

Extreme Value Distributions on Closing Quotations and Returns of Islamabad Stock Exchange

Abstract

This study is an experimental test done on the secondary data of banking sector of Islamabad Stock Exchange for year 2017 and applied different techniques on the given data record by using Generalized Extreme Value Distribution (GEV), Gumble Distribution (GBL), Generalized Pareto Distribution (GPD), Exponential Distribution (EXP), Gamma Distribution (GAM), Weibull Distribution (WBL) on the data of four banks Habib Bank, Allied Bank, Bank Alfalah and Askari Bank. This data is concerning the closing quotations and returns of four banks registered in Islamabad Stock Exchange. We try to fit different distributions on the data and found the best fit distribution.

We estimated the parameters of each distribution and also find the standard deviations of each distribution by using R Language and find which distribution is the best fit distribution on the basis of standard deviation distribution. We analyzed that shape wise GEV is the most suitable distribution, scale wise EXP distribution the best and location wise the best one is Gumbal distribution. This article shows that the overall GEV is the best distribution to model correctly the data.

Keywords: GEV Distribution, EXP Distribution, GBL distribution, WBL Distribution, GPD, R-Language

1. Introduction

From the previous three decades, the world economy has been confronting securities exchange crashes, cash emergency, the website and land bubble burst, credit crunch and saving money alarms. As a reaction, extreme value theory (EVT) gives an arrangement of instant ways to deal with chance administration investigation. In this research we have used Generalized Extreme Value Distribution (GEV), Gumble Distribution (GBL), Generalized Pareto Distribution (GPD), Exponential Distribution (EXP), Gamma Distribution (GAM), Weibull Distribution (WBL) on the data of daily closing price of Islamabad stock exchange of four banks

30 Habib Bank, Allied Bank, Bank Alfalah and Askari Bank. An experimental test is done on the
31 secondary data of banking sector of Islamabad Stock Exchange for year 2017 and applied
32 different statistical techniques on the given data record to estimate the parameters of each
33 distribution and also estimated the standard deviations (S.D) of each distribution and find which
34 distribution is the best fit distribution on the basis of standard deviation distribution.

35 On the basis of their standard deviations we analyzed that shape wise GEV is the most
36 suitable distribution, scale wise EXP distribution is the best and location wise the best fit is
37 Gumbal distribution. This data is concerning the closing quotations and returns of four banks
38 registered in Islamabad Stock Exchange.

39 For the first time the Weibull distribution is found by Fréchet in 1927. This distribution
40 has given a name after Waloddi Weibull who introduced this distribution briefly in 1951.
41 Rammler applied this to discuss a small particle size distribution. The shape parameter makes
42 Weibull distribution to express in different shapes, relies upon the examined parameter
43 estimation of the shape. These types of distributions are particularly great in displaying
44 applications since they are parcel of edges to demonstrate numerous arrangements of
45 information. The Weibull distribution has less confusion and has easy to express. In any case,
46 because of the state of this parameter the Weibull to assume numerous shapes. Because of easy
47 to express and easy to apply the Weibull Distribution has numerous and quality applications in
48 many fields

49 The gamma distribution, meant as gama (α, β), is a two-parameter distribution. Because
50 of direct skewness, the gamma distribution is a fitting model in numerous fields of measurements
51 in those situations where the typical distribution isn't appropriate. As a hypothesis, the gamma
52 distribution is connected as estimation for holding up times and administration times (Whitt
53 2000). This circulation is utilized as a part of numerous instances of environ measurements, for
54 example, natural observing of precipitation sizes (Krishnamoorthy et al. 2008). The gamma
55 distribution is a one of the proper distribution in numerous fields of study and research (Chen
56 and Ye 2016; Meeker and Escobar 1998). Since this model is likewise used in flag preparing
57 (Vaseghi 2008), and clinical preliminaries (Wiens 1999).

58 The Generalized Pareto distribution was presented by Pickands (1975), and enthusiasm

59 and appeared by Davison Smith, van Montfort and Witter. The applications incorporate use in
60 the examination of extraordinary occasions, in the displaying of vast protection claims, as a
61 disappointment time appropriation in unwavering quality investigations, and in any circumstance
62 in which the exponential distribution may be utilized however in which some heartiness is
63 required against heavier followed or lighter followed choices.

