

## 6.5. 0 → Overview

→ Overview → the Cape Cod method is similar to the BF technique.

→ In this section, we will discuss how the Cape Cod method works & conclude by examining how changes in an insurer's environment may impact their reserving method.

### 6.5.1 → Cape Cod method

→ overview → The Cape Cod method, also known as the standard-gullion method, is similar to the BF method. Like the BF technique, the Cape Cod method divides ultimate claims into two parts: actual reported (or paid) claims & expected unreported (or unpaid) claims. As an AY (or other given period) progresses, actual reported claims increase, expected unreported claims, making the historical expected claims assumption less significant over time.

→ The key difference between the two methods lies in how the expected claims ratio (ECR) is determined. In the Cape Cod method, this ratio is derived from reported claims experience, whereas in the BF technique, it is typically selected independently & may involve judgment.

→ Below, we illustrate the formula for the reported BF method, which is identical to the Cape Cod method:

$$\text{Ultimate claims} = \frac{\text{Actual claims}}{\text{Reported claims}} + \frac{\text{Expected unreported claims}}{\text{Reported claims}}$$

→ For the Cape Cod method, the expected unreported claims is derived from the product of the ECR, the expected claims ratio, & a "percentage unreported" factor that accounts for the portion of claims development still outstanding:

$$\begin{aligned} \text{Expected unreported claims} &= (\text{on-level EP} \times \text{ECR}) \times \% \text{ unreported} \\ \rightarrow \text{The Cape Cod ECR is determined as follows:} \\ \text{Cape Cod ECR} &= \frac{\text{Total reported claims to date}}{\text{Total used-up premium}} \\ &\downarrow \\ &= \frac{\% \text{ reported claims}}{\sum (\text{on-level EP} \times \% \text{ reported})} \end{aligned}$$

→ Note that the product of the on-level EP & the percent reported is commonly referred to as the used-up premium, which is the denominator in our determination of the ECR. This portion of the premium represents the premium corresponding to the claims reported to be reported through the valuation date.

→ b/c this above equation is always derived from historical claims data, the Cape Cod method places less emphasis on actuarial judgement than the BF method (which uses an *a priori* estimate of the expected claims ratio). Additionally, unlike the BF method, data from the year in which the estimate is made is included.

#### → Assumptions & bias

→ The Cape Cod method operates on the assumption that unreported claims will develop based on expected claims, which are determined using reported claims & EP. It is commonly used by reinsurers & is applicable to all lines of insurance, including both short-tail & long-tail lines.

→ An advantage of the Cape Cod method, when compared to the development technique, is its resilience against early random fluctuations in the development of an AY or time interval. This is similar to the BF technique.

→ To better understand the Cape Cod method, let's practice with an example.

→ Example → You are given the following information:

CY/AY	Earned Premium	On-Level Earned Premium	Cumulative Reported Loss	Cumulative % Reported
1998	\$6,500	\$8,500	\$8,500	90%
1999	7,500	9,000	6,500	80%
2000	8,700	9,500	4,500	65%
2001	9,200	9,600	2,300	40%
2002	12,100	12,100	1,500	25%

Using the Cape Cod method, calculate the total IBNR reserve. Show all work.

→ Start by calculating the Cape Cod ECR as:

$$\begin{aligned} \text{Cape Cod ECR} &= \frac{\text{Expected claims}}{\sum (\text{on-level EP} \times \% \text{ reported})} \\ &= \frac{8,500 \times 0.90 + 6,500 \times 0.80 + 4,500 \times 0.65 + 2,300 \times 0.40}{(8,500 \times 0.90) + (6,500 \times 0.80) + (4,500 \times 0.65) + (2,300 \times 0.40)} \\ &= 83.54\% \end{aligned}$$

→ Recall the IBNR equals the ultimate claims, minus the reported claims:

$$\begin{aligned} \text{IBNR} &= \text{Ultimate claims} - \text{Actual reported claims} \\ &= \text{Expected unreported claims} \\ &= \text{on-level EP} \times \text{Expected claims ratio} \times \% \text{ unreported} \end{aligned}$$

→ Thus, the IBNR for each AY is:

$$\begin{aligned} 1998 \text{ IBNR} &= 8,500 \times 83.54\% \times (1 - 90\%) = 710.11 \\ 1999 \text{ IBNR} &= 9,000 \times 83.54\% \times (1 - 80\%) = 1,563.76 \\ 2000 \text{ IBNR} &= 9,500 \times 83.54\% \times (1 - 65\%) = 2,777.79 \\ 2001 \text{ IBNR} &= 9,600 \times 83.54\% \times (1 - 40\%) = 4,815.05 \\ 2002 \text{ IBNR} &= 12,100 \times 83.54\% \times (1 - 25\%) = 7,581.48 \end{aligned}$$

→ Taking this sum, the total IBNR reserve is \$17,886.10.

→ Notes → keep in mind that only reported claims are used to estimate ultimate losses in the Cape Cod method. B/c of this emphasis on reported claims, most exam questions will ask you to solve for the IBNR.

→ If an exam question does ask you to estimate unpaid claims using the Cape Cod method, simply subtract paid losses from the Cape Cod estimate of ultimate losses.

