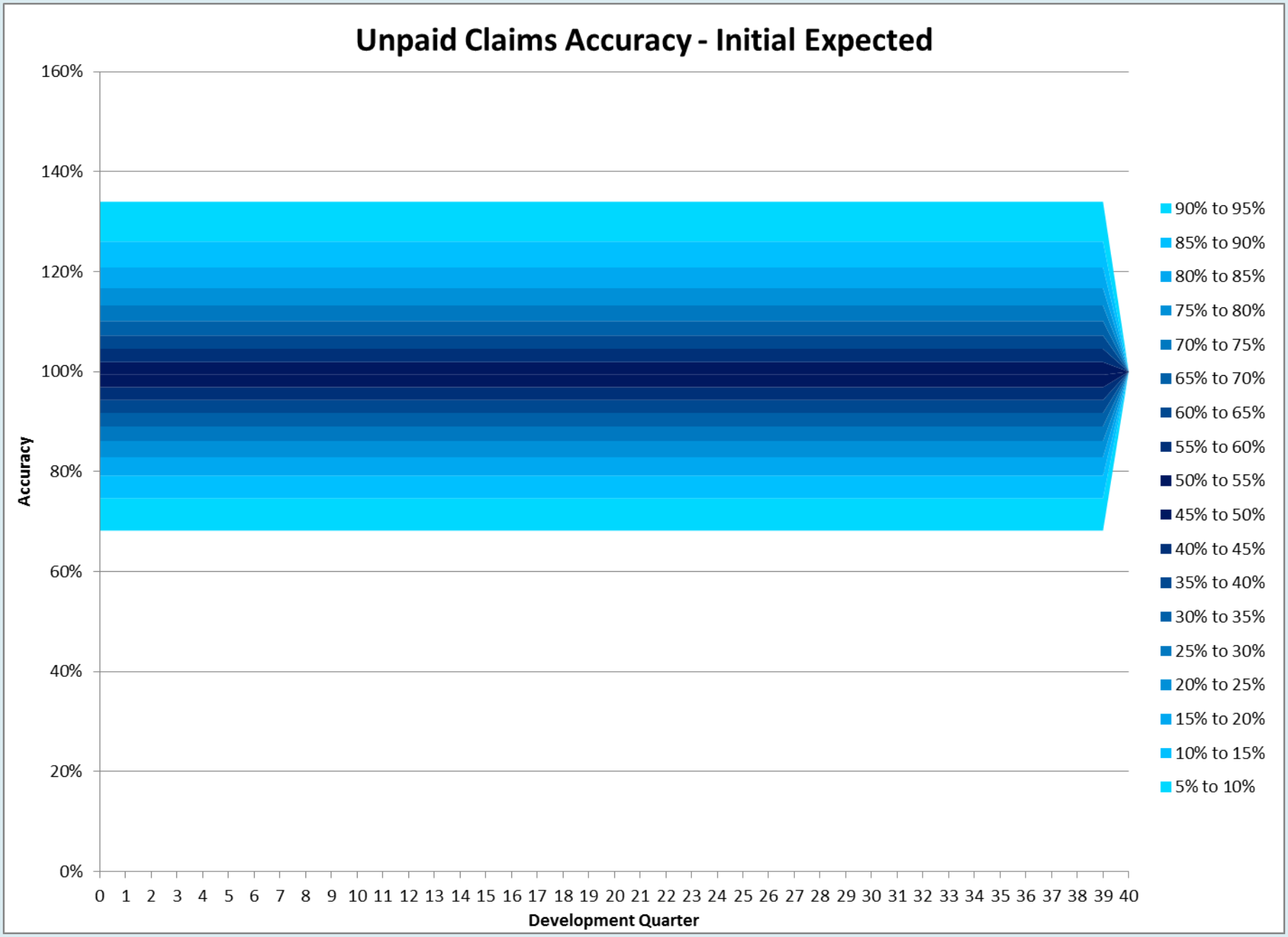

Underwriting Profit Impact - Mixed
$1,000
$500
$0
($500)
($1,000)
($1,500)
$'000s
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40
Development Quarter
90% to 95%
85% to 90%
80% to 85%
75% to 80%
70% to 75%
65% to 70%
60% to 65%
55% to 60%
50% to 55%
45% to 50%
40% to 45%
35% to 40%
30% to 35%
25% to 30%
20% to 25%
15% to 20%
10% to 15%
5% to 10%