64 The Generalized Pareto distribution is the distribution of an arbitrary variable X
65 characterized by $\alpha(1-e^{-kY})/k$, where Y is an irregular variable.

66 Gumbel distribution is a specific instance of the summed up extraordinary esteem
67 circulation (otherwise famous as Fisher-Tippett distribution). Generally called the log-Weibull
68 allotment and the twofold exponential scattering (a term that is on the other hand sometimes used
69 to suggest the Laplace scattering). It is related to the Gompertz scattering: when its thickness is
70 first reflected about the beginning stage and after that restricted to the positive half line, a
71 Gompertz work is gained.

72 In probability theory and estimations, the Gumbel flow (Generalized Extreme Value
73 transport Type-I) is used to show the apportionment of the best (or the base) of different cases of
74 various scatterings. This apportionment might be used to address the dispersal of the most
75 extraordinary level of a conduit in a particular year if there was a summary of most prominent
76 characteristics for whatever length of time that ten years. It is important in anticipating the given
77 that an unbelievable tremor, flood or other disastrous occasion will happen. The potential
78 congruity of the Gumbel course to address the movement of maxima relates to incredible regard
79 theory, which demonstrates that it is presumably going to be useful if the scattering of the
80 shrouded case data is of the normal or exponential make. Whatever is left of this article suggests
81 the Gumbel to exhibit the scattering of the most extraordinary regard. To show the base regard,
82 use the negative of the primary characteristics.

83 Objective of the study:

- 84
- 85 • Using extreme value distributions checked the best fit distribution on the assets price
86 of Islamabad stock exchange data using three parameters location wise, scale wise
and shape wise of each distribution using R (statistical software).

87 **2. Literature Review**

88 Combus & Dussauchoy (2006) used a similar evaluation utilizing different hypothetical
89 distributions: Normal, LogNormal, Gamma, Gumbel, Weibull and Generalized Extreme Value
90 (GEV). They used GEV transport in some other setting than over the top regard theory (in
91 actuality committed to this region). From the trial distribution on brief periods (3, 6, 9 and a
92 year), we exhibit that GEV assignment grants to precisely fit returns and opening/closing
93 references (without focus only the direct of maxima or minima in an illustration, yet all things
94 considered of the case) by relationship with exchange scatterings. This paper bases on the GEV
95 distribution in the univariate case. Following a review of the composition, univariate GEV
96 scattering is associated with a movement of consistently stock-exchange of TOTAL oil
97 association. They demonstrate this article with the opening/closing references less the moving
98 ordinary of the five a days back and the benefits of this association on short and medium terms
99 (3, 6, 9, a year pushing ahead multi month).

100 Fevzi & Tamer (2017) concentrated on forecast of surge recurrence factor (K) for the
101 Gumbel distribution utilizing quality articulation programming (GEP) and relapse demonstrate.
102 Some desire models are presented for choosing of flood repeat factor (K). The proposed
103 backslide illustrates (Model 4) and GEP show (Model 7) gives a snappy and practical strategy
104 for assessing the flood repeat factor. Along these lines, Gumbel's system has been revised in such
105 a farsighted model, to the point that one can obtain the span of a given return period for flood
106 discharges without plan of move to making a gander at a table. The execution of the figure
107 models was evaluated with an illustrative case for 2, 5, 10, 20, 50, 100, 200, 250, 500 and 1000
108 years flood.

109 Chen et al. (2016) noted that the parameters of a Weibull distribution are evaluated by
110 most extreme probability estimation. To reduce the inclinations of the best likelihood estimators
111 (MLEs) of two-parameter Weibull spreads, they proposed informative tendency balanced MLEs.
112 Two other fundamental estimators of Weibull movements, scarcest squares estimators and
113 percentiles estimators are moreover exhibited. In perspective of an examination of their displays
114 in the entertainment consider; we immovably propose the logical tendency balanced MLEs for
115 the parameters of Weibull transports, especially when the case assesses are nearly nothing.

