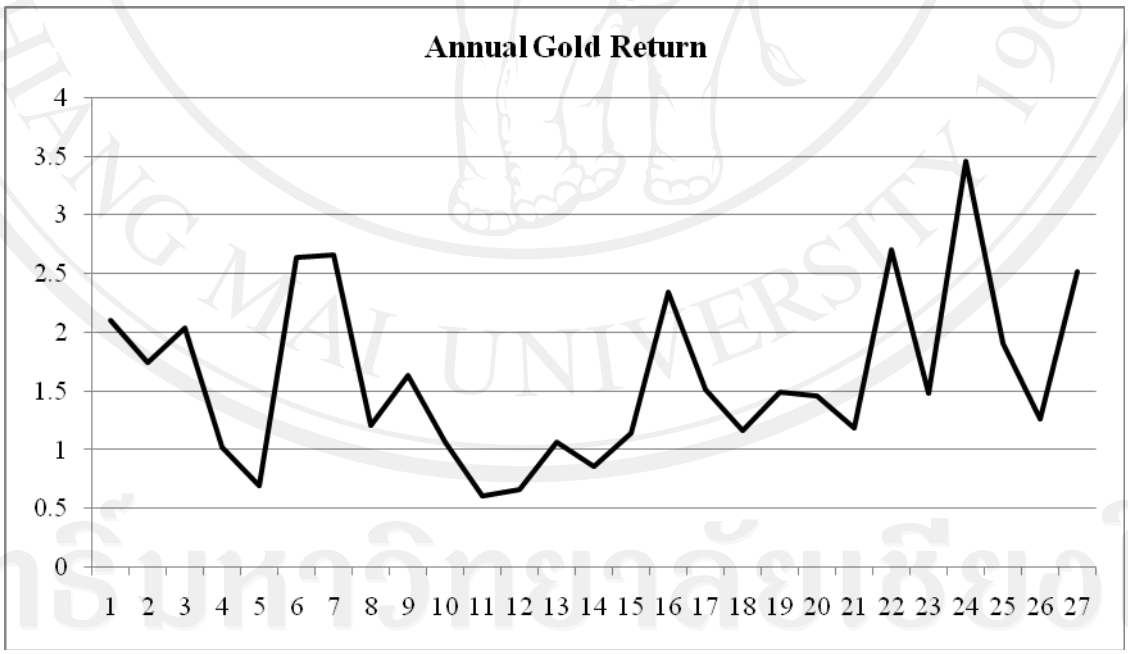
Chapter 4

Empirical Results

4.1 The empirical result of Generalized Extreme values (GEV)

In this study, the block maxima method shows that data has divided into 27 years from 1985 to 2011. Figure 4.1 shows a negative return of gold which maximum loss return is nearly to 3.5% around the year of 2008 and minimum loss return is nearly to 0.5% around the year of 1996. As shown in Table 4.1, it was found that observation of data is 27 which is a block maximum of 27 years. Mean of the data is 1.6186 and standard deviation is 0.7313. Minimum and Maximum of data are 0.6085 and 3.4621. Median of data is 1.4876. Also, the first quartile and the third quartile are 1.1088 and 2.0732, respectively.



Source: Computed Result

Figure 4.1 Annual Gold loss Return (%percentage)

Table 4.1 Descriptive Statistics of Daily Gold Percentage Returns

Total N	27
Mean	1.6186
Std. Dev.	0.7313
Min	0.6085
Q1	1.1088
Median	1.4876
Q3	2.0732
Max	3.4621

Source: Computed Result

The block maxima of negative returns have been fitted to GEV model with yearly block sizes. The results, listed in Table 4.2, show the estimates of three parameters μ, σ and ξ, and the estimates of standard error of the parameters are listed in parentheses. Maximization of the GEV log-likelihood for the data leads to the estimate: (μ, σ, ξ) = (1.2728, 0.5488, and 0.0473). Taking square roots, the standard errors are 0.1250, 0.0954 and 0.1946 for μ, σ and ξ respectively.

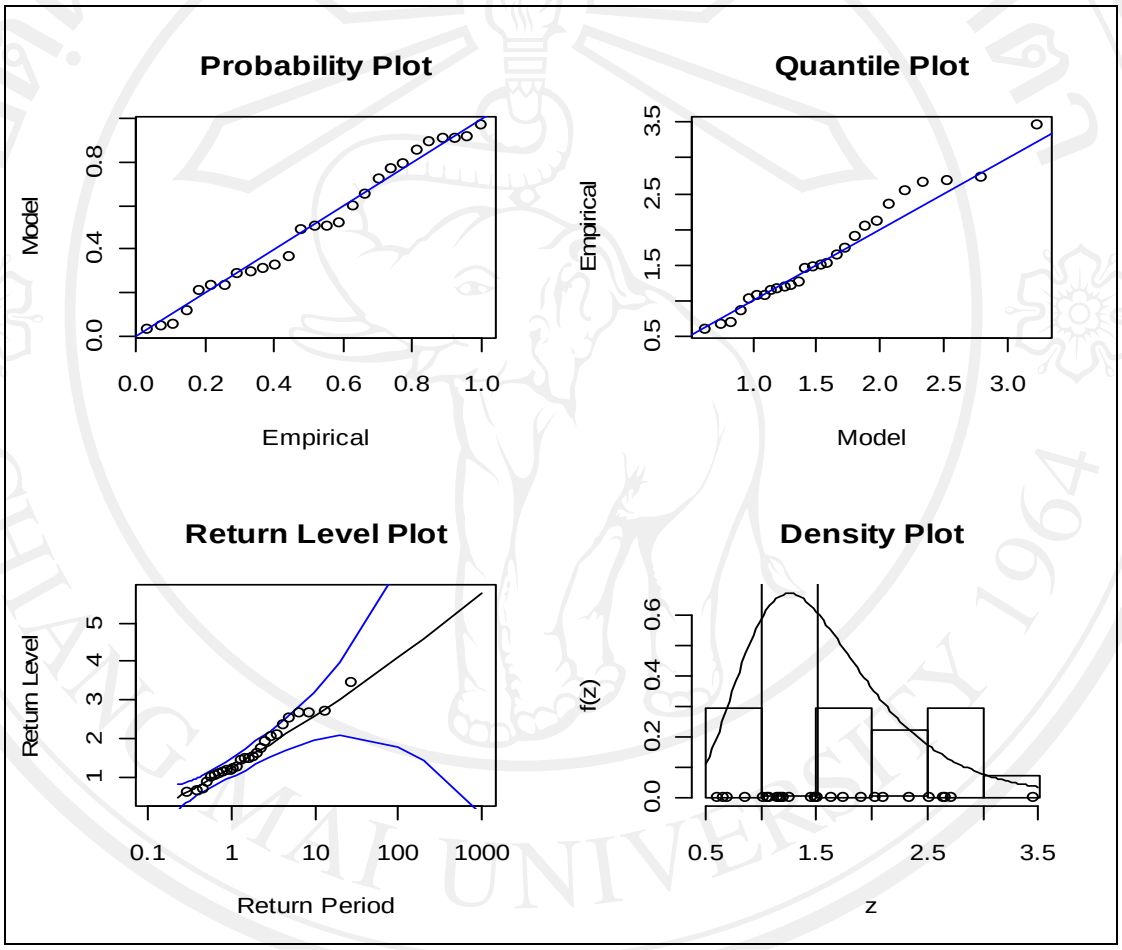
Table 4.2 Parametric Maximum Likelihood Estimates with Yearly Block Frames

	μ	σ	ξ
Year	1.2728	0.5488	0.0473
	(0.1250)	(0.0954)	(0.1946)

Source: Computed Result

The variance diagnostic plots for assessing the accuracy of the GEV model covers pending to the Gold Price Return are shown in Fig. 4.2. The probability plot corresponds to the model as near-linear but the quintiles plot corresponds to the model as near-linear only in the beginning while then diverge outward in the end. This means

that the distribution of model is not reliable in the long term. The return level curve asymptotes to a finite level as a consequence of the positive estimate of ξ, though since the estimate is close to zero. The estimated curve is closed to linear. The density estimate seems consistent with the histogram of the data with short tailed in the left and the long tailed in the right.



Source: Computed Result

Figure 4.2 Diagnostic Plots for GEV Compared to the Gold Price Return

Table 4.3 presents the gold price return in US dollar based on Generalized Extreme Value Analysis in during the period between 1985 and 2011 in order to forecast the gold price return for the next twenty years (2012 to 2032). For the United State of America the extreme value of gold price return will be increased as of 2012 to 2032. In 2017, the extreme values of gold price return will be 2.1261% (1.6725%, 3.1102%) at the significant level of 99%. In 2022 the extreme values of gold price

return will be 2.5763% (2.0142%, 4.7597%) at the significant level of 99%. In 2032 the extreme values of gold price return will be 3.0234% (2.3103%, 7.3933%) at the significant level of 99 %.

