

## 6.2.2 → Analyzing the development method

### → Assumptions & uses

- The development method calculates claim development factors based on historical data. As such, it makes the following key assumptions:
  - 1) claims recorded to date will continue to develop in a similar fashion in the future
  - 2) for accident years that are not fully developed, claims observed thus far give us relevant information on claims that haven't yet to be observed
  - 3) throughout the policy period:
    - mixture of claim types is stable
    - policy limits & deductible (if any) are stable
    - reinsurance retention limits (if any) are stable
    - There is consistent claims processing (claim settlement rates & case outstanding adequacy).

→ If any of these assumptions are violated, the development method will produce inaccurate ultimate claims estimates. So if it seems unreasonable to believe that any of these assumptions are true, it might be a good idea to consider using another reserving method.

### → The development method works well:

- 1) when there is a large amount of credible historical claims data available
- 2) for high-frequency, low-severity lines w/ stable & timely reporting of claims does not greatly distort the data
- 3) when the presence or absence of large claims does not

→ It is valid in other scenarios as well, as long as the key assumptions of the method are met.

- Over the course of this section, we will cover many different reserving techniques. It is important to understand the key assumptions behind each technique, as well as when to apply it.
- For the rest of this section, we'll discuss how certain factors impact the paid & reported development methods. To better illustrate how the changes in these factors affect the data, assume a baseline dataset where the claims, both paid & reported, develop according to the following pattern:

Cumulative Claims as of (months)					
12	24	36	48	60	
200	280	340	380	400	

→ We will assume that claims reach the ultimate level of 400 at 60 months, & that all other factors (including claim frequency & severity) are consistent year-over-year.

### → Changes in exposures

- An increase (or decrease) in the number of written exposures would cause the expected paid & expected reported losses during a period to increase (or decrease) proportionately. It would have the same effect on premium. This should be fairly intuitive. All else equal, doubling the number of exposures written during the year should double the calendar year EP & double the AV losses.

→ Below is an example of a dataset w/ an increase in exposures starting in AFY 2012.

Accident Year	Cumulative Paid Claims as of (months)				
	12	24	36	48	60
2011	200	280	340	380	400
2012	220	308	374	418	
2013	240	336	408		
2014	260	364			
2015	280				

→ Although paid (or reported) amounts will be larger for each year, notice that the claim development factors are unchanged between AFYs.

Accident Year	Paid Claim Development Factors (months)			
	12-to-24	24-to-36	36-to-48	48-to-60
2011	1.40	1.21	1.12	1.05
2012	1.40	1.21	1.12	
2013	1.40	1.21		
2014	1.40			
Average	1.40	1.21	1.12	1.05

→ This is because the change in the number of exposures written during an AFY does not always imply that development factors have changed. So, the development method would still be appropriate for estimating ultimate claim amounts in this case.

→ Hence, a change in the number of written exposures would impact ultimate claim amounts in the same direction as the change but not affect the selected development factors for both the paid & reported development methods. This is assuming the exposures distribution remains stable year over year.

→ That said, when there are changes in exposures, it is common for the exposures distribution with the year to change, causing a shift in the average accident date. For example, consider company A, which sells annual policies uniformly throughout each month. Assume Company A begins increasing the number of policies written each month by 30% starting in March of 2012:

Year \ Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2010	100	100	100	100	100	100	100	100	100	100	100	100
2011	100	100	100	100	100	100	100	100	100	100	100	100
2012	100	100	100	130	169	220	286	372	484	629	818	1,063

→ This compounding growth leads to a steady increase in in-force exposures throughout 2012.

Year \ Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2011	1,200	1,200	1,200	1,200	1,200	1,200	1,200	1,200	1,200	1,200	1,200	1,200
2012	1,200	1,200	1,200	1,230	1,299	1,419	1,605	1,877	2,261	2,790	3,508	4,471

→ Due to a larger portion of exposures are concentrated in the later months of 2012, the average accident date for that year shifts later compared to 2011:

2011	Jul 1, 2011
2012	Aug 17, 2012

→ When the average accident date shifts later in the year:

→ Claims have had less time to develop by the evaluation date (e.g. year end). As a result, newer claims have been reported or paid, & those that have are generally less mature than claims from accident years w/ earlier accident dates.

→ Applying development factors from prior years w/o adjustment to the newer accident year fails to account for the delayed development. These factors assume more time for claims to emerge & settle than has actually occurred, leading to an underestimation of future development.

→ This mismatch results in underestimated claims & inadequate reserves. Both the paid & reported development methods are impacted, as they depend on the relative maturity of claims at each development rate.

→ If we notice that the average accident date is changing, we can mitigate some of the inaccuracy by using smaller intervals for the development triangle. These intervals tend to have more consistent average accident dates, making development factor adjustments more reliable. For example:

	Q1	Q2	Q3	Q4
2011	Feb 14, 2011	May 16, 2011	Aug 15, 2011	Nov 15, 2011
2012	Feb 14, 2012	May 17, 2012	Aug 19, 2012	Nov 20, 2012

→ Notice that the quarterly average accident dates between 2011 & 2012 are much closer than the annual average accident dates. This reduces the impact on estimates produced using the development method.

### → Changes in claim ratios

→ Similar to changes in exposure, shifts in frequency, severity, or the overall claim ratio do not affect the claim development factors in either the paid or reported development methods. However, they do affect the ultimate claims estimates produced by these methods.

→ Claim ratios are calculated as:

$$\text{Claims Ratio} = \frac{\text{Claims}}{\text{Premium}} = \frac{\text{Frequency} \times \text{Severity}}{\text{Premium}}$$

→ This means claim ratios can change w/o impacting the selected development factors or ultimate claims.

→ For example, if premiums increase while claims remain stable, the claims ratio will decrease — even though the claims behavior hasn't changed. So, a change in the claims ratios alone is not enough to conclude that ultimate claims are changing. You need to determine whether the change is driven by:

→ A change in premium (e.g. pricing changes), or

→ A change in claims frequency, severity, or both

→ When analyzing a paid or reported claims triangle, a change in the claims ratio due to shifts in frequency & severity will appear the same as a change in exposures. The key distinction is:

$$\rightarrow \text{A change in exposures implies a corresponding change in premium}$$

$$\rightarrow \text{A change in claims ratios (due to frequency/severity) does not imply a change in premium}$$

→ For instance, increasing exposures would cause both the numerator & denominator of the claim ratio to increase proportionally, leaving the ratio itself unchanged.

→ In contrast, changes in frequency or severity will alter the total claims (the numerator), which affects the ultimate claims estimate — but they do not impact the selected development factors. As a result, the development methods remain appropriate for estimating ultimate claims in these cases.

→ Notes → note that the addition of policy provisions such as a deductible, policy limit, or coinsurance clause are essentially ways to alter claim frequency, severity, or both. As such, changes to any of these provisions would impact the development method similarly to a change in frequency or severity.

→ In general, an increase or decrease in the settlement rates have no impact on the reported development since it uses reported claim data, what is not impacted by changes in the part of which claims are paid.

→ Changes in the average accident date also have no impact on the paid development method since it uses paid claim data, which is not impacted by changes in the part of which claims are paid.

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