116 Markose & Amadeo (2010) used the Generalized Extreme Value (GEV) distribution to
117 model the implied Hazard Neutral Density (RND) work gives an adaptable system that catches
118 the negative skewness and overabundance kurtosis of profits, and furthermore conveyed the
119 market suggested tail record. We got a unique systematic shut frame answer for the Harrison and
120 Pliska 1981 no arbitrage harmony cost for the European alternative on account of GEV resource
121 returns. The GEV based choice valuing model effectively evacuates the in-test evaluating
122 inclination of the Black-Scholes display, and furthermore demonstrates more noteworthy out of
123 test valuing exactness, while requiring the estimation of just two parameters. We clarify how the
124 inferred tail record is solid at demonstrating the fat followed conduct and negative skewness of
125 the suggested RND capacities, especially around emergency occasions.

126 The generalized Pareto distribution was presented by Pickands (1975), and enthusiasm
127 for it was appeared by Davison (1984), Smith (1984, 1985), and van Montfort and Witter (1985).
128 Its applications incorporate use in the investigation of extraordinary occasions, in the
129 demonstrating of huge protection claims, as a disappointment time circulation in unwavering
130 quality examinations, and in any circumstance in which the exponential appropriation may be
131 utilized yet in which some power is required against heavier.

132

133 **3. Data Description and Methodology**

134 **3.1 WEIBULL DISTRIBUTION**

135 We determined in many different estimation techniques of the parameters of the two-
136 parameter Weibull distribution, and to find two different processes to overcome the biases of
137 maximum likelihood estimators (MLEs). Given mathematical form is the cumulative distribution
138 function of a Weibull distribution:

$$F(x; l, m) = \begin{cases} 1 - e^{-\left(\frac{x}{m}\right)^l}, & x > 0, m > 0, l > 0 \\ 0 & x \leq 0 \end{cases}$$

139 and its probability density function is:

$$f(x; l, m) = \begin{cases} \left(\frac{1}{m}\right)^l x^{l-1} e^{-\left(\frac{x}{m}\right)^l}, & x > 0, m > 0, l > 0 \\ 0 & x \leq 0 \end{cases}$$

140 The Weibull distribution is the first distribution found by Fréchet in 1927, also, this
 141 circulation has given a name after Waloddi Weibull, a Swedish mathematician who presented the
 142 weibull distribution exhaustively in 1951. Rammler used this to translate a little molecule
 143 measure appropriation. Weibull circulation isn't the main dispersion, however we can state it a
 144 group of appropriations, because of its diverse attributes like the distribution having the shape
 145 parameter. The shape parameter makes Weibull circulations to express in different shapes, relies
 146 upon the broke down parameter estimation of the shape. These sorts of conveyances are
 147 particularly great in displaying applications since they are parcel of edges to show numerous
 148 arrangements of information. The Weibull dispersion is relatively less difficulties and has easy to
 149 express. In any case, because of the state of this parameter the Weibull to assume numerous
 150 shapes. Because of every one of these attributes of effortlessly reasonable and foldability in the
 151 state of the Weibull circulation empowers it an amazing model of dispersion in tried and true use
 152 in our day by day life. The model has inclination to numerous distributional shapes by applying
 153 similarly simple distributional frame that can be occur in different other distributional families.
 154 The connection of Weibull distribution with numerous different distributions. Shown that, it is
 155 popular that a Weibull conveyance keeps the exponential circulation (when the estimation of $l =$
 156 1) however the Rayleigh appropriation (when the estimation of $l = 2$). A brief timeframe prior,
 157 Ling and Giles proposed the Rayleigh circulation as it has a predisposition inurement of the
 158 Rayleigh appropriation. The extraordinary state of the summed up outrageous esteem
 159 appropriation is the Weibull conveyance and it is spoken to by Fréchet. The pdf of Fréchet
 160 distribution is given by

$$f_{Frechet}(x; l, m) = \begin{cases} \frac{l}{m} \left(\frac{x}{m}\right)^{-1-l} e^{-\left(\frac{x}{m}\right)^{-l}}, & x > 0, m > 0, l > 0 \\ 0 & x \leq 0 \end{cases}$$

161 Actually, $f_{Frechet}(x; l, m) = -f_{Weibull}(x; -l, m)$. We can also define Weibull
 162 distribution as a uniform distribution; as U is uniformly distributed when it is $(0, 1)$, and the
 163 random variable $m(-\ln(U))^{1/k}$ is Weibull distributed with parameters L and m . There is a