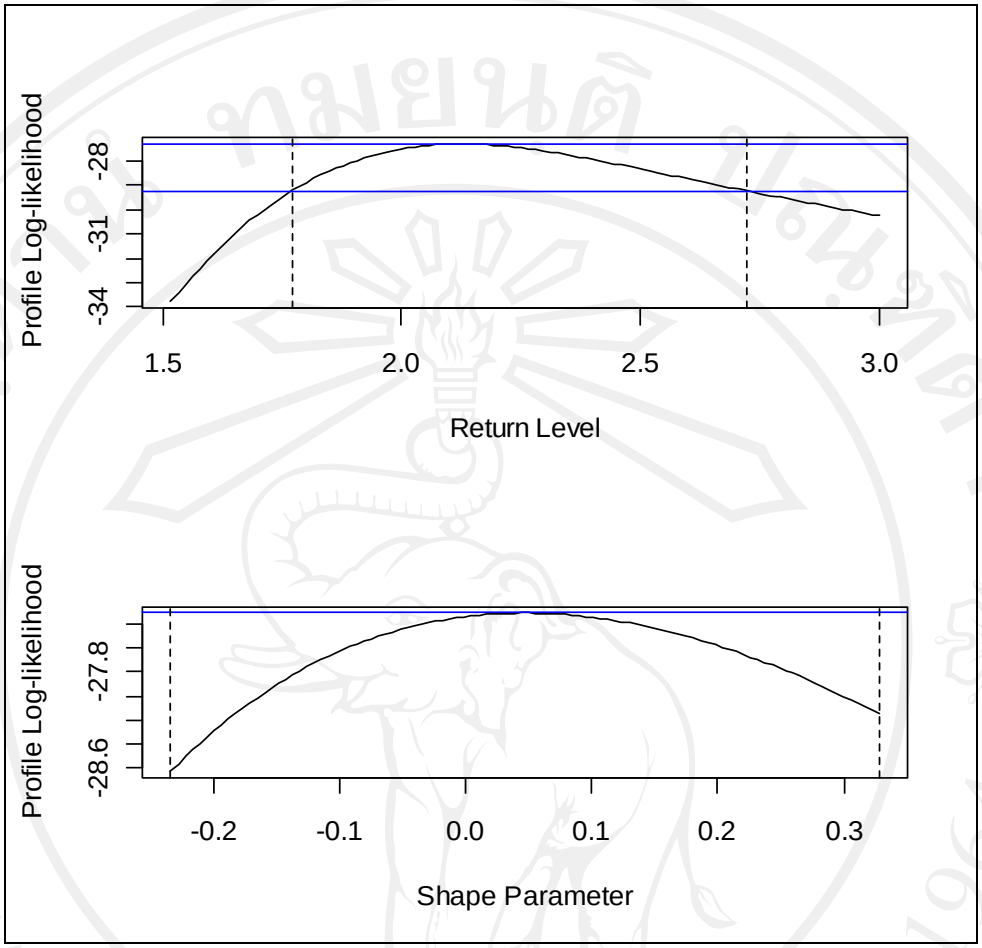
As mentioned that the log-likelihood estimates are $\mu = 1.2728$, $\sigma = 0.5488$ and $\xi = 0.04736$, therefore, for the next 20 years, Value at Risk from GEV estimates gives the result as 3.0234%. This implies that, the extreme loss in every year will exceed to 3.0234% with 1% risk. It means that if we invest $1 US million in gold return, we are 99% confident that our daily loss at worst will not exceed $30,234 US. In other word, we are 1% confident that our loss return will exceed 3.0234% or $30,234 US if we have an investment of $1 US million in that market.

Table 4.3 The Summary Results of Gold Price Return in the Next 20 Year (2012-2032) Based on Generalize Extreme Value Analysis

Item	5-year	10-year	20-year
Value at Risk of Gold Price Return	2.1261	2.5763	3.0234
95%	(1.7708,2.7218)	(2.1264,3.7858)	(2.4348,5.286)
99%	(1.6725,3.1102)	(2.0142,4.7597)	(2.3103,7.3933)

Source: Computed Result

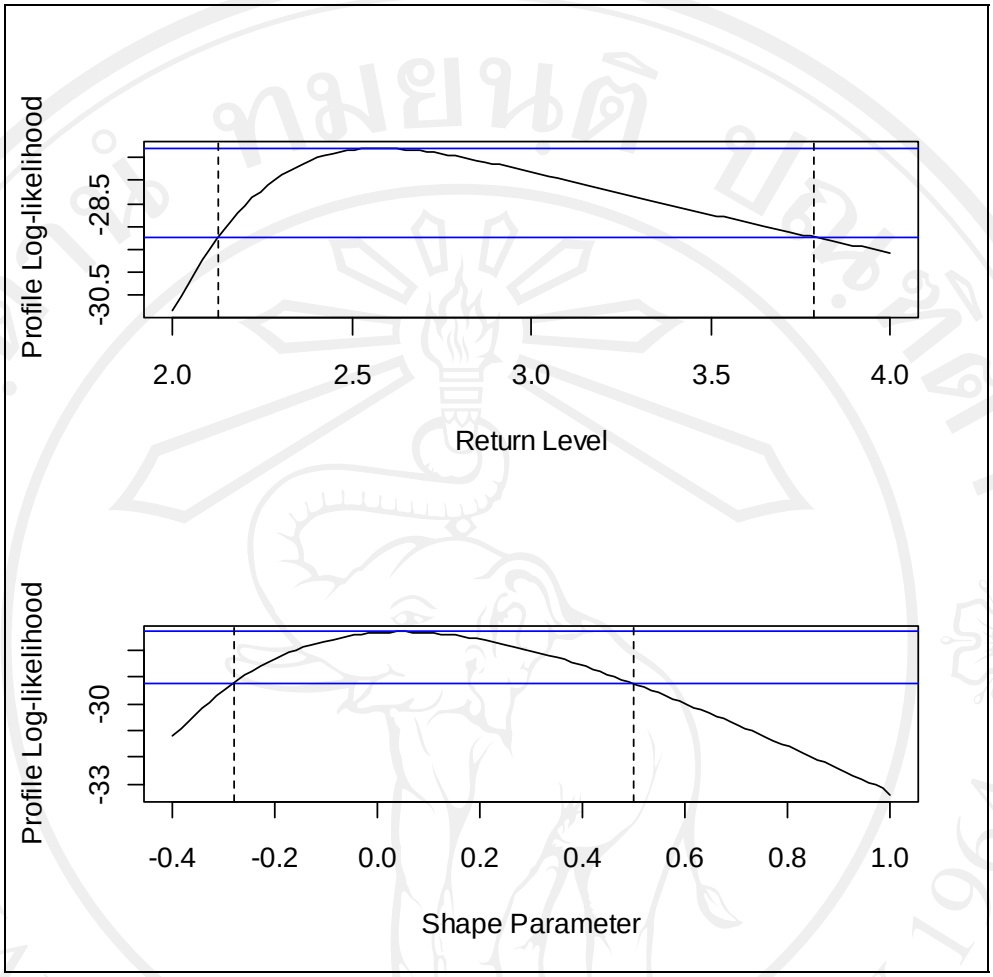
The profile log-likelihood for GEV 5-year return level and shape parameter with 95% confident interval shows as figure 4.3. The estimated return level equals to 2.1261 and estimated (MLE) shape parameter is 0.0474. Moreover, a 5-year return level at 95% confidence interval approximately is between 1.7708, 2.7218. A shape parameter at 95% confidence interval approximately is between -0.23336, 0.32809.



Source: Computed Result

Figure 4.3 Profile Log-Likelihood for GEV 5-year Return Level and Shape Parameter at 95% Confident Interval

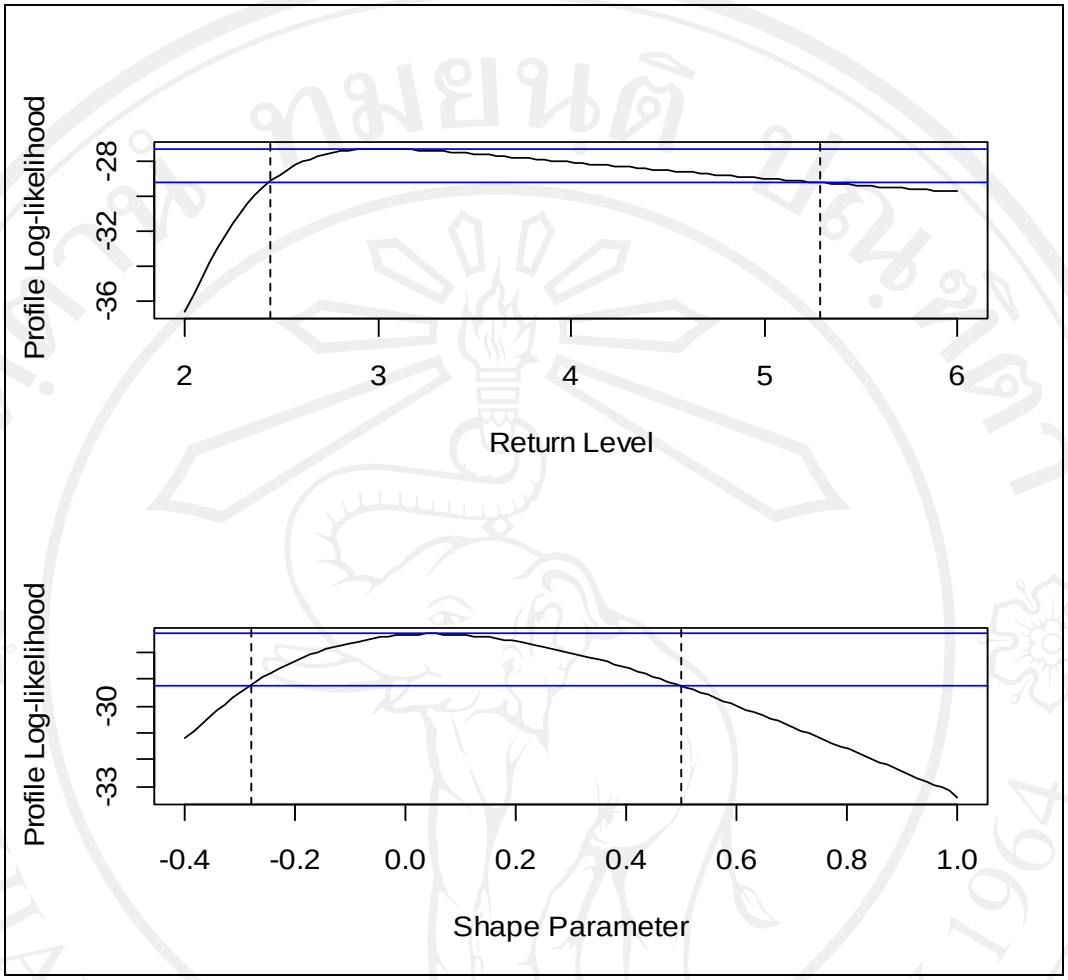
The profile log-likelihood for GEV 10-year return level and shape parameter with 95% confident interval shows as figure 4.4. The estimated return level equals to 2.5743 and estimated (MLE) shape parameter is 0.00474. Moreover, a 10-year return level at 95% confidence interval approximately is between 2.1264, 3.7858. A shape parameter at 95% confidence interval approximately is between -0.28234 and 0.4989.



