Estimating Claims Reserves in Insurance Industries Evidence from the Egyptian Market

By

Mohamed Ahmed Mohamed Maait

Cairo University Faculty of Commerce

Department of Insurance and Actuarial Science

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Estimating Claims Reserves in Insurance Industries Evidence from the Egyptian Market

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Abstract:

Purpose - Claims reserve plays a crucial role for the insurance industry. Reserves enable the insurance company to meet its obligations towards the insurers whenever accidents happen. Reserves appear as an item on the company's balance sheet and is also necessary as a practical indicator for the insurance company's performance and premium calculation. In specific, estimating Incurred but Not Reported (IBNR) claim reserve is a key task for the actuary to put aside the necessary money to meet the company's obligations whenever needed. The purpose of this paper is to investigate the results of estimating reserves using the chain ladder method by employing different ways to calculate the development factor from year-to-year over the years following the occurrence of the accident.

Design/methodology/approach – In this paper, the author uses real data from one of the well-known insurance companies in Egypt to study the accuracy of the estimation of the claim's reserves over the period 2012-2020. The author applies the chain ladder method of for reserves estimation where the method is investigated in detail by applying a number of suggested approaches to calculate the development factor from year-to-year over the years following the occurrence of the accident.

Findings – The results show that there is no significant difference between the reserve estimation using different method of calculating the development factors.

Keywords: Reserve estimation, IBNR, Chain Ladder Method, Cumulative sum, Developing Factor, Reserve Adjustment

Paper type: Research paper

1. Introduction

A claims reserve is defined as the amount of money that is set aside by an insurance company to meet its future obligations towards its policyholders who have filed or are expected to file legitimate claims on their policies. Insurers use the fund to pay out incurred claims that are yet to be paid. Although insurance companies collect premiums from their clients (the insurers) throughout the year, future planning and risk management necessitate the rational practice to estimate the reserves to be ready to meet the filed claims whenever needed. Thus, this is the general practice in the different branches of insurance. Accordingly, the reserve acts as an estimate of the amount of the claims an individual will file. In other words, accurate claim reserves estimation allows the insurance companies to fulfill its obligations towards their insurers.

Claim reserves are estimated based on a multiple of factors: the company's experience with the claims over years, and the amount of losses the company incurred in the past. Furthermore, individual experience of the adjuster helps adjusting the reserve according to the adjuster's experience with the company's claims. By accumulating all the reserves for individual claims, the company can obtain a relatively accurate estimate of what will be paid out for pending claims. Moreover, the company will estimate what it will incur for claims that have not been filed yet. Adding these two types of claims enables the company to assess the amount of money that will be paid during a given period of time.

Incurred but not reported claims (IBNR) (Kremer, 1982) must also be considered. It is important for the company to anticipate the claims that have already transpired but have not yet been reported. Generally, insurance companies maintain three principal types of reserves: premium reserves, loss reserves, and voluntary reserves. Premium reserves are the premiums paid to the insurers for the insurance policy over the life of the policy. An unearned premium reserve appears as a liability on an insurer's balance sheet to reflect

the amount of the premiums that would be returned to policyholders if all policies were canceled on the date the balance sheet was prepared. Loss reserves represent an estimate of the amount an insurer would need to pay for future claims on the insurance policies it underwrites. Lastly, voluntary reserves are the additionally held liquid assets. This study focuses on generally estimating loss reserves for an insurance company.

2. Types of Loss Reserves

The type of the insurance determines the name and definition of loss reserves. For instance, in property and liability insurance, these liabilities are defined as the unearned premium reserves and the loss reserves. As mentioned earlier, this study focuses on loss reserves estimation, which can be classified into four types:

- Losses reported and adjusted but still unpaid
- Losses reported but not adjusted
- Losses incurred but not reported
- Loss adjustment expenses

In this paper, we are using the chain ladder method of estimating loss reserves.