164 comprehensive use of Weibull distribution in many fields, like manufacturing, mills, analysis of
165 datasets, efficiency in different instruments, testing of material things and assessments of
166 environmental. This distribution was proposed and applied in an aircraft system to enquire into
167 in or ready for use of performing consistently well by Kaltschmidt *et al.* Nikolaj demonstrated
168 that this conveyance can be utilized as a part of oil contamination examination. Singh considered
169 the Weibull distribution and worked in hydrology by utilizing this distribution. Aarset connected
170 a Weibull distribution to test disappointment times of gadgets, and the information were
171 additionally breaking down and altered by Lai et al. It was utilized as a part of breakdown
172 voltage estimation by Hirose, and Fabiani utilized it to test electrical breakdown of protecting
173 materials. It was connected to edited information by Ghitany et al. In the investigation of wind
174 vitality, the Weibull distribution was likewise connected by Akdag et al.

175 3.2 GAMMA DISTRIBUTION

176 We can denote gamma distribution as $\text{gam}(a, b)$, and it has two-parameters with
177 probability density function (PDF)

$$178 \quad f_{gam}(x) = \frac{x^{a-1}}{b^a \Gamma(a)} e^{-\frac{x}{b}}, x > 0$$

179 Where $a > 0$ is the shape parameter, $b > 0$ is the scale parameter and $\Gamma(\cdot)$ is the gamma
180 function. Because of the moderate skewness, the gamma distribution is an appropriate model in
181 many fields of statistics in those cases where the normal distribution is not suitable. For example,
182 it is applied to model weakness and random-effects. According to queueing theory, the gamma
183 distribution is applied as a distribution for waiting times and service times (Whitt 2000). This
184 distribution is used in many cases of environ metrics such as environmental monitoring of
185 rainfall sizes (Krishnamoorthy et al. 2008). The gamma distribution is a one of the appropriate
186 distribution in many fields of study and research (Chen and Ye 2016; Meeker and Escobar 1998).
187 Because this model is also utilized in signal processing (Vaseghi 2008), and clinical trials (Wiens
188 1999).

189 **3.3 GENERALIZED PARETO DISTRIBUTION**

190 Pareto distribution is used in additionally the appropriation of an arbitrary variable X as Y
191 speaks to an irregular variable with its standard exponential distribution. The Pareto circulation
192 has likelihood dispersion work as neglected:

$$F(x) = 1 - (1 - sx/t)^{\frac{1}{s}}, \quad s \neq 0$$

193
$$= 1 - \exp(-x/t), \quad s = 0$$

194 The density function

$$f(x) = t^{-1}(1 - sx/t)^{\frac{1}{s}-1}, \quad s \neq 0$$

195
$$= t^{-1}\exp(-x/t), \quad s = 0$$

196 The range of x is $0 < x < \infty$ for $s \leq 0$ and $0 < x < t/s$ for $s > 0$. The Pareto
197 distribution has parameters of t as the scale parameter, and s as the shape parameter. In the
198 special cases $s = 0$ and $s = 1$ it happens respectively, the exponential distribution with mean t
199 and the uniform distribution on $[0, t]$; Pareto distributions are obtained when $s < 0$.

200 **3.4 EXPONENTIAL DISTRIBUTION**

201 The exponential distribution is one of the broadly utilized persistent distributions. Usually
202 used to show the time slipped by between occasions. We will now scientifically characterize the
203 exponential distribution and infer its mean and standard error. At that point we will build up the
204 instinct for the dispersion and talk about a few fascinating properties this distribution.

205 A continuous random variable X is said to have an exponential distribution with
206 parameter $\lambda > 0$, shown as $X \sim Exponential(\lambda)$ if its PDF is given by

$$f_X(x) = \begin{cases} \lambda e^{-\lambda x} & x > 0 \\ 0 & otherwise \end{cases}$$

207 It is convenient to use the unit step function defined as

$$u(x) = \begin{cases} 1 & x \geq 0 \\ 0 & \text{otherwise} \end{cases}$$

208 so we can write the pdf of an Exponential (λ) random variable as

$$f_X(x) = \lambda e^{-\lambda x} u(x)$$

209 Let us find its CDF, mean and variance. For $x > 0$, we have

$$F_X(x) = \int_0^x \lambda e^{-\lambda t} dt = 1 - e^{-\lambda x}$$

210 So we can the CDF as $F_X(x) = (1 - e^{-\lambda x})u(x)$.

211 3.5 GENERALIZED EXTREME VALUE(GEV) DISTRIBUTION

212 Given a time series (X_1, \dots, X_n) consisting of a sequence of independent and identically
 213 distributed (iid) random variables, the maximum $M_{x,n} = \max(X_1, \dots, X_n)$ converges in law
 214 (weakly) to the following generalized extreme value distribution:

