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Modelling Non - Normality and Consistency of Returns Distribution of Major Industries in BSE

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Abstract

In modern portfolio management and security analysis it is assumed that return of an industry follows normal distribution but practically it is not so. Pragmatically, this research made an attempt to study the normality as well as non-normality of returns in industries listed in BSE. More over this study tries to establish a consistency index for returns based on risk return framework by using the data envelopment analysis. The results of the study gives an insight that the each industry follows separate statistical distribution which explains that the nature of returns differs from one another and consistency index gives an insight to the investors that there is an opportunity to achieve good returns due to the consistency in the returns of Indian industries listed in BSE.

Keywords: Normal distribution, BSE, risk, returns, Data envelopment analysis.

1. Introduction and related works

The use of the Non normal distribution is ubiquitous in statistical analysis in all branches of Finance. Any datum,that is the result of the aggregation of many individual data, has an approximate non normal distribution when subject to

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certain fairly unrestrictive conditions. This research is based on distribution fitting for non-normal returns, of industries in BSE. We chose the distribution as unbounded distribution (+∝ to -∝), because returns are (+ to -). Recently the usage of statistical models which are explicitly model returns with non-normal probability distributions has been in an increasing trend among the quantitative finance community. (e.g. Sheikh and Qiao, 2009, Bhansali, 2008, Harvey and Siddique, 2004). The fit of three different statistical distributions to the returns of the S&P 500 Index from 1950-2005 was examined by Egan (2007). The study revealed that normal distribution is a poor fit to single period continuously compounded returns for the S&P. Also, the lognormal distribution is a poor fit to single period continuously compounded returns for the S&P 500. Monthly Industry returns typically have non-normal and asymmetric distributions, potentially leading to problems with hypothesis testing based on reported probability statistics from regression analysis (Fama 1976). While monthly industry return data for many years is readily available, recent studies indicate that the non-normality problems may persist even in large samples (Bai et al 2002; Corrado and Zivney 1992). The practical importance of non-normality on traditional hypothesis testing is of some significance because of the frequent use of monthly return data with standard estimation methods such as least squares. The dummy variable version of the event study is one statistical application employing monthly return data, which is commonly estimated by least squares (MacKinlay 1997). In such studies, the t -tests and F-tests based on the estimated standard errors of the regression is used to measure statistical significance of abnormal returns (MacKinlay 1997). If the error term is non-normal, however, appealing to the reported test-statistics may be problematic. The only choice for analyzing a large number of assets due to its analytical formulas for parameter estimates is the normal distribution. However, this does not give normal distribution a decisive advantage. Owing to the path breaking EM algorithm of Dempster et.al (1977), and especially Liu and Rubin (1995), explicit iterative formulas are available to obtain fast and monotonically convergent parameter estimates under the *t*. Asset pricing theories that are valid under normality are usually also valid under *t* which is another reason supporting the use of a *t*-distribution. For example, the well-known Capital Asset Pricing Model (CAPM) of Sharpe (1964) and Lintner (1965) is still valid under *t* (see Chamberlain (1983) and Owen and Rabinovitch (1983). In this paper authors made an effort to fit normal and non-normal distribution. Risk and Return oriented consistency Index of Industries for the period from 2010 to 2016 were also analysed using Data envelopment analysis.

2. Data and Methodology

Objectives of the study

1. To know the profile of BSE and the top Industries listed in BSE.
2. To study the Non Normality of returns and Risk of the Indian Industries.
3. To establish a consistency Index based on return and Risk for each year as well as for each Industry.

Hypothesis

H_0 - The Returns of the Indian Industries came from normal distribution
H_1 - The Returns of the Indian Industries departed from normal distribution

Industry Selection

The monthly data of industries such as Automobile, Bank, Capital goods, Consumer durables, FMCG, Health care, IT, Metal, Oil & gas, Realty, Public sector, Power and Telecommunication were selected for the study to know the normality and non-normality of BSE over all industries. The study was conducted for Risk and Returns of industries from January 2010 to April 2016. These Adjusted closing prices of the Industries were collected from BSE website.

3. Theoretical framework of Risk, Return and its Consistency

Traditionally statisticians and financial analysts use Mean and Standard deviation as a measure of expected return and risk. In order to find the consistency of return we can use the tool co-efficient of variance, mathematically we can write the formula as $c_v = \frac{\sigma}{\mu}$. If c_v lies between 0 and 1 then we call the return of the industry or company as low variance returns. On the other hand if c_v is greater than one the return of the security has high variance. If we want to calculate c_v for the returns of multiple industry forms, there are no standard techniques in the literature. Here we introduce consistency index which is calculated as follows.

$$\textbf{Consistency Index} = \frac{\textbf{weighted risk}}{\textbf{weighted return}}$$

Return expresses the amount which an investor actually earned on an investment during a certain period.Return includes the interest, dividend and capital gains; while risk represents the uncertainty associated with a particular task. In

financial terms, risk is the chance or probability that a certain investment may or may not deliver the actual/expected returns. The risk and return trade off says that the potential return rises with an increase in risk. It is important for an investor to decide on a balance between the desire for the lowest possible risk and highest possible return. **Risk** in investment exists because of the inability to make perfect or accurate forecasts. Risk in investment is defined as the variability that is likely to occur in future cash flows from an investment. The greater variability of these cash flows indicates greater risk. Variance or standard deviation measures the deviation about expected cash flows of each of the possible cash flows and is known as the absolute measure of risk; while co-efficient of variation is a relative measure of risk. **Returns -** An investment is the current commitment of funds done in the expectation of earning a greater amount in future. Returns are subject to uncertainty or variance. Longer the period of investment, greater will be the returns sought. An investor will also like to ensure that the returns are greater than the rate of inflation.