3. Chain Ladder Method of Estimating the Reserve (CLM)

The chain ladder method (CLM) was discussed by Hrneck (1966). Wuthrich (2008) considers the CLM as the most popular reserve estimation method. England & Verrall (2002) state that the method does not require any advanced programming to compute. In its simplest form, the CLM aims to obtain a forecast only for final losses. It thus focuses on the losses in the last observed year and does not include the assessment of possible further loss development (tail factor). For the assessment of final value of losses, the factor of possible further loss development (tail factor) is often used.

Several assumptions underlie the use of the chain ladder method of estimating the reserves. We assume that the loss distribution will continue to behave in the same pattern as its past behavior. We also assume that the estimates of the settlement amounts are accurate if we use all the available data in the estimation process. We additionally assume that the data used in estimation are free of errors. Finally, the insurer does not let his own experience contradicts the estimation. In brief, the CLM is a method for computing the claims reserve requirements in an insurance company's financial statement. It is used by insurers to forecast the amount of reserves that must be available in order to cover estimated future claims by projecting past claims experience into the future. The method can be outlined in 4 steps:

- Compile claims data in a developing triangle.
- Calculate average of age-to age factors.
- Calculate the rest of the empty incurred loss using the development factors.
- Calculate the estimated reserves.

The data used in the following parts was collected in comprehensive motors insurance from one of the insurance companies operating in Egypt over the period 2012 - 2020.

The method can be mathematically described as follows. The first step in applying the CLM is the calculation of the loss development factor, $\hat{f}_j$, using the following equation: $\hat{f}_j=\frac{\sum_{i=1}^{n-j} C_{i,j+1}}{\sum_{i=1}^{n-j} C_{i,j}}$, where $C_{i,j}$ is the cumulative losses that have occurred in the i^{th} period and are settled at the end of the j^{th} period. The cumulative loss $C_{i,j}$ is calculated as $C_{i,j} = \sum_{h=1}^{j} D_{i,h}$,where $D_{i,h}$ is the loss that occurred in i^{th} year and settled in the h^{th}year.

After determining the loss development factors for all development years, the amount of ultimate claims for the i^{th} period of loss occurrence is given by the following equation:

$$\hat{c}_{i,n} = C_{i,j} \times \prod_{j=1}^{n-1} \hat{f}_j$$

where $\hat{c}_{i,n}$ is the estimate of the final cumulative loss in the last n^{th} development year.

The estimate of the total reserve for loss occurred in the n^{th} year is given by:

$$\hat{R}_i = \hat{c}_{i,n} - c_{i,n}$$

Table (1): Incremental Amount of Paid Claims over Subsequent Years after Accident

Year n of Accidents	0	12	24	36	48	60	72	84	96
2012	419,086.40	1,244,987.20	1,905,991.20	2,575,381.60	3,061,640.00	3,619,346.40	3,698,750.40	3,805,096.78	3,835,585.76
2013	635,552.80	1,637,914.40	2,145,082.40	2,980,448.00	3,375,762.40	3,618,708.00	4,110,733.72	4,152,940.21	
2014	633,332.80	2,209,646.40	3,026,578.40	4,254,682.40	4,871,020.80	5,417,110.70	5,718,282.19		
2015	843,512.80	3,004,518.40	4,083,841.60	4,581,164.80	5,055,260.38	5,465,080.44			
2016	988,948.80	3,015,592.00	4,190,951.20	4,331,583.68	4,985,960.18				
2017	1,080,945.52	2,590,992.56	3,242,689.90	3,596,215.88					
2018	1,314,587.52	3,608,041.00	4,777,837.61						
2019	766,166.63	1,782,478.57							
2020	444,044.63								

Source:

Note: Data in Table (1) is shown in incremental payment. Each raw represents the year the accident occurred, while each column represents the information, we got in subsequent years following the year of accidents. The patterned of the triangle is going to be the incurred loss to gross IBRN ultimate loss. Each diagonal element represents the same moment in time.

We then calculate the rest of the empty incurred loss using the development factor. Finally, we calculate the reserve for any future year = Total claims - Element claims.