Source: Computed Result

Figure 4.4 Profile Log-Likelihood for GEV 10-year Return Level and Shape Parameter at 95% Confident Interval

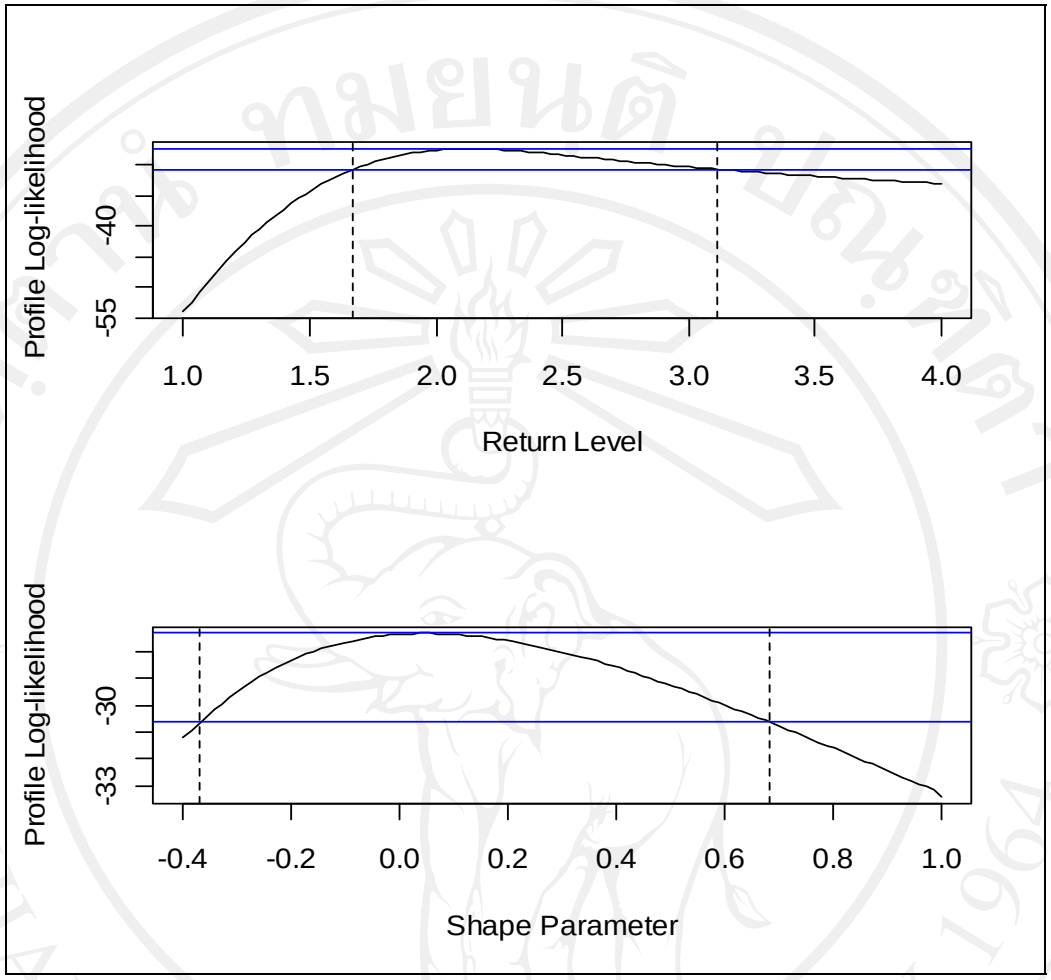
The profile log-likelihood for GEV 20-year return level and shape parameter with 95% confident interval shows as figure 4.5. The estimated return level equals to 3.0234 and estimated (MLE) shape parameter is 0.0474. Moreover, a 20-year return level at 95% confidence interval approximately is between 2.4348 and 5.286. A shape parameter at 95% confidence interval approximately is between -0.2823 and 0.4989.



Source: Computed Result

Figure 4.5 Profile Log-Likelihood for GEV 20-year Return Level and Shape Parameter at 95% Confident Interval

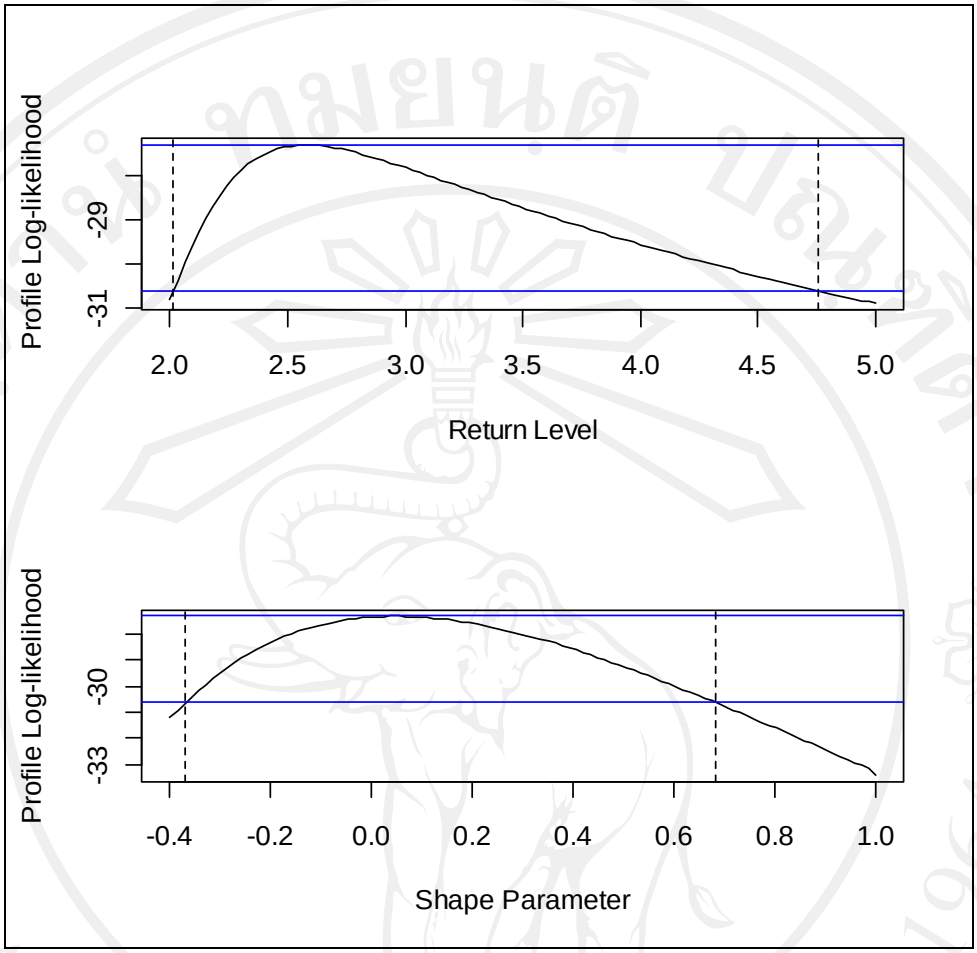
The profile log-likelihood for GEV 5-year return level and shape parameter with 99% confident interval shows as figure 4.6. The estimated return level equals to 2.1261 and estimated (MLE) shape parameter is 0.0474. Moreover, a 5-year return level at 99% confidence interval approximately is between 1.6725 and 3.1102. A shape parameter at 99% confidence interval approximately is between -0.36901 and 0.6825.



Source: Computed Result

Figure 4.6 Profile Log-Likelihood for GEV 5-year Return Level and Shape Parameter at 99% Confident Interval

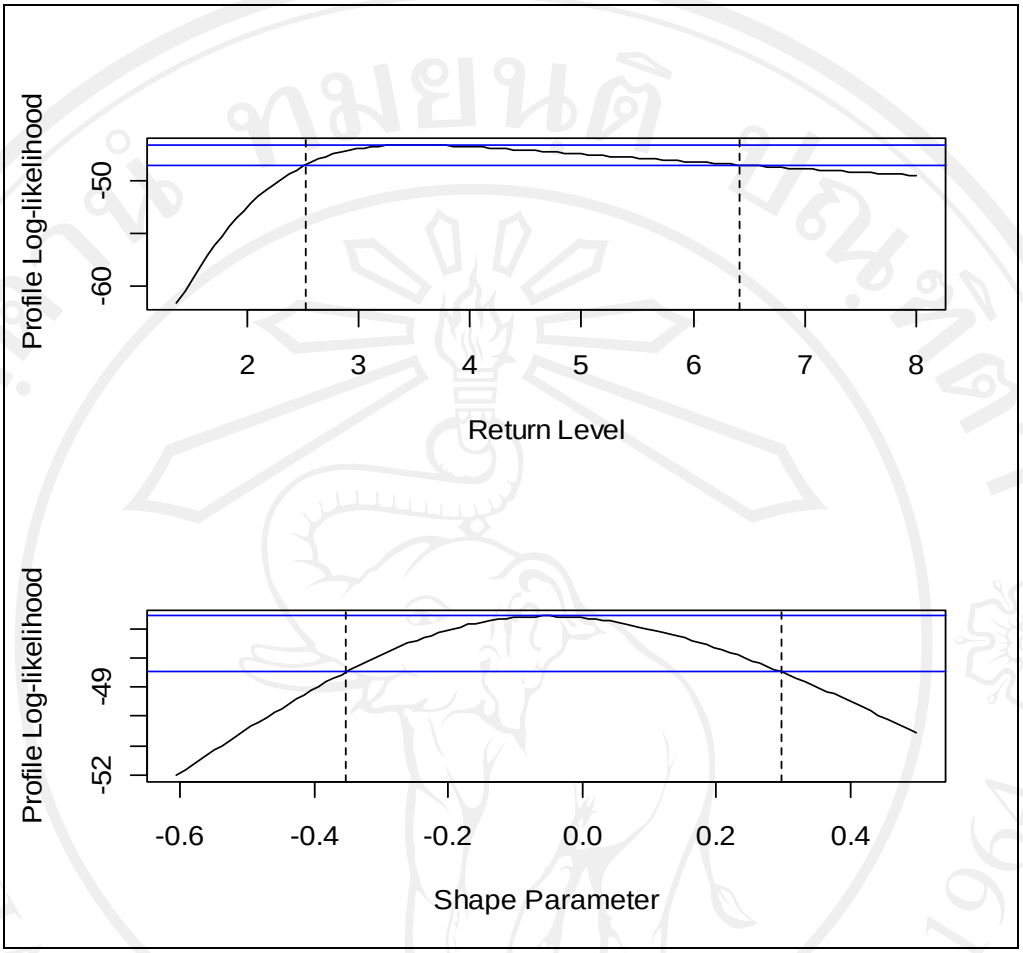
The profile log-likelihood for GEV 10-year return level and shape parameter with 99% confident interval shows as figure 4.7. The estimated return level equals to 2.5763 and estimated (MLE) shape parameter is 0.0474. Moreover, a 10-year return level at 99% confidence interval approximately is between 2.0142 and 4.7597. A shape parameter at 99% confidence interval approximately is between -0.3690 and 0.6825.