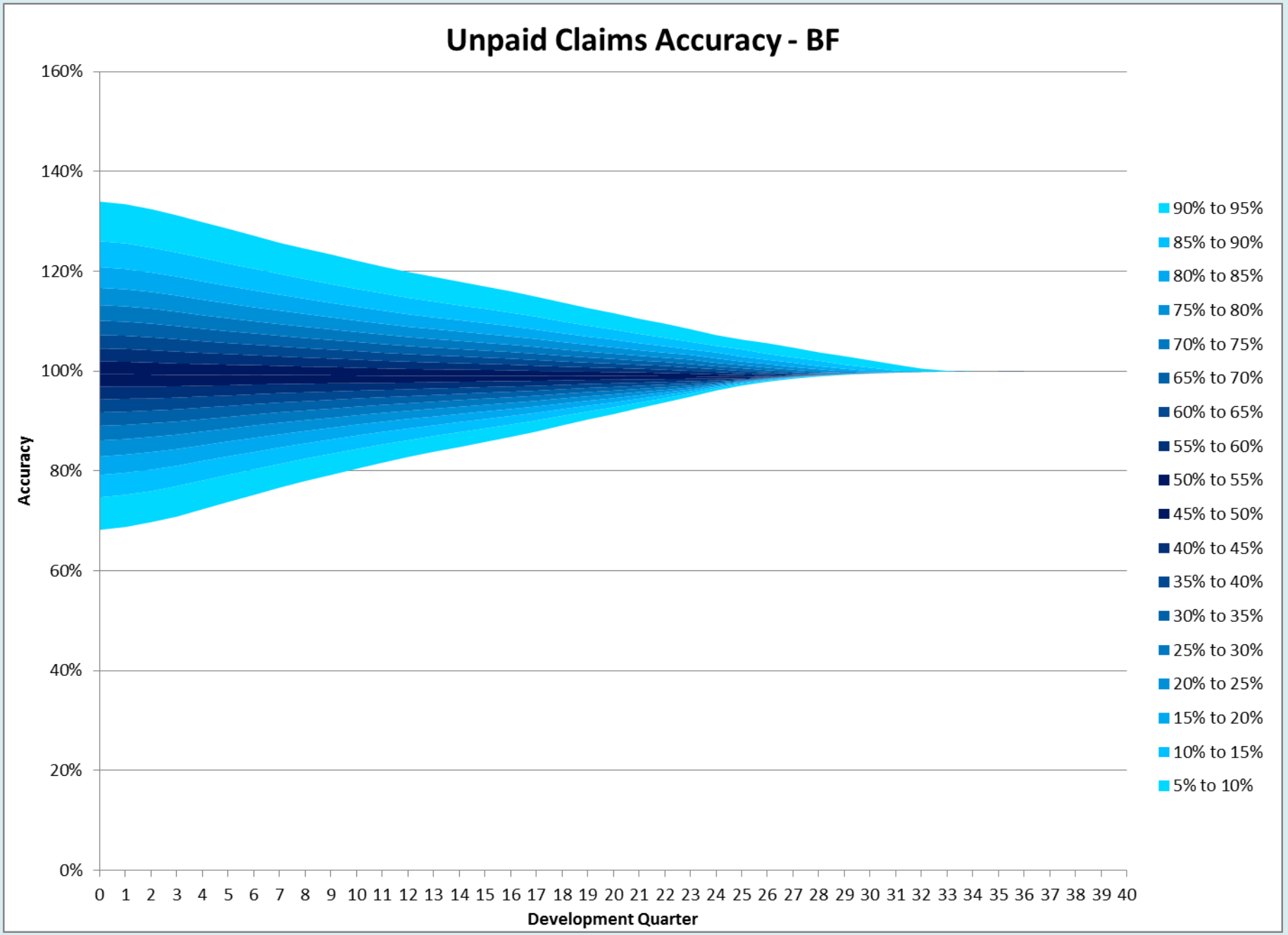
RESULTS: RESERVE ACCURACY

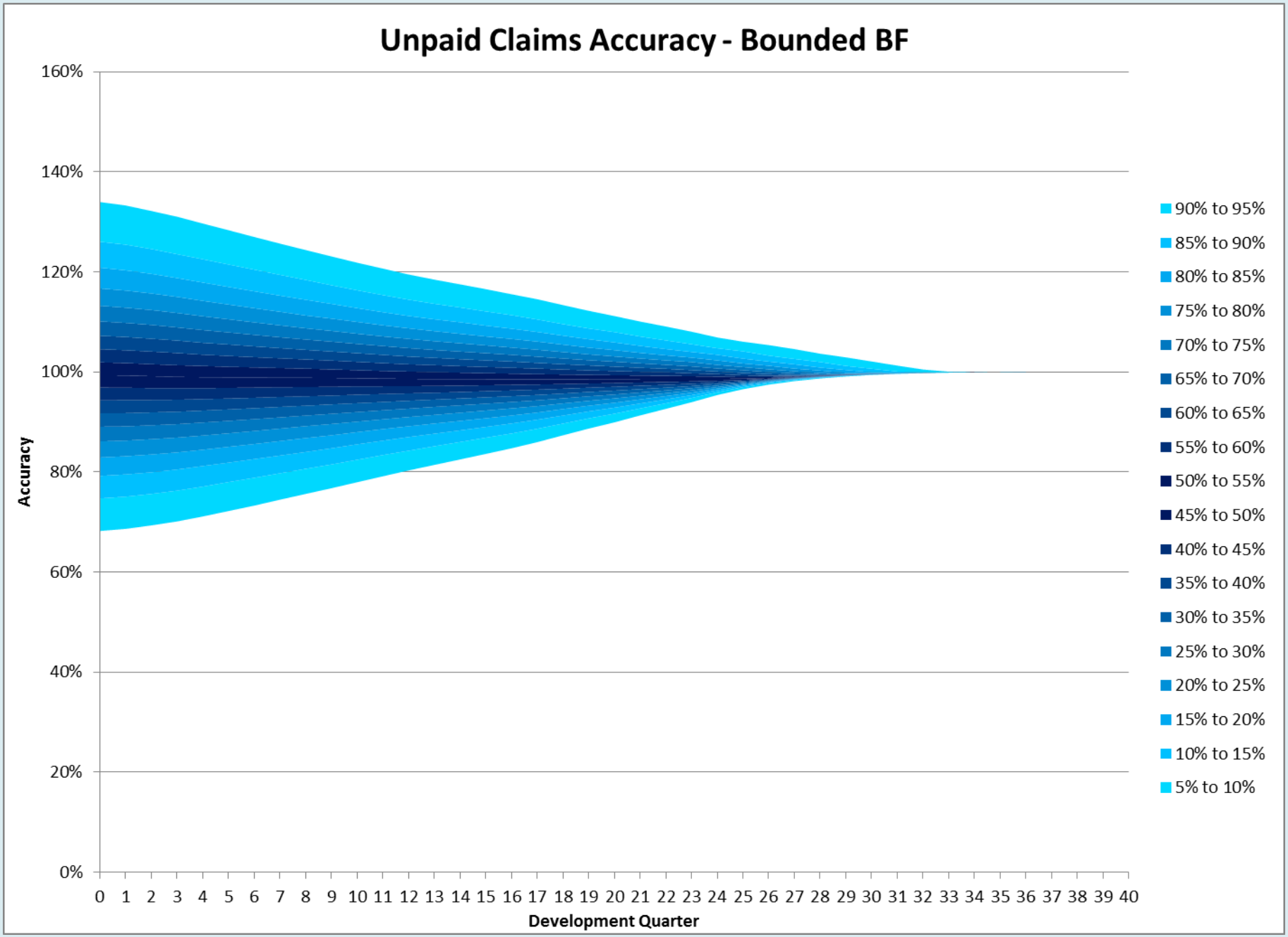
Product 3 – General Liability

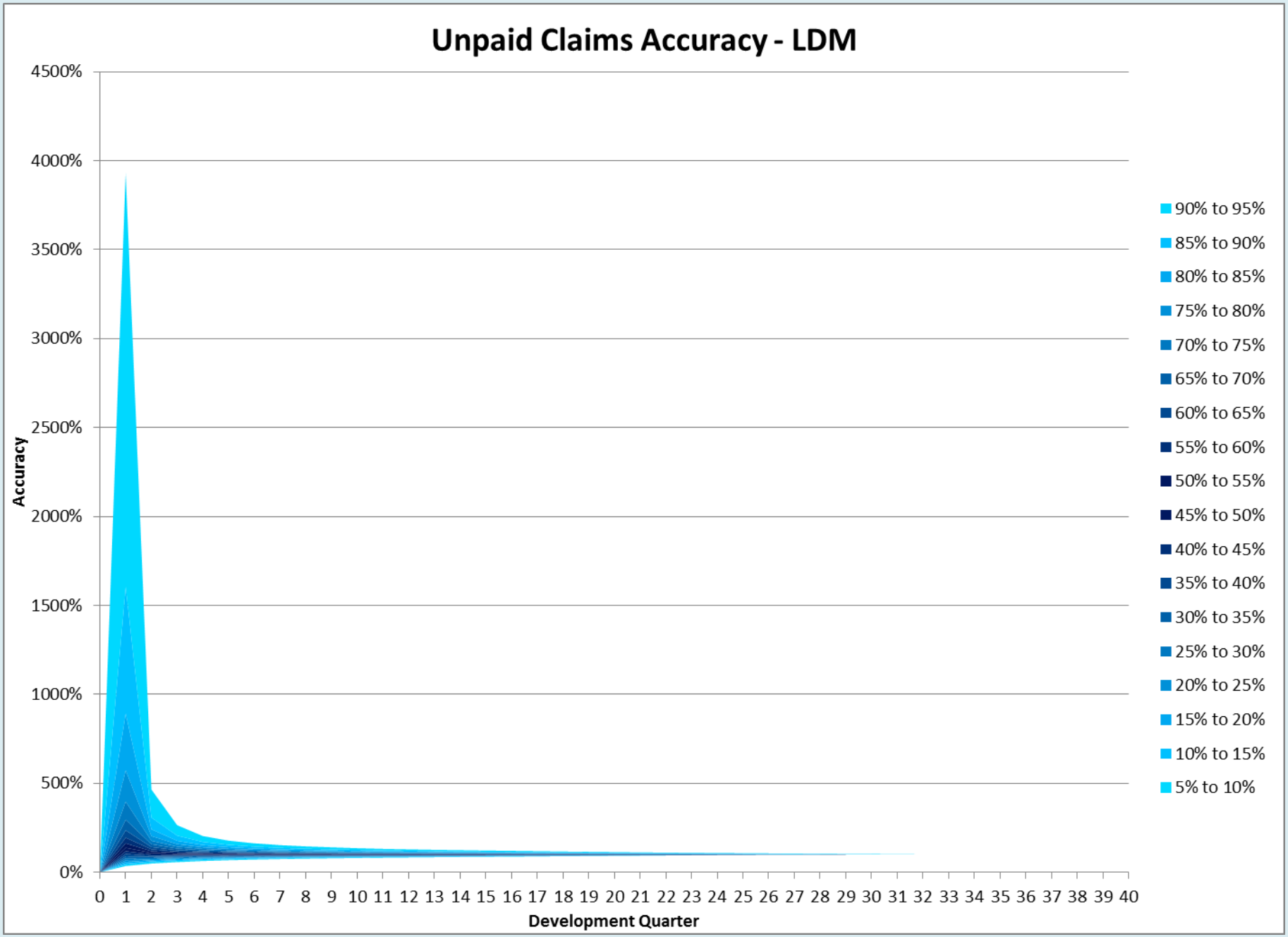
Slightly higher Frequency

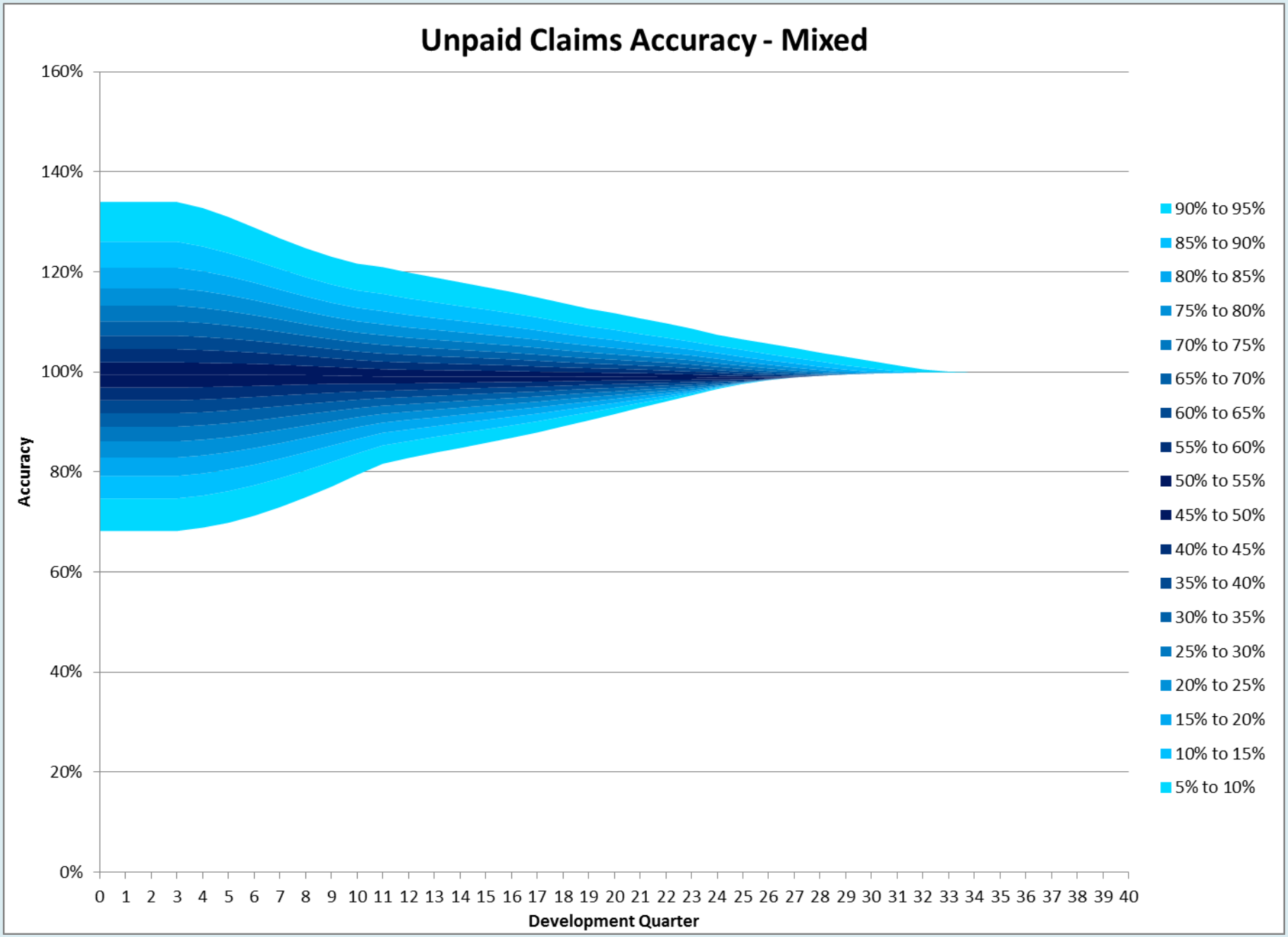
Lower Severity


Unpaid Claims Accuracy - Initial Expected
160%
140%
120%
100%
80%
60%
40%
20%
0%
Accuracy
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40
Development Quarter
90% to 95%
85% to 90%
80% to 85%
75% to 80%
70% to 75%
65% to 70%
60% to 65%
55% to 60%
50% to 55%
45% to 50%
40% to 45%
35% to 40%
30% to 35%
25% to 30%
20% to 25%
15% to 20%
10% to 15%
5% to 10%


Unpaid Claims Accuracy - BF
160%
140%
120%
100%
80%
60%
40%
20%
0%
Accuracy
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40
Development Quarter
90% to 95%
85% to 90%
80% to 85%
75% to 80%
70% to 75%
65% to 70%
60% to 65%
55% to 60%
50% to 55%
45% to 50%
40% to 45%
35% to 40%
30% to 35%
25% to 30%
20% to 25%
15% to 20%
10% to 15%
5% to 10%


Unpaid Claims Accuracy - Bounded BF
160%
140%
120%
100%
80%
60%
40%
20%
0%
Accuracy
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40
Development Quarter
90% to 95%
85% to 90%
80% to 85%
75% to 80%
70% to 75%
65% to 70%