$$215 \quad G_{ev}\left(\frac{x}{\xi}, \sigma, \mu\right) = \begin{cases} \exp\left\{-\left[1 + \xi\left(\frac{x-\mu}{\sigma}\right)\right]^{-\frac{1}{\xi}}\right\} & \xi \neq 0 \\ \exp\left\{-\exp\left(-\frac{x-\mu}{\sigma}\right)\right\} & \xi = 0 \end{cases} \quad 1 + \left(\frac{x-\mu}{\sigma}\right) > 0, \sigma > 0$$

216 And the density of GEV is

$$217 \quad g_{ev}\left(\frac{x}{\xi}, \sigma, \mu\right) = \frac{1}{\sigma} G_{ev}\left(\frac{x}{\xi}, \sigma, \mu\right) \left[1 + \xi\left(\frac{x-\mu}{\sigma}\right)\right]^{-\left(1 + \frac{1}{\xi}\right)} \quad 1 + \left(\frac{x-\mu}{\sigma}\right) > 0$$

218 In this distribution σ is representing the scale parameter, μ is representing the location
 219 parameter. Where ξ is representing the shape parameter that shows the tail behavior. So Fréchet
 220 type tail represents to $\xi > 0$ but Weibull type tail represented to $\xi < 0$. The Gumbel type is
 221 interpreted as the limit as $\xi \rightarrow 0$ of Equation 4.1 with $\xi = 0$. The Fréchet distribution compares
 222 to overwhelming followed circulations and has usually been observed to be the most fitting for

223 the substantial tail of money related information. The asymptotic dispersion of the most extreme
 224 can be assessed without making any suppositions about the idea of the first conveyance of the
 225 perceptions since the asymptotic circulation of the greatest (on the off chance that it exists)
 226 dependably has a place with one of these three appropriations, whatever the first distribution.
 227 When the minima $M_{x,n} = \min(X_1, \dots, X_n)$ is of concern, the distribution function is as
 228 $G_{ev}\left(\frac{x}{\xi}, \sigma, \mu\right)$ as $M_{x,n} = \min(X_1, \dots, X_n) = M_{x,n} = \max(X_1, \dots, X_n)$. The reverse of
 229 circulation capacity of GEV for the maxima, $[[G_{ev}]^{(-1)}(1-p)]$ speak to the quantile of $1 - p$,
 230 here p is the little likelihood (upper tail) as $P(x > x_p) = p$, which x_p is known as the arrival level
 231 which have the arrival time of $1/p$. We can translate this as it will be watched an extraordinary
 232 more prominent than the arrival level x_p . Every $1/p$ period is by and large or as the mean
 233 holding up time between particular extremal occasions. To deal with the hazard in the field of
 234 fund x_p is known as the Value at Risk (VAR) to express the most elevated conceivable
 235 misfortune amid a specific period $1/p$. For instance, a most extreme misfortune amid a time of 30
 236 days is close to R_p is to be seen with a 5% danger of false. As indicated by this the arrival level
 237 of R_p with an arrival period 585 days ($p = 0.0017083$) as understood for $P(L(R_p) \leq 30) = 1 -$
 238 $[[1-p]]^{30} = 0.05$, and $L(R_p)$ communicated for the season of first disappointment which is
 239 gathered as a Bernoulli distribution.

240 3.6 GUMBELL DISTRIBUTION

241 In likelihood hypothesis and measurements, the Gumbel distribution (Generalized Extreme
 242 Value dispersion Type-I) is utilized to demonstrate the circulation of the most extreme (or the
 243 base) of various examples of different distributions. This distribution may be utilized to speak to
 244 the distribution of the most extreme level of a stream in a specific year if there was a rundown of
 245 greatest qualities for as far back as ten years. It is valuable in foreseeing the possibility that an
 246 extraordinary tremor, surge or other catastrophic event will happen. The potential pertinence of
 247 the Gumbel distribution to speak to the appropriation of maxima identifies with extraordinary
 248 testing of hypothesis, which shows that it is probably going to be helpful if the distribution of the
 249 basic example information is of the typical or exponential compose. Whatever is left of this

250 article alludes to the Gumbel to demonstrate the distribution of the most extreme esteem. To
251 display the base esteem, utilize the negative of the first qualities.