Source: Computed Result

Figure 4.7 Profile Log-Likelihood for GEV 10-year Return Level and Shape Parameter at 99% Confident Interval

The profile log-likelihood for GEV 20-year return level and shape parameter with 99% confident interval shows as figure 4.8. The estimated return level equals to 3.0234 and estimated (MLE) shape parameter is 0.0474. Moreover, a 20-year return level at 99% confidence interval approximately is between 2.3103 and 7.3933. A shape parameter at 99% confidence interval approximately is between -0.36901 and 0.6825.

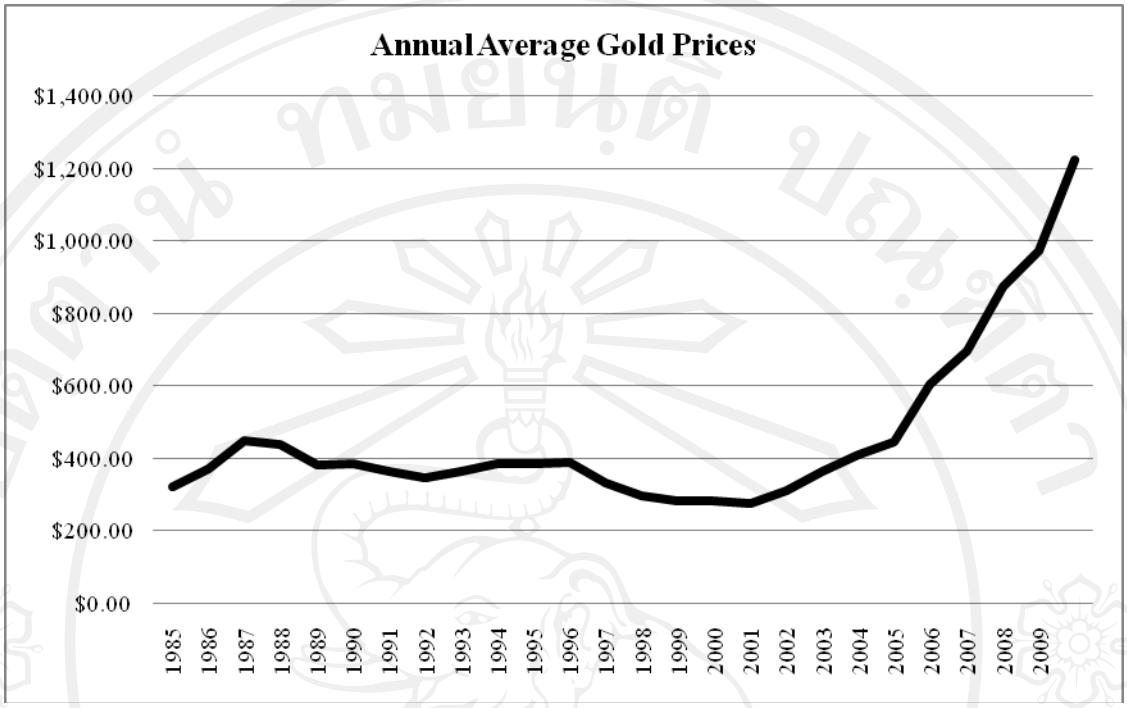


Source: Computed Result

Figure 4.8 Profile Log-Likelihood for GEV 20-year Return Level and Shape Parameter at 99% Confident Interval

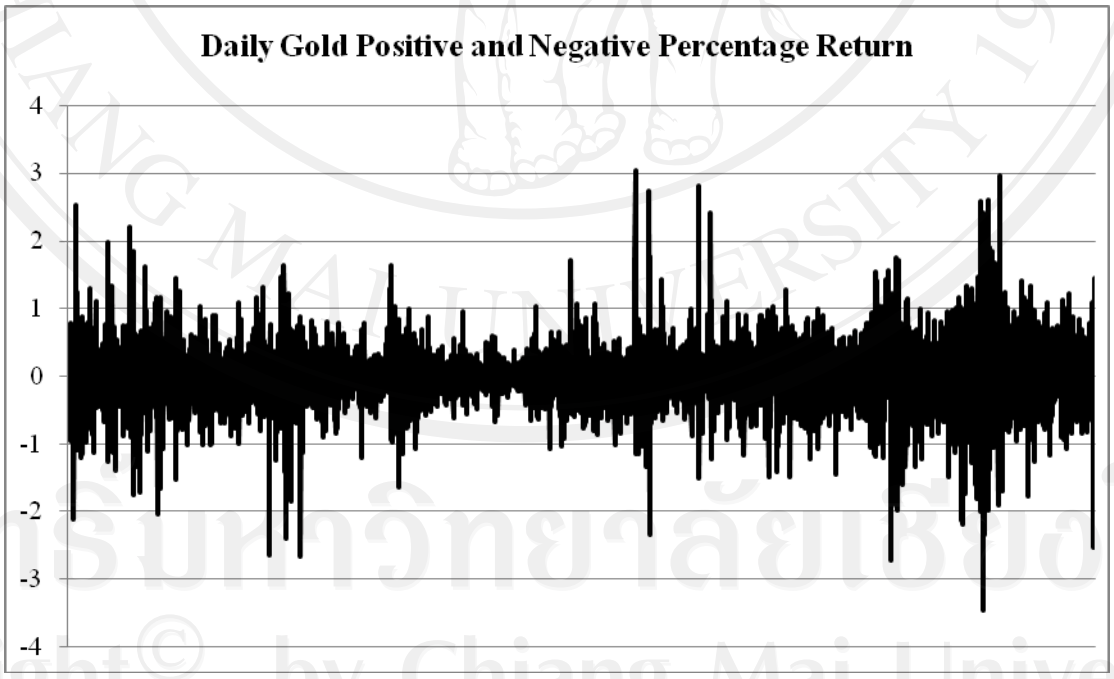
4.2 The empirical result of Generalized Pareto Distribution (GPD)

For Peak over Threshold method, the data regarding gold price data is gathered from January 1, 1985 to August 31, 2011. The study sample includes 3,181 observations of daily gold prices. The recorded gold price data is then transformed in terms of gold price return as figure 4.9 and figure 4.10. In figure 4.11 shows only a daily gold negative percentage return during 1985 to 2011.