60% to 65%
55% to 60%
50% to 55%
45% to 50%
40% to 45%
35% to 40%
30% to 35%
25% to 30%
20% to 25%
15% to 20%
10% to 15%
5% to 10%


Unpaid Claims Accuracy - LDM
4500%
4000%
3500%
3000%
2500%
2000%
1500%
1000%
500%
0%
Accuracy
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40
Development Quarter
90% to 95%
85% to 90%
80% to 85%
75% to 80%
70% to 75%
65% to 70%
60% to 65%
55% to 60%
50% to 55%
45% to 50%
40% to 45%
35% to 40%
30% to 35%
25% to 30%
20% to 25%
15% to 20%
10% to 15%
5% to 10%


Unpaid Claims Accuracy - Mixed
160%
140%
120%
100%
80%
60%
40%
20%
0%
Accuracy
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40
Development Quarter
90% to 95%
85% to 90%
80% to 85%
75% to 80%
70% to 75%
65% to 70%
60% to 65%
55% to 60%
50% to 55%
45% to 50%
40% to 45%
35% to 40%
30% to 35%
25% to 30%
20% to 25%
15% to 20%
10% to 15%
5% to 10%

QUESTIONS

QUESTIONS

Stochastic Model

- Can the stochastic claims model as outlined be improved?
  - If so, how?
- Are there other uses for such a model?

RESULTS

- What observations can be drawn from the results?

Bounded BF

- Could this be a functional actuarial reserving method?
- How should the upper and lower bounds be determined?