Table (2): Calculation of Cumulative Losses

Cumulative	0	12	24	36	48	60	72	84	96
2012	419,086.40	1,244,987.20	1,905,991.20	2,575,381.60	3,061,640.00	3,619,346.40	3,698,750.40	3,805,096.78	3,835,585.76
2013	635,552.80	1,637,914.40	2,145,082.40	2,980,448.00	3,375,762.40	3,618,708.00	4,110,733.72	4,152,940.21	
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2015	843,512.80	3,004,518.40	4,083,841.60	4,581,164.80	5,055,260.38	5,465,080.44			
2016	988,948.80	3,015,592.00	4,190,951.20	4,331,583.68	4,985,960.18				
2017	1,080,945.52	2,590,992.56	3,242,689.90	3,596,215.88					
2018	1,314,587.52	3,608,041.00	4,777,837.61						
2019	766,166.63	1,782,478.57							
2020	444,044.63								

Source: Author's calculations

As shown in Table (3), we calculate the development factors, to select the best way from the insurance company standpoint. We calculate the developing factors for each year by dividing the incremental payments of the subsequent payments periods as a ratio of the following year payments and the preceding payments as shown in Table (3).

Table (3): Development Factors based on the Ratio of Incremental Payments

year	0	1	2	3	4	5	6	7
2012	2.971	1.531	1.351	1.189	1.189	1.182	1.022	1.008
2013	2.577	1.310	1.389	1.133	1.133	1.072	1.136	
2014	3.489	1.370	1.406	1.145	1.145	1.112		
2015	3.562	1.359	1.122	1.103	1.103			
2016	3.049	1.390	1.034	1.151				
2017	2.397	1.252	1.109					
2018	2.745	1.324						
2019	2.326							

Source: Author's calculations

We then employ several ways of calculating the development factors to decide the best from the company's view. Table (4) gives the development factors based on the median, mean, the worst selection from the company's view over years for 12 months, 24 months, 36, months, …etc., and the sum ratio. The ratio of the cumulative sum is give based on the formula $\hat{f}_j=\frac{\sum_{i=1}^{n-j} C_{i,j+1}}{\sum_{i=1}^{n-j} C_{i,j}}$.

Table (4): Different Methods of Calculating the Development Factors

Method Used to Calculate the Development Factor	1	2	3	4	5	6	7	8	9
Based on Median	2.858	1.359	1.236	1.145	1.139	1.112	1.079	1.008	1.000
Based on the Average	2.890	1.362	1.235	1.144	1.142	1.122	1.079	1.008	1.000
Based on Worst Selection	3.562	1.531	1.406	1.189	1.189	1.182	1.136	1.008	1.000
Based on the Sum Ratio	2.857	1.350	1.200	1.140	1.111	0.744	0.588	1.008	1.000

Source: Author's calculations

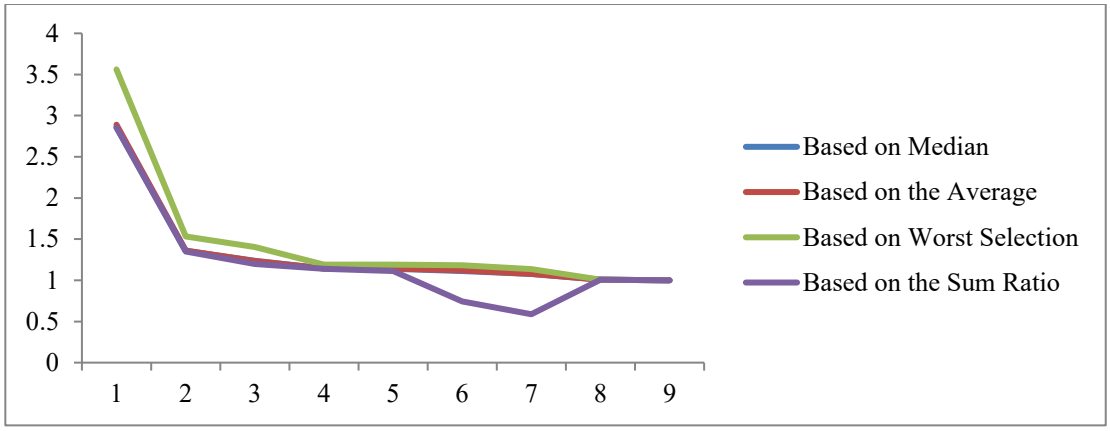

Figure (1): Different Methods of Calculating Development Factors
Source: Author's calculations

To be able to present the company with the best development factor from its standpoint, the development factors obtained from the different methods are compared. The Analysis of Variance statistical technique is used to test if there are significant differences between different methods of calculating the developing factor.