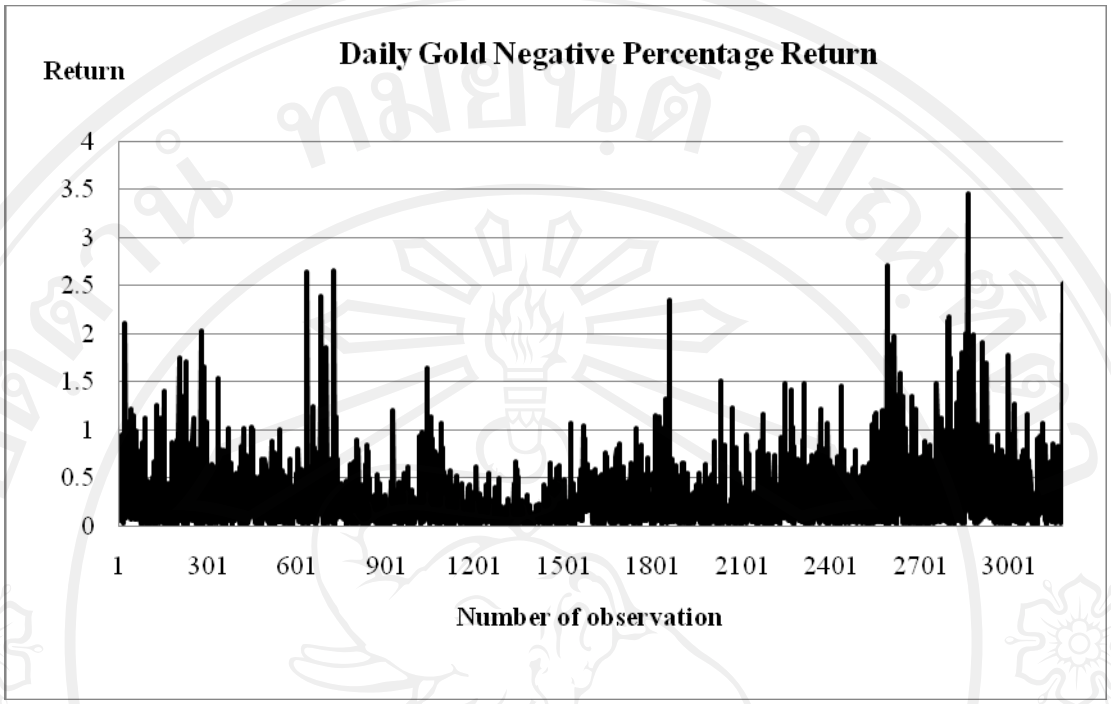
Source: World gold Council

Figure 4.9 Annual Average Gold Price from 1985 to 2011



Source: Computed Result

Figure 4.10 Daily Gold Positive and Negative Percentage Return from 1985 to 2011



Source: Computed Result

Figure 4.11 Daily Gold Negative Percentage Return

Table 4.4 Descriptive Statistics of Daily Gold Percentage Returns

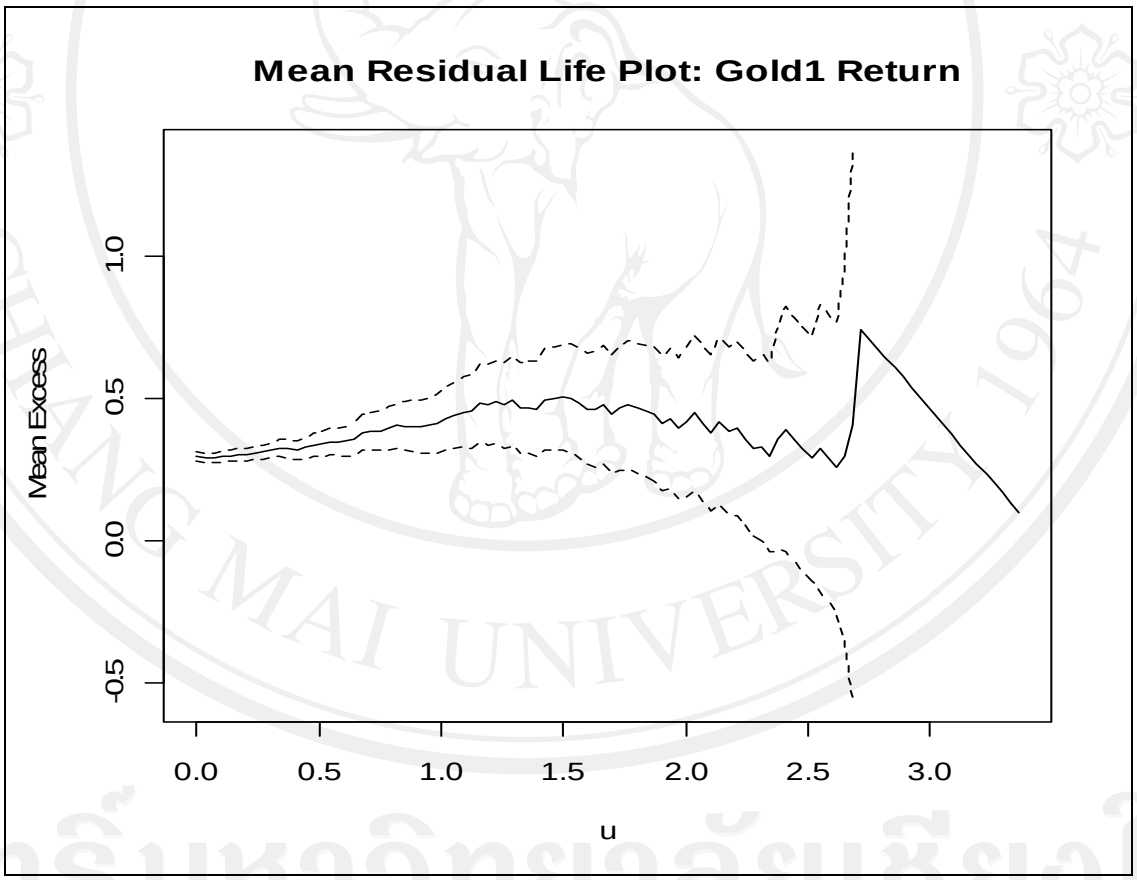
Total N	3181
Mean	0.2962
Std. Dev.	0.3212
Min	0.0000
Q1	0.0866
Median	0.1994
Q3	0.3992
Max	3.4621

Source: Computed Result

As shown in Table 4.4, it was found that observation of data is 3,181. Mean of the data is 0.2962 and standard deviation is 0.3212. Minimum and Maximum of data are

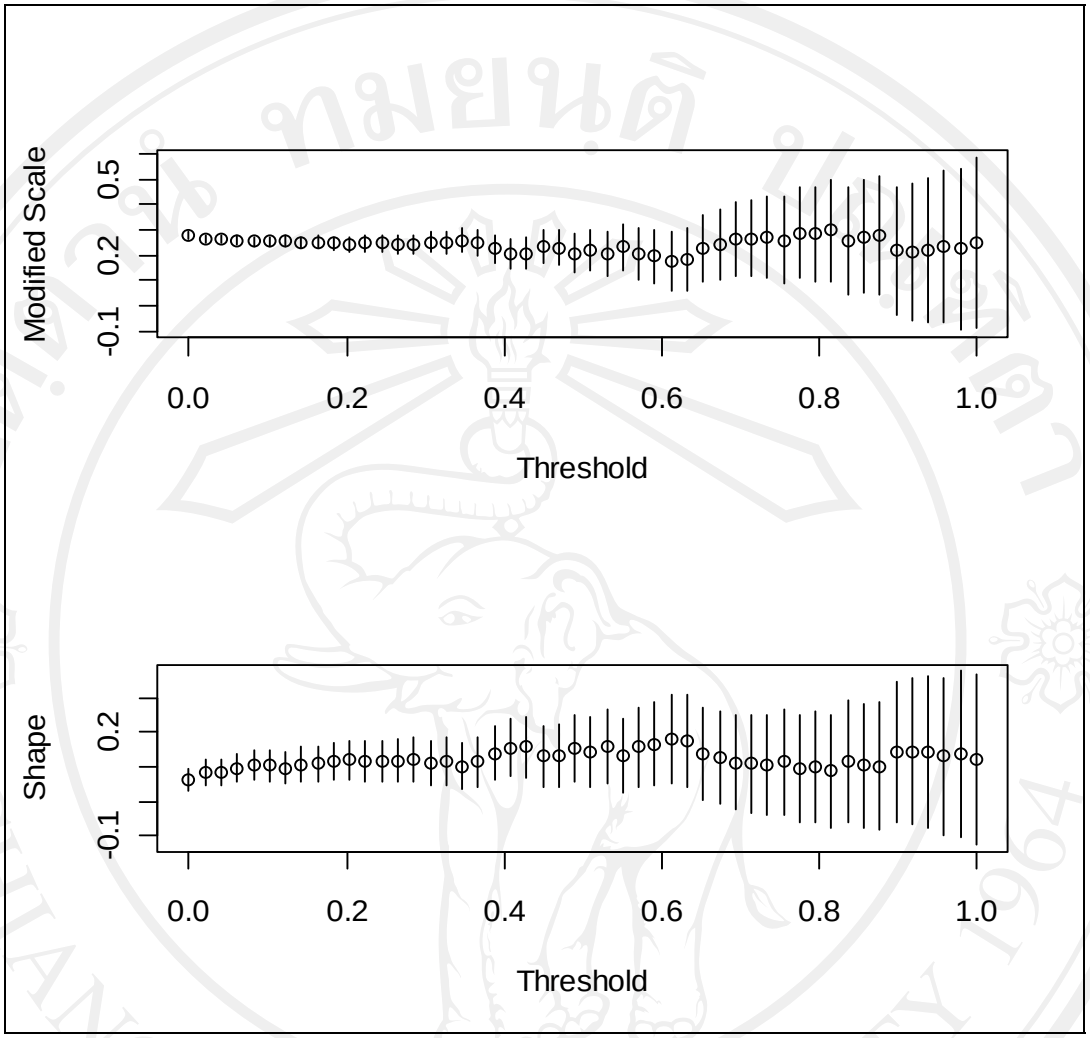
0.0000 and 3.4621. Median of data is 0.1994. Also, the first quartile and the third quartile are 0.0866 and 0.3992, respectively.

Figure 4.12 shows the mean residual life plot with approximate 99% confidence intervals for the daily gold price return. The graph appears to curve from u=0 to u≈3, beyond which it is approximately linearity. Accordingly, it might be concluded that there is some evidence for linearity around u=0 to u=1. Moreover, figure 4.13 can show more obvious mean residual life plot for parameter estimate, for which the selected threshold of u=0.38 is reasonable .There are 842 cases of over-the-threshold occurrences u=0.38 in the complete set of 3,181 observations.