252 The Gumbel distribution is a particular example of the summed up silly regard scattering
253 (generally called the Fisher-Tippett scattering). It is generally called the log-Weibull dispersal
254 and the twofold exponential apportionment (a term that is of course all over used to imply the
255 Laplace flow). It is related to the Gompertz movement: when its thickness is first reflected about
256 the beginning and after that bound to the positive half line, a Gompertz work is gained.

257 In the idle variable arrangement of the multinomial logit exhibit fundamental in discrete
258 choice theory the mix-ups of the dormant components take after a Gumbel scattering. This is
259 profitable in light of the way that the qualification of two Gumbel-passed on discretionary
260 components has an ascertained scattering.

261 The Gumbel scattering with zone parameter (an) and scale parameter (b) is executed in the
262 Wolfram Language as Gumbel Distribution [alpha, beta]. It has probability thickness limit and
263 apportionment work.

$$P(x) = \frac{1}{b} \exp \left[\frac{x-a}{b} - \exp \left(\frac{x-a}{b} \right) \right]$$
$$D(x) = 1 - \exp \left[- \exp \left(\frac{x-a}{b} \right) \right]$$

264 **4. Results and Discussion**

265 In this article we have analyzed the data of four registered bank in Islamabad Stock Market
266 using the Generalized Extreme Value Distribution (GEV), Gumble Distribution (GBL),
267 Generalized Pareto Distribution (GPD), Exponential Distribution (EXP), Gamma Distribution
268 (GAM) and Weibull Distribution (WBL). We estimated the parameters of each distribution and
269 also find the standard deviations of each distribution and find which distribution is the best fit
270 distribution on the basis of standard deviation distribution. Distribution having the smallest value
271 of S.E is the best fit.

272 This data is concerning the closing quotations and returns of four banks registered in
273 Islamabad Stock Exchange. We try to fit different distributions on the data and analyzed the best
274 fit. We determined that GEV is the best distribution. We analyzed the data in three ways and

275 concluded that shape wise GEV is the most suitable distribution, scale wise EXP distribution is
 276 the best and location wise the best one is Gumbal distribution but overall GEV is the best
 277 distribution to model correctly the data.

278
 279
 280
 281
 282
 283

Table 1: Allied Bank 2017

Distribution	Parameter-I	Parameter-II	Parameter-III
S.E			
GEV	Shape (0.1238393)	Scale/rate (7.283996)	Location (88.99022)
S. E	0.1254005	0.9270635	1.206489
GBL	-	Scale/rate (7.676439)	Location (89.48872)
S. E	-	0.8983158	1.161836
GPD	Shape (-10.04509)	Scale/rate (1174.854)	-
S. E	1.305546	NaN	-
EXP	Shape -	Scale/rate (0.01061849)	Location -
S. E	-	0.00151891	-
GAM	Shape (84.00906)	Scale/rate (0.8920622)	Location -
S. E	17.11199	0.182248	-

	Shape	Scale/rate	Location
WBL	(8.273724)	(99.19448)	-
S. E	0.8406732	1.843414	-

284

285 The following table shows the shape wise, scale wise and location wise standard error
 286 (S.E).

287 In shape wise comparison GPD is more appropriate distribution than others as its S.E is
 288 least which is 0.1254005.

289 In scale wise comparison Exponential distribution is more appropriate than others as its
 290 S.E is least which 0.00151891

291 In location wise comparison Gumbel distribution is more appropriate than others as its
 292 S.E is least which is 1.161836

293

Table 2: Askari Bank 2017

Distribution	Parameter-I	Parameter-II	Parameter-III
S.E			
	Shape	Scale/rate	Location
GEV	(0.4758544)	(1.308208)	(19.6438)
S. E	0.1874865	0.2177561	0.232455
	-	Scale/rate	Location
GBL	-	(1.739013)	(20.02309)
S. E	-	0.215353	0.2619266
	Shape	Scale/rate	-
GPD	(-1.787793)	(41.29086)	-
S. E	0.1137081	NaN	-
	Shape	Scale/rate	Location
EXP	-	(0.0472654)	-

S. E	-	0.006819118	-
GAM	Shape (70.92737)	Scale/rate (3.352428)	Location -
S. E	14.44396	0.6851164	-
WBL	Shape (7.712964)	Scale/rate (22.37737)	Location -
S. E	0.7979002	0.4461521	-

294

295 The following table shows the shape wise, scale wise and location wise standard error
296 (S.E).

297 In shape wise comparison GPD is a more appropriate distribution than others as its S.E is
298 least which is 0.1137081.