  - Should we include changing the IELR as an option?

HOW ACCURATE ARE YOUR UNPAID CLAIMS ESTIMATES?

As Helmuth Karl Bernhard Graf von Moltke (German Field Marshal from the 18th century) noted, 'no plan survives contact with the enemy'.

In P&C actuarial speak, the equivalent is … 'no reserving method survives contact with the future'.

Presenter: Timothy J Pratt, FIAA, FCAS, MAAA
Contributors: Timothy J Pratt, Andy Moriarty
CLRS, San Diego, Sept 16th 2014

APPENDIX

RESERVING HAS NO* IMPACT ON PROFIT

RESERVING HAS NO* IMPACT ON PROFIT

- When considering a cohort of policies …
  - Reserving has a profit impact (short term)
    - Reserves go up, profit in the year goes down
  - However, once all claims from this cohort have been settled and paid, reserving has no profit impact

RESERVING HAS NO* IMPACT ON PROFIT

- Consider an insurance product cohort that will eventually result in ...
  - 75% loss ratio
  - 20% expense & commission ratio
  - 5% profit margin
  - Note:
    - Losses are reported evenly over 3 years
    - They are paid as they are reported
- What does the profit look like using a Bornhuetter-Ferguson approach with a ...
  - 0% IELR?
  - 50% IELR?
  - 75% IELR?
  - 100% IELR?