Source: Computed Result

Figure 4.12 Mean Residual Life Plot for Daily Gold Price Return



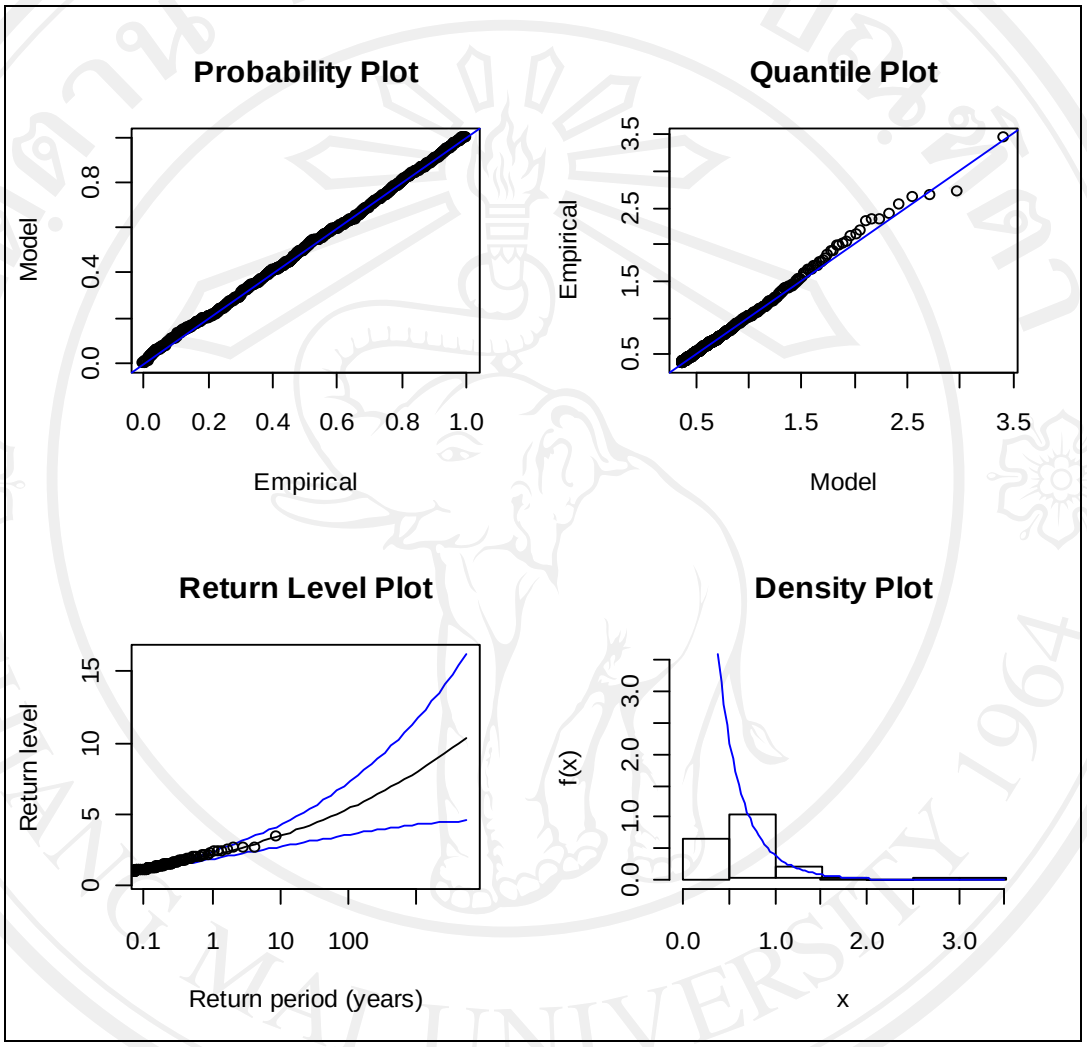
Source: Computed Result

Figure 4.13 Parameter Estimates against Threshold for Daily Gold Price Return

Diagnostic plots for the threshold model are shown in Fig.4.14. The accuracy correspondence to the probability plot and quartile plot is unconvincing because the curve is only about near-linear. Also, the return level illustrates the large certainties that correspond exactly to the model.

The results of Peak over Threshold of negative returns, listed in Table 4.5, show the estimates of three parameters σ and ξ, and the estimates of standard error of the parameters are listed in parentheses. Maximization of the GPD log-likelihood for the data leads to the estimate: $(\sigma, \xi) = (0.2795, 0.1326)$ with a corresponding maximized log-likelihood of -119.4822. The shape parameter is fat tailed because ξ is greater than

zero. Taking square roots, the standard errors are 0.0145, 0.0391 for σ and ξ respectively.



Source: Computed Result

Figure 4.14 Diagnostic Plots for Threshold Model Compared to the Gold Price Return

Table 4.5 Parametric Maximum Likelihood Estimates with Daily Return

	σ	ξ
Daily	0.2795	0.1326
	(0.0145)	(0.0391)

Source: Computed Result

Table 4.6 The Summary Results of Gold Price Return in the Next 20 Year (2012-2032) Based on Generalized Pareto Distributions Analysis

Item	5-year	10-year	20-year
Value at Risk of Gold Price Return	3.0569	3.5177	4.0228
95%	(2.5938,3.7976)	(2.9040,4.537)	(3.2274,5.3966)
99%	(2.4855,4.1193)	(2.7639,4.9927)	(3.0499,6.0265)

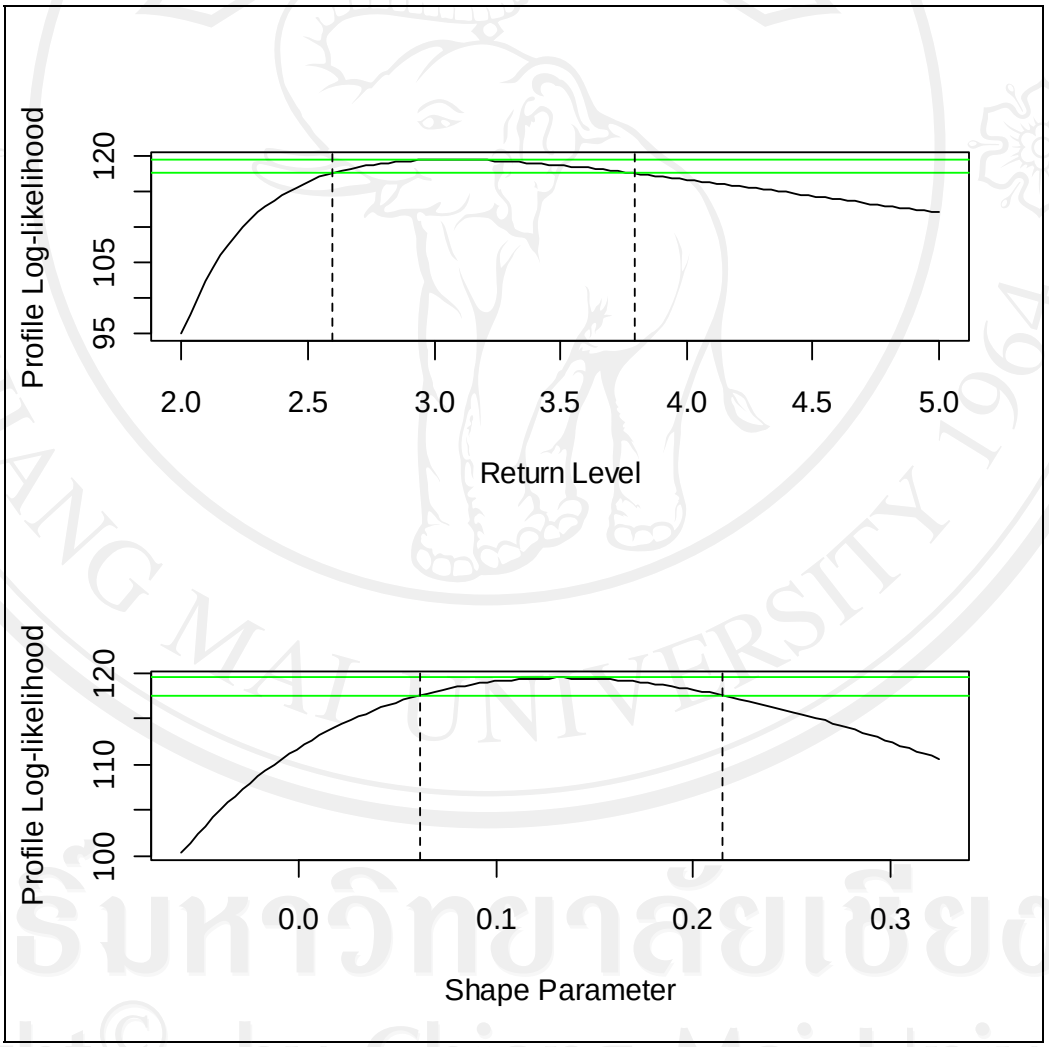
Source: Computed Result

Table 4.6 presents the gold price return in US dollar based on Generalized Pareto Distributions Analysis during the period of 1985 to 2011 to forecast the gold price return for the next twenty years (2012 to 2032). For the United State of America the extreme value of gold price return will increase from 2012 to 2032. In the 2017 the extreme values of gold price return will be 3.0569% (2.4855%, 4.1193%) at the significant level of 99%. In 2022 the extreme values of gold price return will be 3.5177% (2.7639%, 4.9927%) at the significant level of 99%. In 2032 the extreme values of gold price return will be 4.0228% (3.0499%, 6.0265%) at the significant level of 99%.

As mentioned that the log-likelihood estimates are $\sigma = 0.2795$ and $\xi = 0.1326$, therefore, this study gives the result of Value at Risk at different value depended on time. For the next 20 years, Value at Risk from GPD estimates gives the result as 4.0228%. This implies that, the extreme loss in daily 20 years return will exceed to 4.0228% with 1% risk. It means that if we invest $1 US million in gold return, we are 99% confident that our daily loss at worst will not exceed $40,228 US during one trade day. In other word, we are 1% confident that our daily loss will exceed to 4.0228% or $40,228 US during one trade day if we have an investment of $1 US million in that market. Then, Expected Shortfall which is the average amount that is lost over a given day, assuming that the loss is greater than the 99th percentile of the loss distribution (Artzner, et al., 1999), shows the result as 4.8071% with 99% confidence intervals. It means that the maximum loss in one-day will be 4.8071% with 99% confidence intervals. In other word, if we invest $1 US million in gold, we are

99% confident that the daily average amount loss over the 99th percentile of the loss distribution is $48,071 US.