299 In scale wise comparison Exponential distribution is a more appropriate than others as its
300 S.E is least which 0.006819118

301 In location wise comparison Gumbel distribution is a more appropriate than others as its
302 S.E is least which is 0.232455.

303

304

Table 3: Bank Alfalah 2017

Distribution	Parameter-I	Parameter-II	Parameter-III
S.E			
GEV	Shape (-0.2585817)	Scale/rate (2.02573)	Location (39.75594)
S. E	0.08785195	0.2241141	0.3216105
GBL	-	Scale/rate (1.962014)	Location (39.48114)
S. E	-	0.2084571	0.3003464

GPD	Shape (-24.67384)	Scale/rate (1022.385)	-
S. E	3.417024	NaN	-
EXP	Shape -	Scale/rate (0.02469072)	Location -
S. E	-	0.003557942	-
GAM	Shape (390.7955)	Scale/rate (9.649045)	Location -
S. E	79.7371	1.970031	-
WBL	Shape (20.39839)	Scale/rate (41.47983)	Location -
S. E	0.3112296	2.134244	-

305

306 The following table shows the shape wise, scale wise and location wise standard error
307 (S.E).

308 In shape wise comparison GEV is a more appropriate distribution than others as its S.E is
309 least which is 0.08785195

310 In scale wise comparison Exponential distribution is a more appropriate than others as its
311 S.E is least which 0.003557942

312 In location wise comparison Gumbel distribution is a more appropriate than others as its
313 S.E is least which is 0.3003464.

314

Table 4: Habib Bank 2017

Distribution	Parameter-I	Parameter-II	Parameter-III
S.E			
GEV	Shape (-0.7072903)	Scale/rate (50.86473)	Location (232.7484)

S. E	0.09980342	6.808803	7.858668
GBL	-	Scale/rate (45.83158)	Location (215.1644)
S. E	-	5.002405	7.032493
GPD	Shape (-5.336282)	Scale/rate (1597.149)	-
S. E	0.6258883	NaN	-
EXP	Shape -	Scale/rate (0.004181759)	Location -
S. E	-	0.0005664332	-
GAM	Shape (24.74098)	Scale/rate (0.1034555)	Location -
S. E	5.001373	0.02112457	-
WBL	Shape (6.730902)	Scale/rate (257.5216)	Location -
S. E	0.8288871	5.783377	-

315

316 In this table we observed the shape wise, scale wise and location wise standard error
317 (S.E).

318 In shape wise comparison GEV is a more appropriate distribution than others as its S.E is
319 least which is 0.09980342.

320 In scale wise comparison Exponential distribution is a more appropriate than others as its
321 S.E is least which 0.0005664332.

322 In location wise comparison Gumbel distribution is a more appropriate than others as its
323 S.E is least which is 7.032493.

324

325 **5. Conclusion**

326 We analyzed that shape wise the best distribution is generalized extreme value
327 distribution and scale wise exponential distribution and location wise Gumbal distributions
328 (GBL) are the most appropriate. But according to overall analysis by using parameter estimates
329 we concluded that generalized extreme value distribution (GEV) is the best fit for this given data
330 set. Because it has all three parameters estimates having some values and none of the parameter
331 is missing. For example it is giving some result in every case if we analyzed it shape wise, scale
332 wise and location wise.

333 But shape wise it has least standard deviation in each case and the best fit distribution as
334 compared to Exponential Distribution (EXP), Gamma (GAM), Weibull (WBL), and Generalized
335 Pareto Distribution (GPD). As we compared the standard errors (S.E) of each year and analyzed
336 that the generalized extreme value distribution (GEV) is most suitable as compared to other
337 distribution are used. According to generalized extreme value distribution (GEV) we can
338 represent the given data in best way. So for this data generalized extreme value distribution
339 (GEV) is most suitable and can define data well.