RESERVING HAS NO* IMPACT ON PROFIT

Reserving with a 0% IELR

End of Year	Premium	Exp Comm	Reported Losses	Δ IBNR IELR of 0%	Profit
1	100	20	25	-	55
2			25	-	(25)
3			25	-	(25)
Total	100	20	75	-	5

RESERVING HAS NO* IMPACT ON PROFIT

Reserving with a 50% IELR

End of Year	Premium	Exp Comm	Reported Losses	Δ IBNR IELR of 50%	Profit
1	100	20	25	33	22
2			25	(17)	(8)
3			25	(17)	(8)
Total	100	20	75	-	5

RESERVING HAS NO* IMPACT ON PROFIT

Reserving with a 75% IELR

End of Year	Premium	Exp Comm	Reported Losses	Δ IBNR IELR of 75%	Profit
1	100	20	25	50	5
2			25	(25)	-
3			25	(25)	-
Total	100	20	75	-	5

RESERVING HAS NO* IMPACT ON PROFIT

Reserving with a 100% IELR

End of Year	Premium	Exp Comm	Reported Losses	Δ IBNR IELR of 100%	Profit
1	100	20	25	67	(12)
2			25	(33)	8
3			25	(33)	8
Total	100	20	75	-	5

RESERVING HAS NO* IMPACT ON PROFIT

- So ...
  - Over the life of the cohort, 5% profit
  - Low IELR leads to large profits followed by losses
  - High IELR leads to losses followed by profits
- Hence ...
  - Reserving has no impact on (eventual) profits

RESERVING HAS NO* IMPACT ON PROFIT

- But ...
  - Reserving has a huge impact on the view of profitability
  - And can lead to management 'mistakes' ...
    - i.e. Writing lots of unprofitable business because you thought it was profitable
    - Or ... Exiting a profitable line because you thought it was unprofitable

STOCHASTIC CLAIM MODEL

STOCHASTIC CLAIM MODEL

- Claim Model built in MS Excel using @Risk
- Advantage of Claim Model v. Actual Results
  - Ultimate values are known
  - Unlimited scenarios are available to test methods
  - Historical results can be used to build the assumptions in the Claim Model

STOCHASTIC CLAIM MODEL

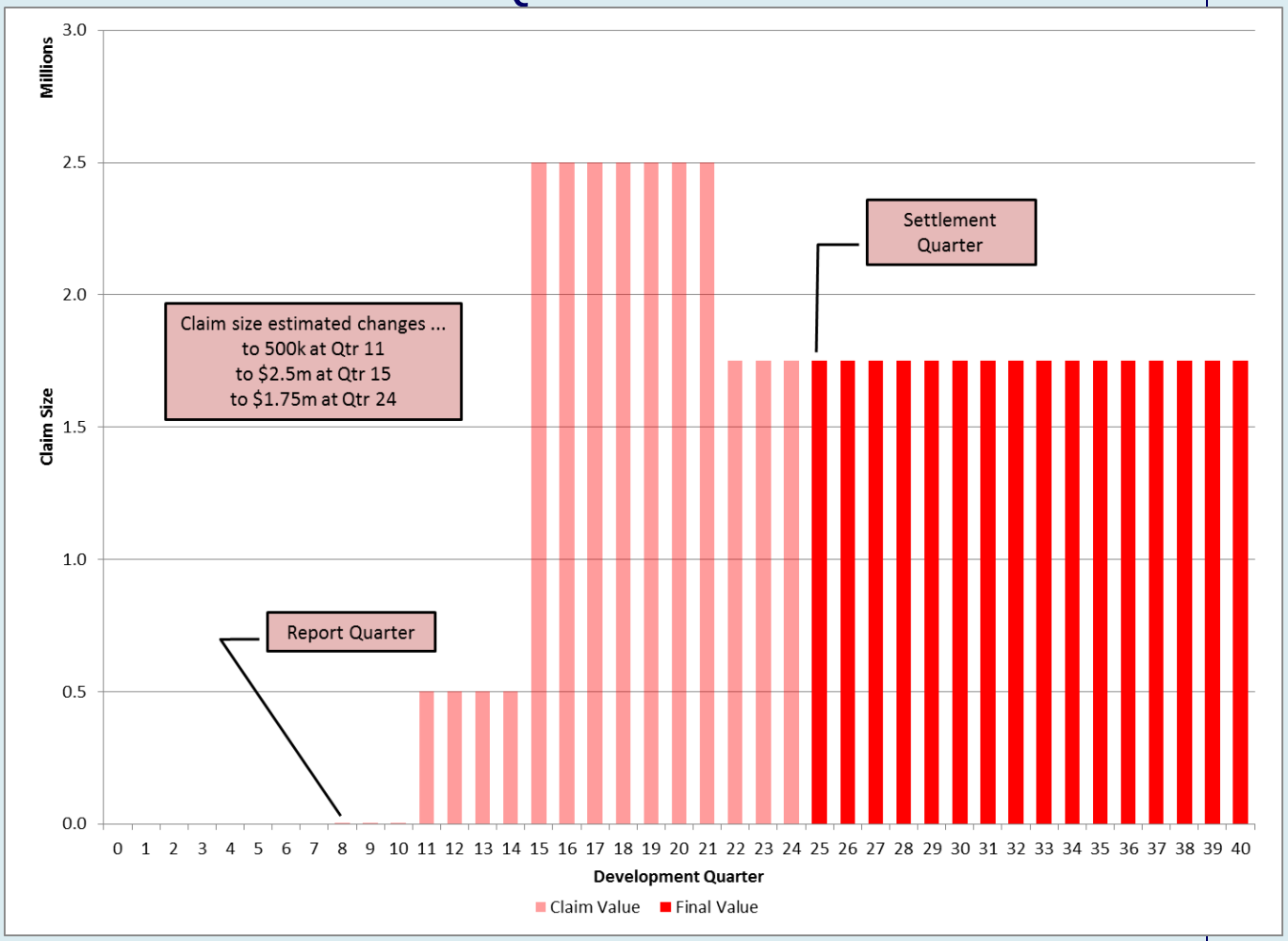
- # of Reported Claims Simulated
- # of Reported Claims that result in any payment
- Individual Claim
  - Report Period
  - Settlement Period
  - Interim Movement modeled based on frequency of:
    - Upward Movement
    - No Movement
    - Downward Movement
  - Attachment point and Limit Applied
- Claims aggregated to get Modeled Experience

STOCHASTIC CLAIM MODEL

- Model Assumptions:
  - All claims are closed by year 10
  - Upward and Downward movements are a function of the policy limit
  - # of Reported Claims can be modelled using InverseGaussian distribution
  - # of Reported Claims that result in payment can be modeled using Binominal distribution
  - All other variables were modeled using a discrete distribution using observed/hypothetical scenarios