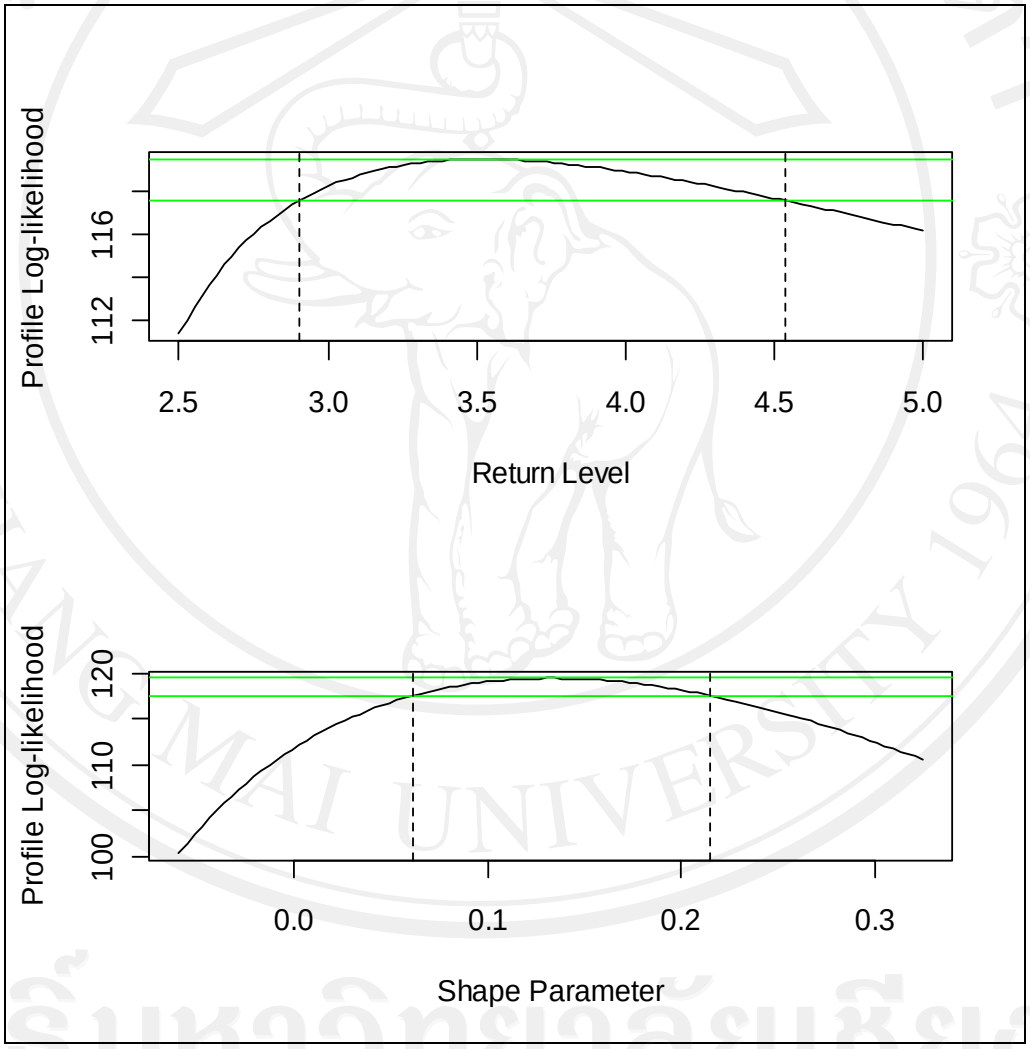
The profile log-likelihood for GPD 5-year return level and shape parameter with 95% confident interval shows as figure 4.15. The estimated return level equals to 3.0569 and estimated (MLE) shape parameter is 0.1326. Moreover, a 5-year return level at 95% confidence interval approximately is between 2.5938 and 3.7976. A shape parameter at 95% confidence interval approximately is between 0.06116 and 0.2149.



Source: Computed Result

Figure 4.15 Profile Log-Likelihood for GPD 5-year Return Level and Shape Parameter at 95% Confident Interval

The profile log-likelihood for GPD 10-years return level and shape parameter with 95% confident interval shows as figure 4.16. The estimated return level equals to 3.5177 and estimated (MLE) shape parameter is 0.1326. Moreover, a 10-year return level at 95% confidence interval approximately is between 2.9040 and 4.5377. A shape parameter at 95% confidence interval approximately is between 0.0611 and 0.2149.

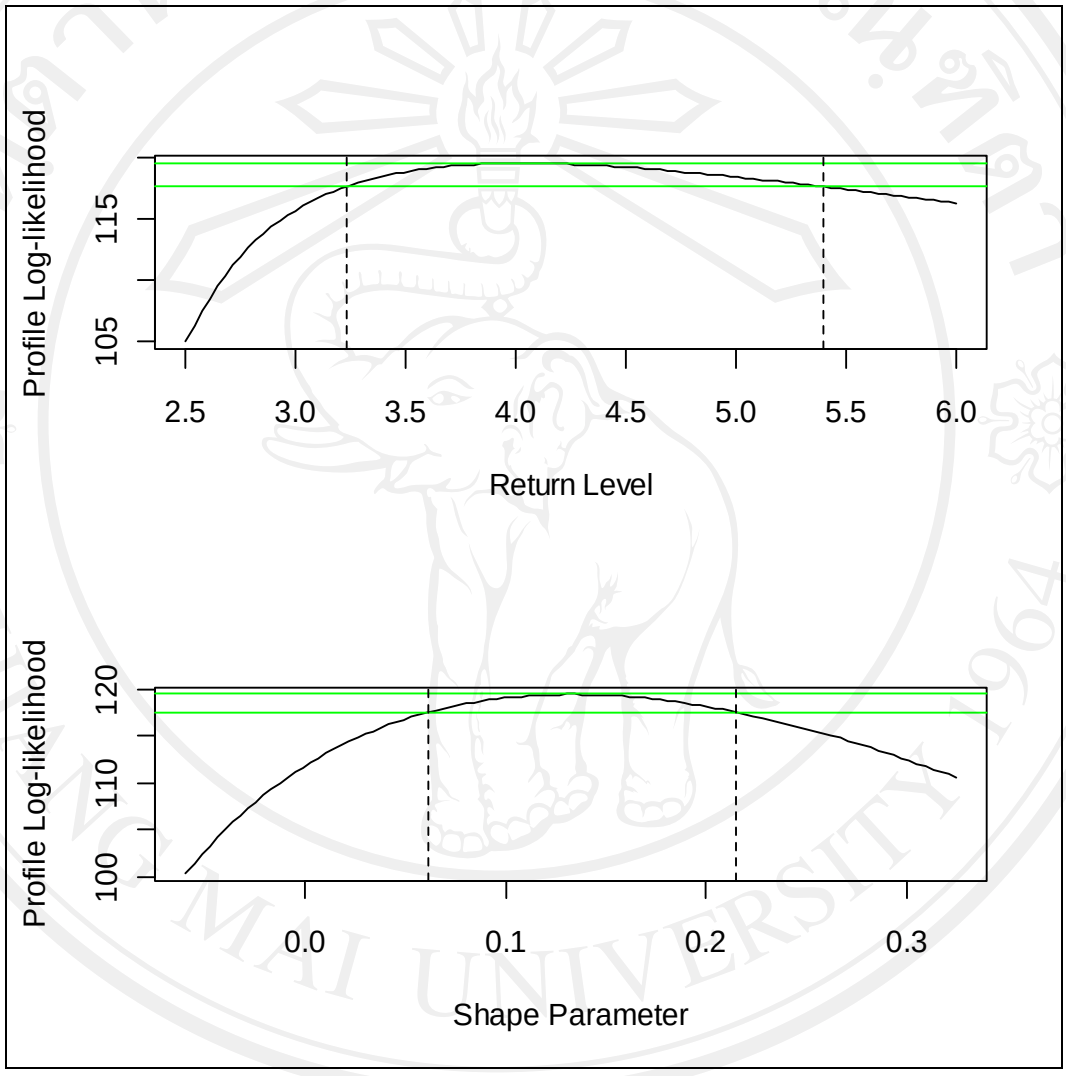


Source: Computed Result

Figure 4.16 Profile Log-Likelihood for GPD 10-Year Return Level and Shape Parameter at 95% Confident Interval

The profile log-likelihood for GPD 20-year return level and shape parameter with 95% confident interval shows as figure 4.17. The estimated return level equals to

4.0228 and estimated (MLE) shape parameter is 0.1326. Moreover, a 20-year return level at 95% confidence interval approximately is between 3.2274 and 5.3966. A shape parameter at 95% confidence interval approximately is between 0.06116 and 0.2149.

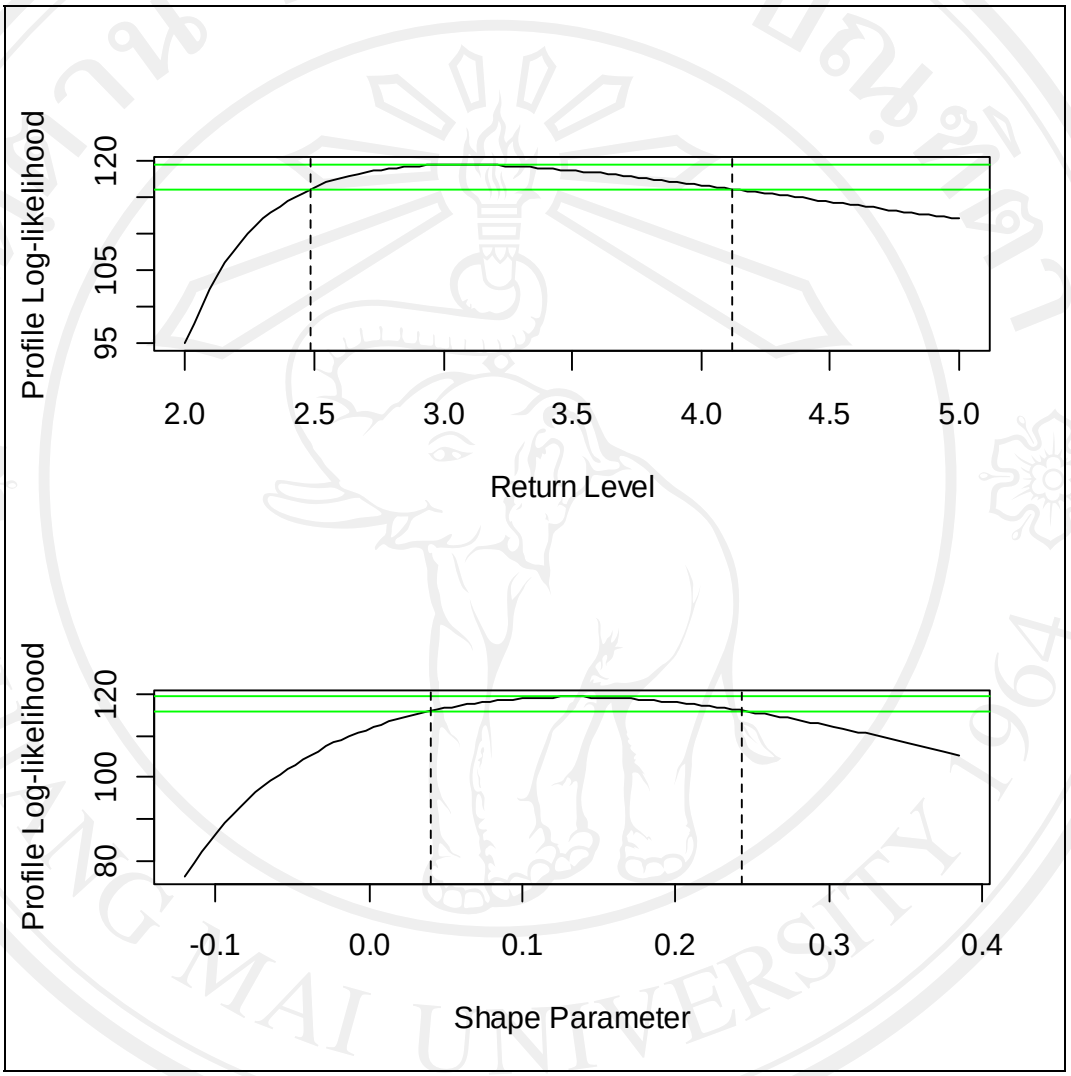


Source: Computed Result

Figure 4.17 Profile Log-Likelihood for GPD 20-Year Return Level and Shape Parameter at 95% Confident Interval

The profile log-likelihood for GPD 5-year return level and shape parameter with 99% confident interval shows as figure 4.18. The estimated return level equals to 3.0569 and estimated (MLE) shape parameter is 0.1326. Moreover, a 5-year return level at 99% confidence interval approximately is between 2.48555 and 4.11933. A

shape parameter at 99% confidence interval approximately is between 0.04081 and 0.24317.