340 **REFERENCES**

- 341 Al-Fawzan, M. A. (2000). Methods for estimating the parameters of the Weibull
342 distribution. *King Abdulaziz City for Science and Technology, Saudi Arabia.*
- 343 Angadi, A. B., Angadi, A. B., & Gull, K. C. (2013). International Journal of Advanced Research
344 in Computer Science and Software Engineering. *International Journal*, 3(6).
- 345 Calderon Vela, A., & Rodríguez, G. (2014). Extreme Value Theory: An Application to the
346 Peruvian Stock Market Returns.

- 347 Chen, M., Zhang, Z., & Cui, C. (2017). On the Bias of the Maximum Likelihood Estimators of
348 Parameters of the Weibull Distribution. *Mathematical and Computational*
349 *Applications*, 22(1), 19.
- 350 Combes, C., & Dussauchoy, A. (2006). Generalized extreme value distribution for fitting
351 opening/closing asset prices and returns in stock-exchange. *Operational Research*, 6(1),
352 3-26.
- 353 Hosking, J. R., & Wallis, J. R. (1987). Parameter and quantile estimation for the generalized
354 Pareto distribution. *Technometrics*, 29(3), 339-349.
- 355 Ilie, N., & Hickel, R. (2009). Macro-, micro-and nano-mechanical investigations on silorane and
356 methacrylate-based composites. *Dental Materials*, 25(6), 810-819.
- 357 Kwaśnicka, H., & Ciosmak, M. (2001). Intelligent techniques in stock analysis. In *Intelligent*
358 *Information Systems 2001* (pp. 195-208). Physica, Heidelberg.
- 359 Lazoglou, G., & Anagnostopoulou, C. (2017, July). An Overview of Statistical Methods for
360 Studying the Extreme Rainfalls in Mediterranean. In *Multidisciplinary Digital Publishing*
361 *Institute Proceedings* (Vol. 1, No. 5, p. 681).
- 362 Nadarajah, S., & Kotz, S. (2004). The beta Gumbel distribution. *Mathematical Problems in*
363 *engineering*, 2004(4), 323-332.
- 364 Nwobi, F. N., & Ugomma, C. A. (2014). A comparison of methods for the estimation of Weibull
365 distribution parameters. *Metodoloski zvezki*, 11(1), 65.
- 366 Vivekan, N. (2012). Comparison of Estimators of Gumbel Distribution for Modelling Wind
367 *Speed Data*. *Bonfring International Journal of Data Mining*, 2(4), 11-15.
- 368 Wang, J., Fan, B., & Wang, T. (2008). Statistical Analysis and Data Analysis of Stock Market by
369 Interacting Particle Models. *JCP*, 3(12), 11-18.

370 Wang, Y. (2014). Stock price direction prediction by directly using prices data: an empirical
371 study on the KOSPI and HSI. *International Journal of Business Intelligence and Data*
372 *Mining*, 9(2), 145-160.

373 Weng, B. (2017). *Application of machine learning techniques for stock market prediction*.

374 Ye, Z. S., & Chen, N. (2017). Closed-form estimators for the gamma distribution derived
375 from likelihood equations. *The American Statistician*, 71(2), 177-181.

376 Yong, T. (2004). *Extended Weibull distributions in reliability engineering* (Doctoral
377 dissertation).

378 De Haan, L., & Ferreira, A. (2007). *Extreme value theory: an introduction*. Springer Science &
379 Business Media.

380 Chen, M., Zhang, Z., & Cui, C. (2017). On the Bias of the Maximum Likelihood Estimators of
381 Parameters of the Weibull Distribution. *Mathematical and Computational*
382 *Applications*, 22(1), 19.

383 Gumbel, E.J. (1954). *Statistical theory of extreme values and some practical applications*.
384 *Applied Mathematics Series*. 33 (1st ed.). U.S. Department of Commerce, National
385 Bureau of Standards. ASIN B0007DSHG

386 Gumbel, E. J. "Multivariate Extremal Distributions." *Bull. Inst. Internat. de Statistique* 37, 471-
387 475, 1960a.

388 Y. Suhov and M. Kelbert, *Probability and Statistics by Example*. Cambridge University Press,
389 2005.

390 Gumbel, E. J. "Distributions del valeurs extremes en plusieurs dimensions." *Publ. l'Inst. de*
391 *Statistique, Paris* 9, 171-173, 1960b.

392