#### → Examples

→ Given the following information evaluated as of December 31, 2011:

AY	Earned Premium	On-Level Earned Premium	Claims Reported	Reported CDF to Ultimate
2009	\$950,000	\$978,500	\$510,000	1.05
2010	\$975,000	\$1,023,750	\$520,000	1.12
2011	\$1,000,000	\$1,000,000	\$465,000	1.30

Use the Cape Cod technique to calculate the IBNR for accident year 2010.

→ first calculate the Cape Cod ECR. This ratio is obtained by dividing the total reported claims by the sum of the on-level EP, each weighted by the reported CDF to ultimate. note that the percentage reported for each AY is equal & divided by the CDF.

$$\text{Cape Cod ECR} = \frac{\text{Expected claims}}{\sum (\text{on-level EP} \times \% \text{ reported})}$$

→ Substituting the values:

$$\text{Cape Cod ECR} = \frac{510,000 + 520,000 + 465,000}{(978,500 \times \frac{1}{1.05}) + (1,023,750 \times \frac{1}{1.12}) + (1,000,000 \times \frac{1}{1.30})} = 52.17\%$$

→ To calculate the IBNR for AY 2010, use the on-level EP for 2010, the ECR, & the unreported percentage based on the CDF:

$$\text{IBNR}_{2010} = 1,023,750 \times 52.17\% \times (1 - \frac{1}{1.12}) = 67,767.78$$

→ Recall that in the EC method, we stated that a claims ratio must be adjusted to the same level (risk level, loss level, premium trend, etc.) as the year we are estimating ultimate claims for. This next example illustrates how that is performed under the Cape Cod method.

→ You are given the following information:

Accident Year	Earned Premium	On-Level Adjustment	Reported Claims	Pure Premium Trend Factors	Tort Reform Factors	Reported CDF to Ultimate
2010	\$50,000	0.900	\$25,000	1.061	0.750	1.250
2011	\$52,000	0.950	\$20,000	1.030	0.900	1.750
2012	\$54,000	1.000	\$10,000	1.000	1.000	2.500

Using the Cape Cod technique, estimate the IBNR for accident year 2011.

→ Step 1: Adjust all values to 2011 levels

→ We want to bring all data points – EPs & reported claims – up to a consistent basis, here at AY 2011, to ensure comparability. The Cape Cod method requires both premiums & claims to be adjusted for any changes in rate levels, pure premium trends, & tort reform across years.

→ (i) Adjusting on-level premiums:

→ Calculating the adjusted on-level adjustment factor for each year to normalize premiums to the 2011 level.

$$\rightarrow \text{For instance, for AY 2010, the adjustment factor relative to AY 2011 is } \frac{0.900}{0.950} = 0.9474$$

→ Adjusting reported claims:

→ Adjust each year's reported claims for the change in trend factors & tort reform to make them consistent w/ AY 2011 levels.

→ for example, for AY 2010, the pure premium trend adjustment relative to AY 2011 is  $\frac{1.061}{1.030} = 1.031$ , & the tort reform adjustment is  $\frac{0.750}{0.900} = 0.8333$ .

→ The reported claims at AY 2011 levels for AY 2010 is thus calculated as:

$$25,000 \times 1.031 \times 0.8333 = 21,460$$

→ The adjusted totals are as follows:

Accident Year	Earned Premium	On-Level Adjustment	% Reported	Used-Up Premium at AY2011 Level
2010	\$50,000	0.900 / 1.030 = 0.9474	1 / 1.250 = 0.8000	\$37,895
2011	\$52,000	0.950 / 1.030 = 0.9000	1 / 1.750 = 0.5714	\$29,714
2012	\$54,000	1.000 / 1.030 = 0.9762	1 / 2.500 = 0.4000	\$22,737

Total				\$90,346

Accident Year	Reported Claims	Pure Premium Trend Factor	Tort Reform Trend Factor	Reported Claims at AY2011 Level
2010	\$25,000	1.061 / 1.030 = 1.0301	0.750 / 0.900 = 0.8333	\$21,460
2011	\$20,000	1.030 / 1.030 = 1.0000	0.900 / 0.900 = 1.0000	\$20,000
2012	\$10,000	1.000 / 1.030 = 0.9762	1.000 / 0.900 = 1.1111	\$10,787
Total				\$52,248

→ Step 2: Calculate the Cape Cod ECR

→ With the adjusted totals from both tables, substitute those into the ECR formula to find the Cape Cod ECR at 2011 levels.

$$\text{Cape Cod ECR} = \frac{\text{Expected claims at AY2011}}{\sum \text{Used-up premium at AY2011 level}}$$

$$= \frac{83,546}{80,346}$$

$$= 52.17\%$$

→ Step 3: Calculate the IBNR reserve for AY 2011

→ To determine the IBNR for AY 2011, substitute the on-level premium for AY 2011, the calculated Cape Cod ECR, & the percentage reported to get the IBNR amount.

$$\text{IBNR}_{2011} = \text{on-level EP}_{2011} \times \text{Cape Cod ECR} \times (1 - \% \text{ reported}_{2011})$$

$$= \$52,248 \times 52.17\% \times (1 - \frac{1}{1.30})$$

$$= \$13,388$$

→ Notes → we could also adjust the premiums & claims to AY 2012 levels, determine the ECR, & then adjust the ECR to AY 2011 levels before multiplying it to the AY 2011 EP.

#### → Assignment

→ (a) Given the following information:

Calendar/Accident Year	Earned Premium (in \$000)	On-Level Premium (in \$000)	Cumulative Reported Loss (in \$000)	Cumulative Percent Reported

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