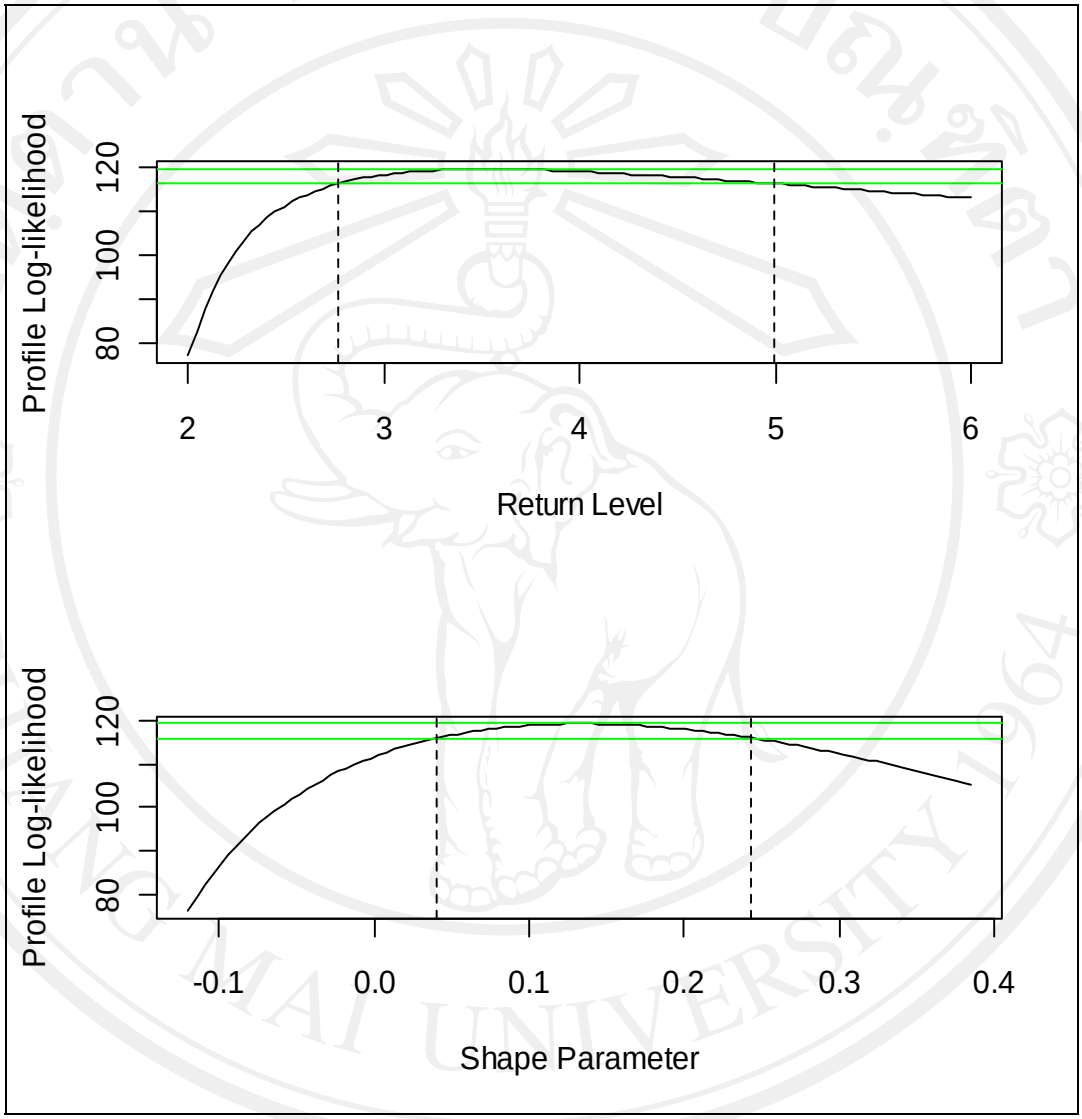


Source: Computed Result

Figure 4.18 Profile Log-Likelihood for GPD 5-Year Return Level and Shape Parameter at 99% Confident Interval

The profile log-likelihood for GPD 10-year return level and shape parameter with 99% confident interval shows as figure 4.19. The estimated return level equals to 3.5177 and estimated (MLE) shape parameter is 0.1326. Moreover, a 10-year return level at 99% confidence interval approximately is between 2.7639 and 4.9927. A

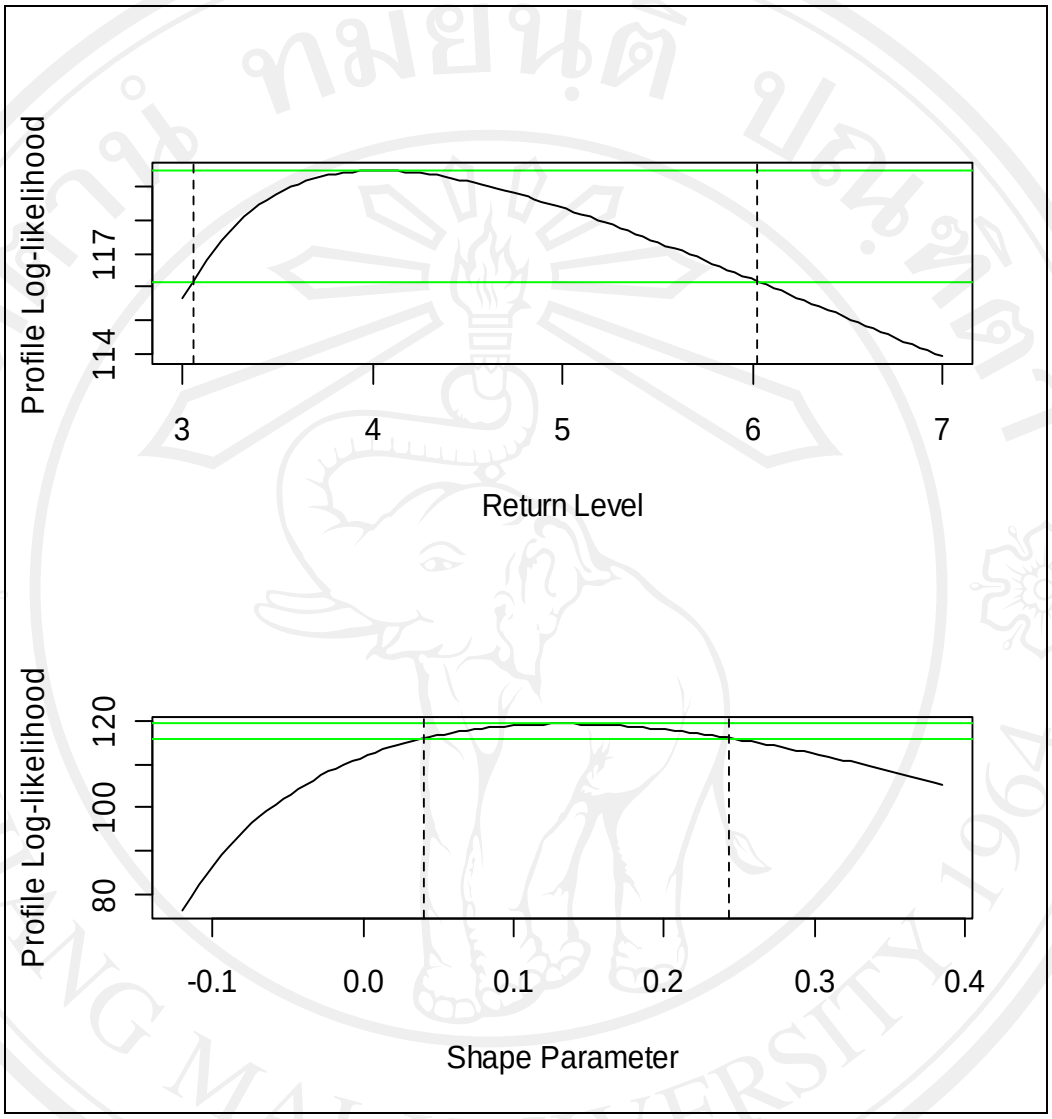
shape parameter at 99% confidence interval approximately is between 0.04081 and 0.2431.



Source: Computed Result

Figure 4.19 Profile Log-Likelihood for GPD 10-Year Return Level and Shape Parameter at 99% Confident Interval

The profile log-likelihood for GPD 20-year return level and shape parameter with 99% confident interval shows as figure 4.20. The estimated return level equals to 4.0228 and estimated (MLE) shape parameter is 0.1326. Moreover, a 20-year return level at 99% confidence interval approximately is between 3.0499 and 6.0265. A shape parameter at 99% confidence interval approximately is between 0.0408 and 0.2431.



Source: Computed Result

Figure 4.20 Profile Log-Likelihood for GPD 20-Year Return Level and Shape Parameter at 99% Confident Interval