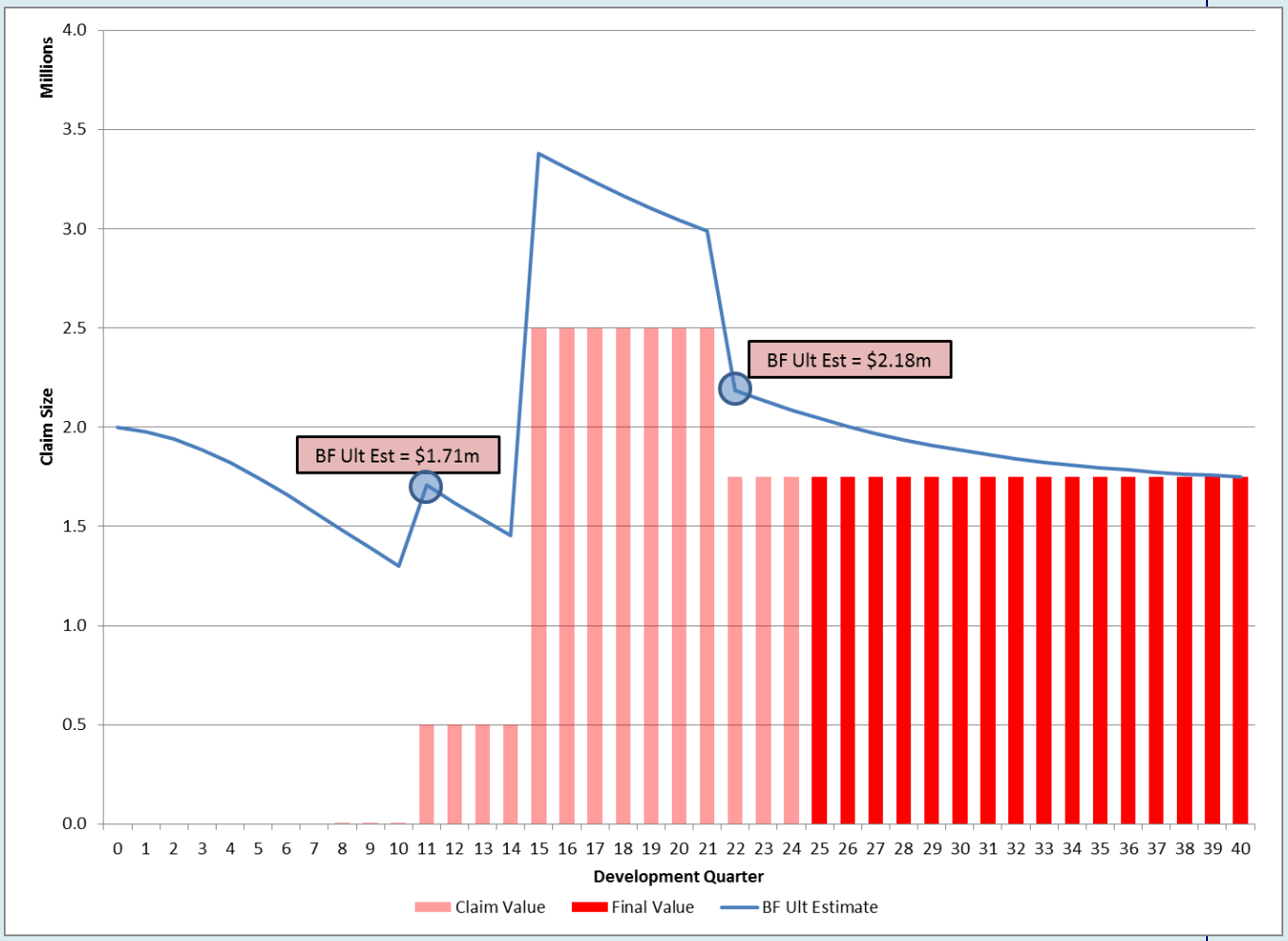
STOCHASTIC CLAIM MODEL

- Below is the 'life cycle' of a particular simulated claim
- Simulate Report and Settlement Quarter
- Simulate possibility and size of claim change movement between report and settlement quarters