Table (4): Analysis of Variance

Sources of Variations	Degrees of Freedom	Sum of Squares	Mean Squares	F-values	P-value
Between Factors	3	0.2725	0.09082	0.21	0.892
Within Factors	32	14.1762	0.44301		
Total	35	14.4486			

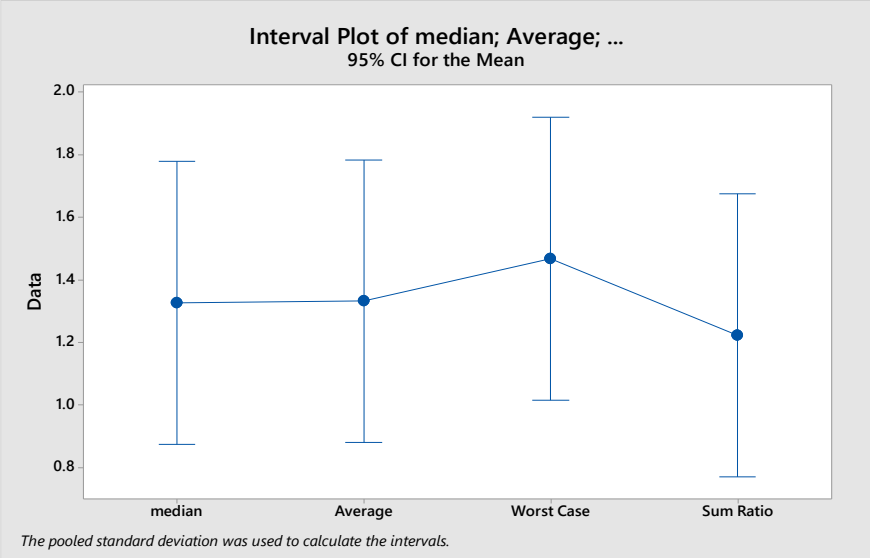

Figure (2): Interval Plot for Methods of Calculating Development Factors

The Analysis of Variance test shows that there are no significant differences between different methods of calculating the development factors at 5% significance level. In the following section, we use the development factors resulting from the different methods to estimate the reserves.

4. Estimating the reserves under the Development Factors from the different methods

4.1. The Development Factor based on the Median

Table (5): Estimating Claims Loss under the Median Development Factor

Year of Accident	Subsequent Years								
	0	12	24	36	48	60	72	84	96
2012	419,086.40	825,900.80	661,004.00	669,390.40	486,258.40	557,706.40	79,404.00	106,346.38	30,488.98
2013	635,552.80	1,002,361.60	507,168.00	835,365.60	395,314.40	242,945.60	492,025.72	42,206.49	42206.49
2014	633,332.80	1,576,313.60	816,932.00	1,228,104.00	616,338.40	546,089.90	301,171.49	342,120.94	388,638.18
2015	843,512.80	2,161,005.60	1,079,323.20	497,323.20	474,095.58	409,820.06	484,472.62	572,723.85	677,050.86
2016	988,948.80	2,026,643.20	1,175,359.20	140,632.48	654,376.50	777,929.48	924,810.53	1,099,424.22	1,307,006.76
2017	1,080,945.52	1,510,047.04	651,697.34	353,525.98	420,275.30	499,627.58	593,962.38	706,108.56	839,429.08
2018	1,314,587.52	2,293,453.48	1,169,796.61	1,644,468.57	2,311,749.62	3,249,795.36	4,568,474.79	6,422,238.81	9,028,210.35
2019	766,166.63	1,016,311.94	1,555,904.84	2,381,985.08	3,646,658.06	5,582,786.85	8,546,869.09	13,084,678.51	20,031,757.84
2020	444,044.63	1,581,647.91	2,421,395.98	8,624,799.52	30,720,777.26	109,424,706.47	389,761,179.67	1,388,295,039.40	4,944,984,818.86
Developing Factor = Median	2.858	1.359	1.236	1.145	1.139	1.112	1.079	1.008	1