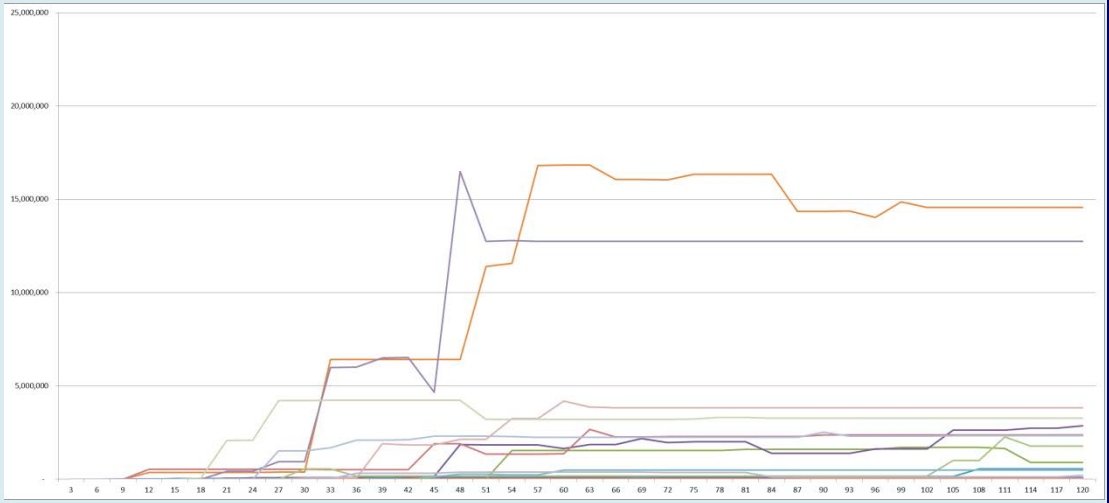
STOCHASTIC CLAIM MODEL

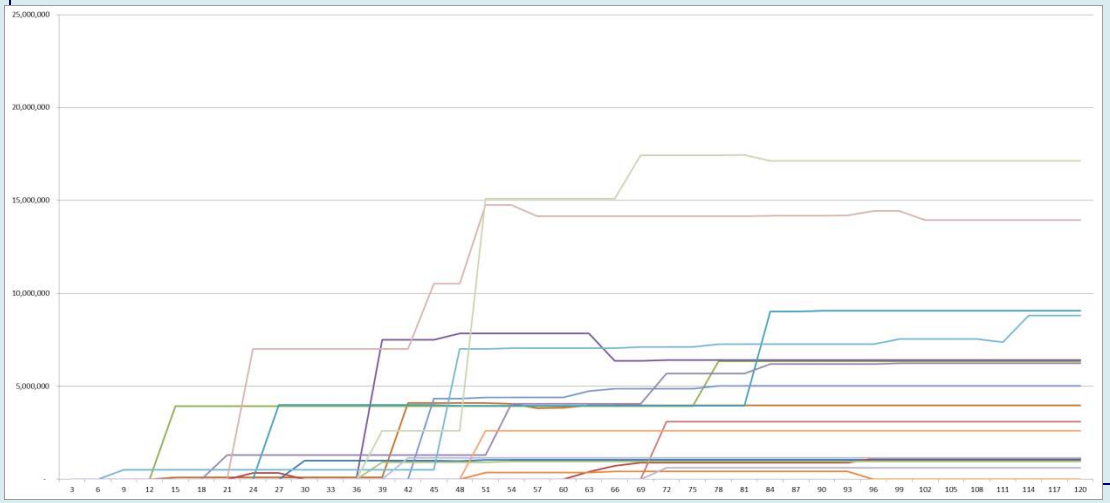
- Illustration of a BF Ultimate Estimate using an initial expected of $2m for the previous claim



STOCHASTIC CLAIM MODEL

Which chart of cumulative loss lines is observed and which is modeled?

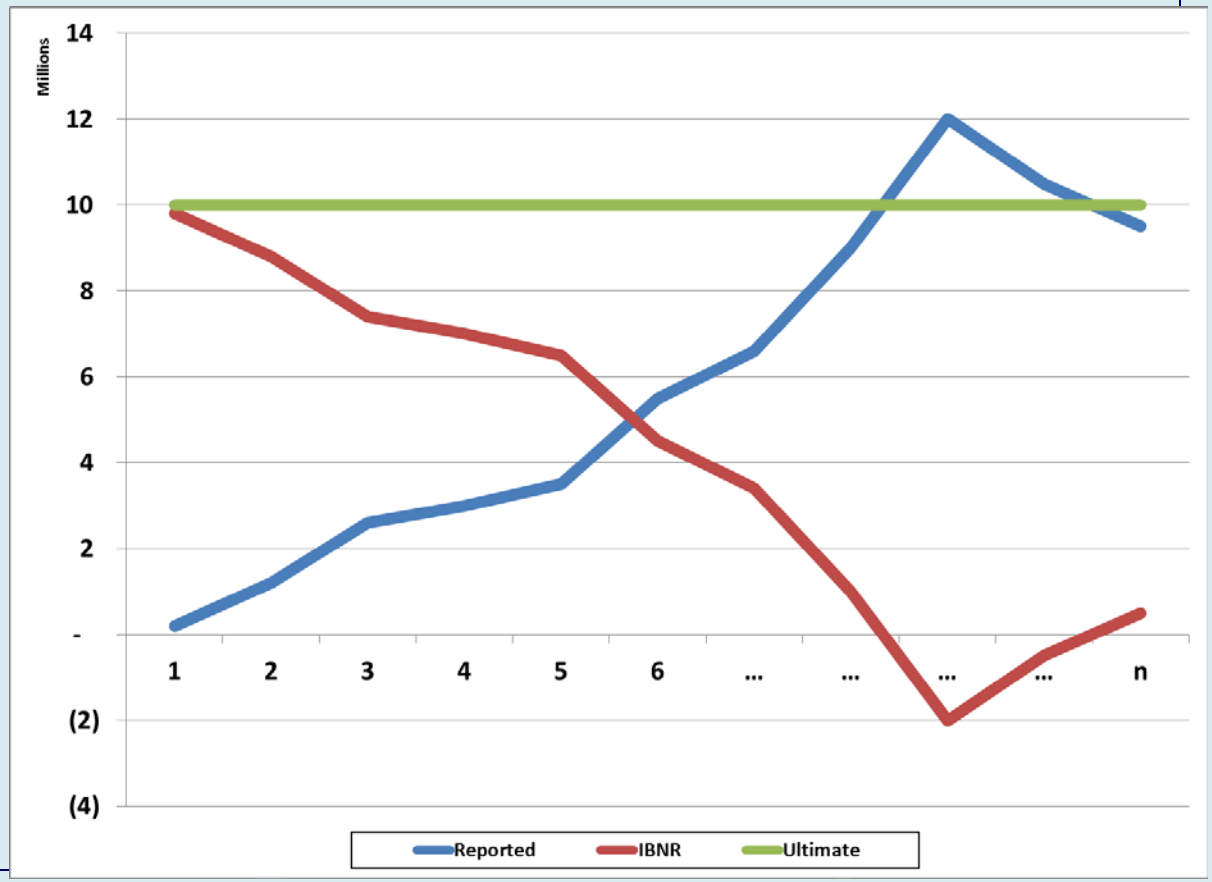




RESERVING METHODS

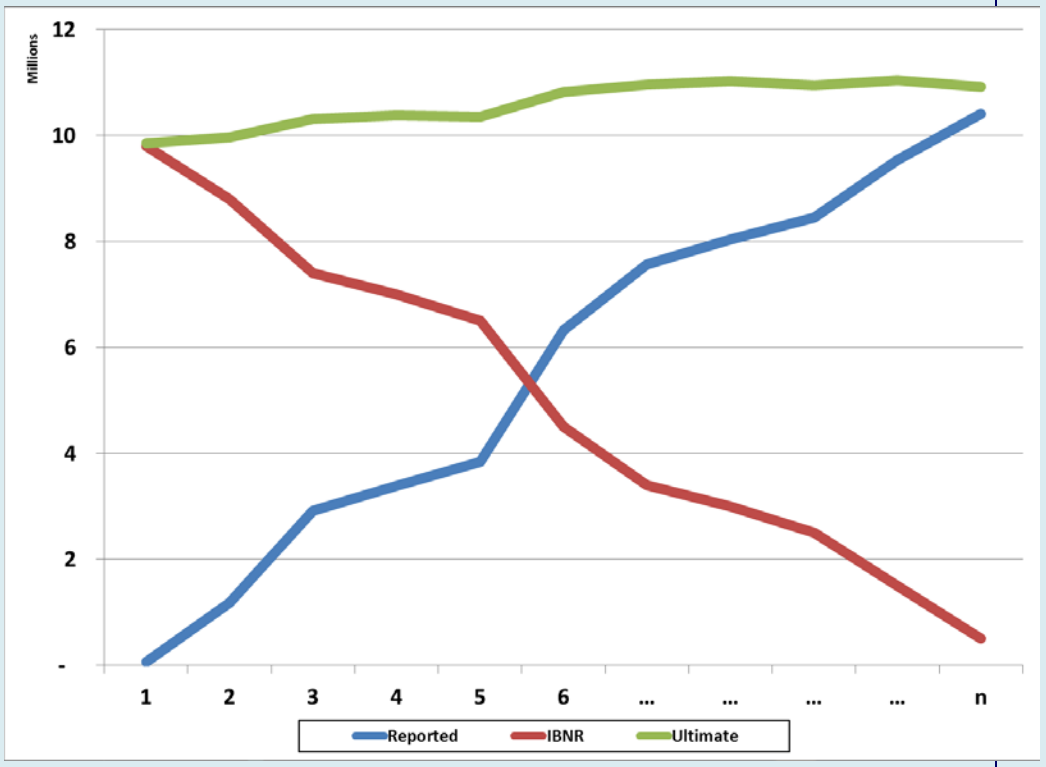
RESERVING METHODS

- Fixed Estimate
  - The ultimate is a fixed amount
  - The IBNR is a balancing item (Ultimate less reported)



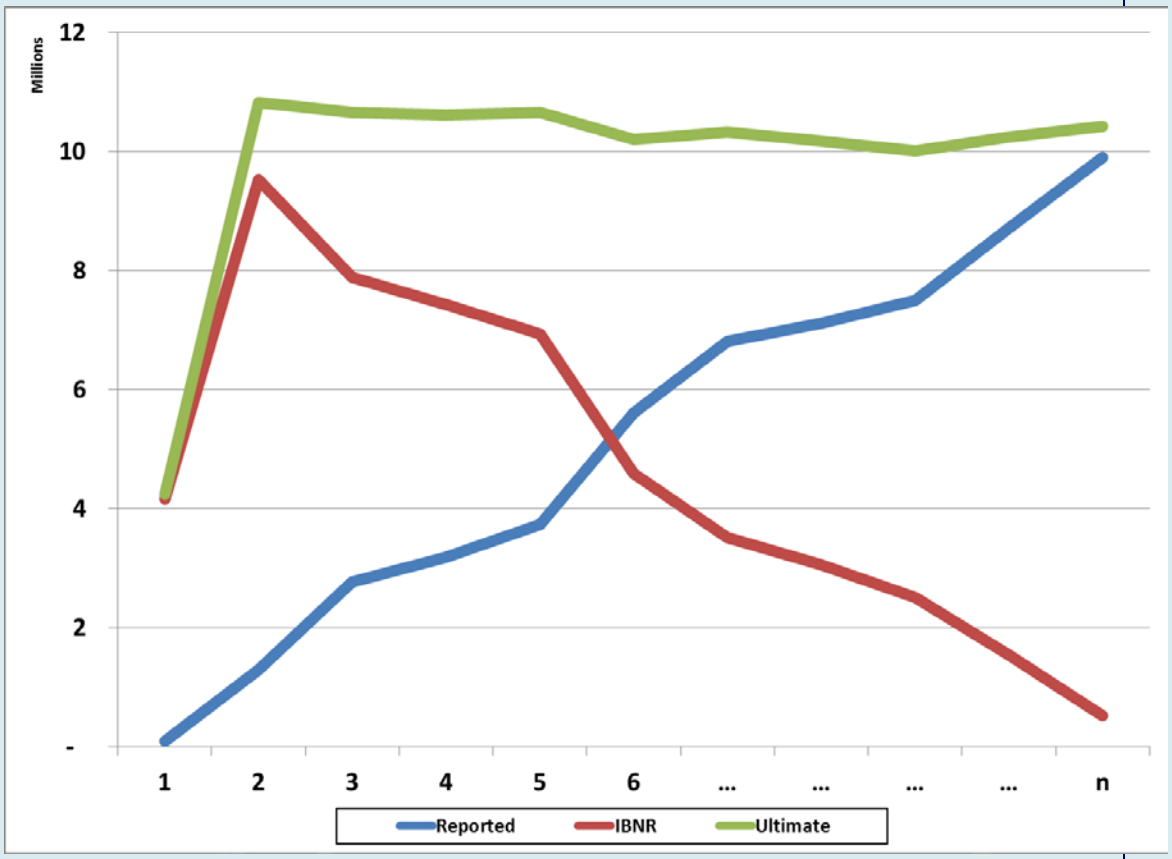
RESERVING METHODS

- Bornhuetter-Ferguson
  - Independent future expectation
  - Past from actual results
  - Credibility weighted of historic reported and future reported for ultimate estimate



RESERVING METHODS

- Loss Development / Chain Ladder
  - Ultimate estimate is reported times up-lift factor



RESERVING METHODS

- Mixed Approach
- The mixed approach blends the following together:
  - Initial Expected (IE)
  - Bornhuetter-Ferguson (BF)
  - Loss Development Method (LDM)
- The blending rules we used are:
  - Quarters 0-3: 100% IE
  - Quarters 11-19: 100% BF
  - Quarters 27+: 100% LDM
  - Others – interpolated between adjacent methods
    - eg: Qtr 4: 87½% IE + 12½% BF

RESERVING METHODS (MIXED)