Source: Author's calculations

The Development Factor based on the Average

Table (6): Estimating Reserves under the Average Development Factor

Years of Accidents	Subsequent Years								
	0	12	24	36	48	60	72	84	96
2012	419,086.40	825,900.80	661,004.00	669,390.40	486,258.40	557,706.40	79,404.00	106,346.38	30,488.98
2013	635,552.80	1,002,361.60	507,168.00	835,365.60	395,314.40	242,945.60	492,025.72	42,206.49	42,544.68
2014	633,332.80	1,576,313.60	816,932.00	1,228,104.00	616,338.40	546,089.90	301,171.49	324,949.88	350,605.65
2015	843,512.80	2,161,005.60	1,079,323.20	497,323.20	474,095.58	474,095.58	531,972.68	596,915.37	669,786.19
2016	988,948.80	2,026,643.20	1,175,359.20	140,632.48	654,376.50	747,591.67	854,085.23	975,748.67	1,114,742.93
2017	1,080,945.52	1,510,047.04	651,697.34	353,525.98	404,494.97	462,812.33	529,537.49	605,882.64	693,234.71
2018	1,314,587.52	2,293,453.48	1,169,796.61	1,444,848.19	1,784,572.02	2,204,174.33	2,722,436.77	3,362,557.05	4,153,187.35
2019	766,166.63	1,016,311.94	1,384,365.55	1,885,708.42	2,568,610.75	3,498,823.64	4,765,909.68	6,491,866.25	8,842,871.62
2020	444,044.63	1,283,070.49	3,707,442.37	10,712,684.20	30,954,386.13	89,442,944.75	258,446,099.72	746,782,059.21	2,157,832,695.33
Developing Factor= average	2.890	1.362	1.235	1.144	1.142	1.122	1.079	1.008	1.000

Source: Author's calculations

4.2. The Development Factor based on the Worst Selection

Table (7): Estimating Claims Loss Under Worst Selection Development Factor

Year of Accidents	0	12	24	36	48	64	72	84	96
2012	419,086.40	825,900.80	661,004.00	669,390.40	486,258.40	557,706.40	79,404.00	106,346.38	30,488.98
2013	635,552.80	1,002,361.60	507,168.00	835,365.60	395,314.40	242,945.60	492,025.72	42,206.49	42206.49
2014	633,332.80	1,576,313.60	816,932.00	1,228,104.00	616,338.40	546,089.90	301,171.49	342,120.94	388,638.18
2015	843,512.80	2,161,005.60	1,079,323.20	497,323.20	474,095.58	409,820.06	484,472.62	572,723.85	677,050.86
2016	988,948.80	2,026,643.20	1,175,359.20	140,632.48	654,376.50	777,929.48	924,810.53	1,099,424.22	1,307,006.76
2017	1,080,945.52	1,510,047.04	651,697.34	353,525.98	420,275.30	499,627.58	593,962.38	706,108.56	839,429.08
2018	1,314,587.52	2,293,453.48	1,169,796.61	1,644,468.57	2,311,749.62	3,249,795.36	4,568,474.79	6,422,238.81	9,028,210.35
2019	766,166.63	1,016,311.94	1,555,904.84	2,381,985.08	3,646,658.06	5,582,786.85	8,546,869.09	13,084,678.51	20,031,757.84
2020	444,044.63	1,581,647.91	5,633,690.75	20,066,710.94	71,475,859.34	254,590,724.10	906,829,765.99	3,230,047,863.64	11,505,146,382.10
Worst Selection Development Factor	3.562	1.531	1.406	1.189	1.189	1.182	1.136	1.008	1

Source: Author's calculations

4.3. The Development Factor based on the Sum Ratio

In this case, the reserve estimation is based on a development factor calculated by the formula $\hat{f}_j = \frac{\sum_{i=1}^{n-j} C_{i,j+1}}{\sum_{i=1}^{n-j} C_{i,j}}$.

Table (8): Estimating Reserves under the Sums Ratio Development Factor

Year of Accident		Subsequent Years							
	0	12	24	36	48	60	72	84	96
2012	419,086.40	1,244,987.20	1,905,991.20	2,575,381.60	3,061,640.00	3,619,346.40	3,698,750.40	3,805,096.78	3,835,585.76
2013	635,552.80	1,637,914.40	2,145,082.40	2,980,448.00	3,375,762.40	3,618,708.00	4,110,733.72	4,152,940.21	4152940.21
2014	633,332.80	2,209,646.40	3,026,578.40	4,254,687182.40	4,871,020.80	5,417,110.70	5,718,282.19	5764100.891	5764100.891
2015	843,512.80	3,004,518.40	4,083,841.60	4,581,164.80	5,055,260.38	5,529,355.96	3252777.898	3278841.33	3278841.33
2016	988,948.80	3,015,592.00	4,190,951.20	4,331,583.68	4,985,960.18	5540763.328	3259488.559	3285605.761	3285605.761
2017	1,080,945.52	2,590,992.56	3,242,689.90	3,596,215.88	4855345.993	5395615.298	3174101.706	3199534.732	3199534.732
2018	1,314,587.52	3,608,041.00	4,777,837.61	5734770.697	8026358.845	8919476.518	5247098.629	5289141.893	5289141.893
2019	766,166.63	1,782,478.57	2406571.371	2888573.473	4042834.225	4492692.843	2642935.649	2664112.617	2664112.617
2020	444,044.63	1,268,855.85	1,713,115.78	2056228.563	2877888.095	3198119.568	1881371.487	1896446.294	1896446.294
Developing Factor= Sum Ratio	2.857	1.350	1.200	1.140	1.111	0.744	0.588	1.008012669	1

Source: Author's calculations

Lastly, we will use the development factor based on the average to calculate the estimate of the total reserve for the loss occurred in the year n, which is given by: $\hat{R}_i=\hat{c}_{i,n} - c_{i,n}$

Table (9): Estimated Total Reserves for 2012-2020

Year of Accident	Total Reserve for loss occurred at Year n
2012	30,488.98
2013	33,276.13
2014	500,911.77
2015	1,218,510.72
2016	1,965,523.52
2017	2,140,538.43
2018	4,635,935.82
2019	3,001,403.11
2020	3,000,093.63

Source: Author's calculations

As a closing remark to this section, it is to be highlighted that the CLM uses the latest information about paid or reported losses for the period. It also produces accurate estimates when the loss ratio is changing. The findings of the study are summarized in the next concluding section.

5. Conclusion

In this paper, four methods of calculating the development factors have been used in estimating the reserves (Qaiser, 2000 and Taylor 2000), in the years following the year of accident occurrence. These methods are the average method, the median method, the worst selection method, and the sum ration method. Using real data to establish the chain ladder method, the development factors from these methods have been used to estimate the loss reserves. The CLM under certain assumptions can provide an adequate assessment of loss reserves.

Analysis of variance statistical technique is used to test if there are significant difference between estimated reserves under these four methods. The analysis revealed that no significant difference between different methods was found. Therefore, we recommend any method of calculating the developing factor can be used. However, we recommend using the average method as it is simple and easy to perform. These four deterministic methods are based on the assumption that the pattern of losses in the past will continue in the future.
In order to ensure the adequacy of the loss reserves, the above methods should be applied cautiously, and they should be combined with the subjective assessments of actuaries, based on their expertise and experience. In the process of estimating loss reserves, actuary should provide an adjustment of the reserving methodology to the characteristics of the insurers business and external changes, which have a decisive influence on the size and frequency of claims, which is in turn important for identifying the most appropriate method. The contribution of the paper is to show that the estimate of the claim reserves cannot be easily established, and application of these methods contains elements of unreliability. A possible area for future research is to focus on the application of stochastic models for estimating claim reserves that eliminate certain shortcomings of these classical methods.

6. References

1. England, P. &Verrall. R., (2002). " Stochastic Claims reserving in general insurance." British Actuarial Journal 8(3), 443. 518.
2. Kremer, E., (1982). "IBRN-Claims and the two-way model for ANOVA." Scandinavian Actuarial Journal , Volume 1, 47-55.
3. Qaiser, R., (2000). "Reserving in general insurance business in India and its implication." National Insurance Academy , 4.
4. Taylor , G. C. (2000). "Loss reserving : An actuarial perspective." Boston –Dordrecht –London :Kluwer Academic Publisher.

5. Wuithrich , M. V. (2008). "Modeling the claims developing results for solvency purposes." Casualty Actuarial Society E-Forum542-568.
6. Wuithrich , M. V, and Merz, M., (2008). "Stochastic claims reserving methods in insurance", version 1.1 John Wiley& Sons.
7. Hindley, D., 2017. Claims Reserving in General Insurance Cambridge University press.
8. Wuthrich, M.V.and Merz, M., 2008. Stochastic claims reserving methods in insurance (Vol.435).John Wiley& Sons.
9. HUrlimann, W.,2015. Old and newton some IBNR methods. International journal of advanced research, 3 (3), pp.384-402.
10. Friedland,J.,2010, July. Estimating unpaid claims using basic techniques. In Casualty Actuarial Society(Vol.201,no.0)
11. Edlicka,P.,2007. Various extension based on Munich Chain Ladder method.In Astin Colloquium, Orlando, Florida
12. Venter,G.G.,2008 Distribution and value of reserves Using paid and incurred triangles. In CAS reserves call papers, causality Actuarial society E-Forum, Fall.
13. Posthuma,B., Cator, E.A., Veer kamp, W.and Van Zwet, E.W., 2008 Combined analysis of paid and incurred losses. In Cas E-Forum Fall(vol.2008,pp.272-293).
14. Merz, M.and Wuthrich, M.V., 2010. Paid-incurred chain claims reserving methods. Insurance: Mathematics and Economics, 46(3), pp.568-579.

تقدير مخصصات المطالبات في قطاع التأمين بالتطبيق على السوق المصري

د. محمد أحمد معيط

الهدف: يلعب مخصص المطالبات دوراً هاماً في قطاع التأمين. تساعد المخصصات الفنية شركات التأمين من مقابلة التزاماتها تجاه حملة الوثائق عند وقوع الحوادث. المخصصات الفنية تعتبر بند في الميزانية لشركة التأمين وتعتبر أيضاً ضرورية كمؤشر تطبيقي هام لتقييم أداء شركات التأمين وحساب القسط. ويعتبر تقدير مخصصات المطالبات التي حدثت ولم يتم الإبلاغ عنها (IBNR)من أهم مهام الخبير الاكتواري لتخصيص جزء من رأس مال شركات التأمين لمقابلة التزاماتها المستقبلية.

إن الهدف من هذا البحث هو تقييم نتائج تقديرات المخصصات الفنية باستخدام طريقة التسلسل السلمي بتطبيق طرق مختلفة لتقدير معدل التطور السلمي لسنوات وقوع الحوادث.

منهجية البحث: لتحقيق هدف الدراسة، استخدم الباحث بيانات فعلية لإحدى شركات التأمين في السوق المصري لتقدير كفاءة مخصصات المطالبات من الفترة ٢٠١٢ وحتى ٢٠٢٠. قام الباحث بتطبيق نموذج التسلسل السلمي لتقدير مخصصات المطالبات بتطبيق طرق مختلفة مقترحة لتقدير معدل التطور السلمي لسنوات وقوع الحوادث.

النتائج: نتائج هذا البحث أوضحت ألا يوجد دلالة على الاختلاف بين تقدير المخصصات باستخدام الطرق المختلفة لتقدير معدل التطور.

الكلمات المفتاحية: تقدير المخصصات الفنية، مخصصات المطالبات التي حدثت ولم يتم الإبلاغ عنها، طريقة التسلسل السلمي، المجموع التراكمي، معدل التطور السلمي.