4. Normal and Non Normal Distribution Theory

Normality - The normal distribution is considered the most prominent probability distribution in statistics. The first reason for the prominence of normal distribution is that it is very tractable analytically, i.e. a large number of results involving this distribution can be derived in explicit form. The second reason is that normal distribution is the outcome of central limit theorem which states that under mild conditions the sum of a large number of random variables is distributed approximately normally. The final reason is that normal distribution is convenient for modelling a large variety of random variables encountered in practice because the shape of the normal distribution is "bell" shape. The risk measure is the variance of the (active) return of the portfolio or its square root, the tracking error. Tracking error works as a risk measure for portfolios whose returns are assumed to be normally distributed because in such cases the tracking error is the standard deviation of the normal distribution. Standard deviation describes the normal distribution completely, since the mean is assumed to be zero. Therefore, the whole return distribution (i.e., the risk profile of a portfolio) can be characterized by the tracking error in the case of normally distributed assets. **Non Normality –** Even though such incongruous events are rare, we observe such extreme "non-normality" in real-world markets more frequently than current risk management approaches allow for. In other words, we believe that conventionally derived portfolios carry a higher level of downside risk than many investors believe, or current portfolio modelling techniques can

identify. Portfolios that contain derivatives with nonlinear payoffs present a different picture. Since they are not linear functions of underlying primary assets or of factor returns, their distribution cannot be assumed to be normal. If a derivative, such as an option, is introduced into the portfolio, it may change the distribution beyond recognition. In fact, since derivatives are bought with the purpose of altering the risk profile, any risk tool must account for the derivatives' effect, especially their effect on the tails of the distribution.

5. Results and discussion

After data collection, the returns of selected 13 industries were analysed with help of Mathwave Easyfit version 5.5 and Efficiency measurement system 1.3 in two different stages. First, 11 unbounded Probability distributions were fitted for the returns of 13 Industries based on the maximum likelihood method and the estimates were derived. Then we used Kolmogorov-Smirnov and Chi-Squared test to scrutinize the nature of returns distribution. Secondly, Data Envelopment Analysis was applied to establish returns oriented and risk oriented consistency index.

Table-01 visualize the results of Kolmogorov-Smirnov test that is used to check the normality and non-normality for the returns of selected 13 Industries. In order to check the non-normality, authors selected 10 non-normal distributions thatinclude Cauchy, Error, Error Function, Gumble Max, Gumble Min, Hyperbolic Secant, Johnson's SU, Laplace, Logistic, Student's T distribution respectively for the purpose of checking the feasible distribution. The results confirm that the returns of industries follow normal and non-normal distributions other than few exclusions that are departed at 5% significance level. They are Automobile, Consumer durable and FMCG which doesn't follow Error function distribution. Similarly, Consumer durable, Healthcare and Telecommunication doesn't follow Gumble Max and Power Industry departs from Gumble Min. Likewise Consumer durable doesn't follow Johnson's SU distribution and Telecommunication doesn't fit with Johnson's SU. Similarly, the Chi-Squared test is used to check normality and non-normality for the return of selected 13 Industries and the results are shown in Table-2. The results confirm that the industries' follows both normal and non-normal distribution except Consumer durables which is departed from Error function, Gumble max, and Normal distribution at 1% significance level. Similarly, FMCG, Healthcare. PSU, Oil and Gas, Power, Realty and Telecommunication industries depart from Student's T distribution. Whereas, Telecommunication industry has no fit with the Johnson's SU distribution.

Table 1: Test of normality- Kolmogorov-Smirnov test

Industries	Cauchy	Error	Error Function	Gumble Max	Gumble Min	Hyperbolic Secant	Johnson's SU	Laplace	Logistic	Normal	Student's T
Automobile	0.0860	0.0583	0.1614*	0.1518	0.1200	0.0693	0.0821	0.0583	0.0820	0.0979	0.4194
Bank	0.0764	0.0709	0.1036	0.1475	0.0866	0.0682	0.0520	0.0965	0.0740	0.0853	0.3778
Consumer durable	0.1102	0.1223	0.1877*	0.2013*	0.1423	0.1283	0.1644*	0.1223	0.1298	0.1454	0.4976
Capital Goods	0.0969	0.0863	0.1305	0.1509	0.1396	0.1026	0.1033	0.0863	0.1164	0.1387	0.3961
FMCG	0.0724	0.0540	0.1573*	0.1080	0.1157	0.0590	0.0640	0.0597	0.0709	0.0917	0.3889
Health Care	0.0865	0.1166	0.1554	0.1614*	0.0821	0.1055	0.0767	0.1262	0.0991	0.0914	0.4531
IT	0.0894	0.0807	0.1343	0.1511	0.0827	0.0710	0.0703	0.0879	0.0772	0.0851	0.3916
PSU	0.0642	0.0504	0.1301	0.1429	0.1384	0.0654	0.0825	0.0504	0.0790	0.1006	0.3495
Metal	0.0696	0.0892	0.1278	0.1267	0.1348	0.0742	0.0685	0.0913	0.0693	0.0899	0.3811
Oil & Gas	0.0934	0.0758	0.1036	0.1181	0.1019	0.0720	0.0661	0.1003	0.0583	0.0645	0.4157
Power	0.0857	0.0780	0.1051	0.1251	0.1221*	0.0630	0.0761	0.0799	0.0783	0.1008	0.4225
Realty	0.0910	0.0933	0.0899	0.0674	0.1698	0.0959	0.0569	0.0939	0.0979	0.1001	0.3728
Telecommunication	0.0826	0.0889	0.1320	0.1593*	0.0700	0.0889	No Fit	0.0889	0.0889	0.0889	0.3978

*p-value <0.05

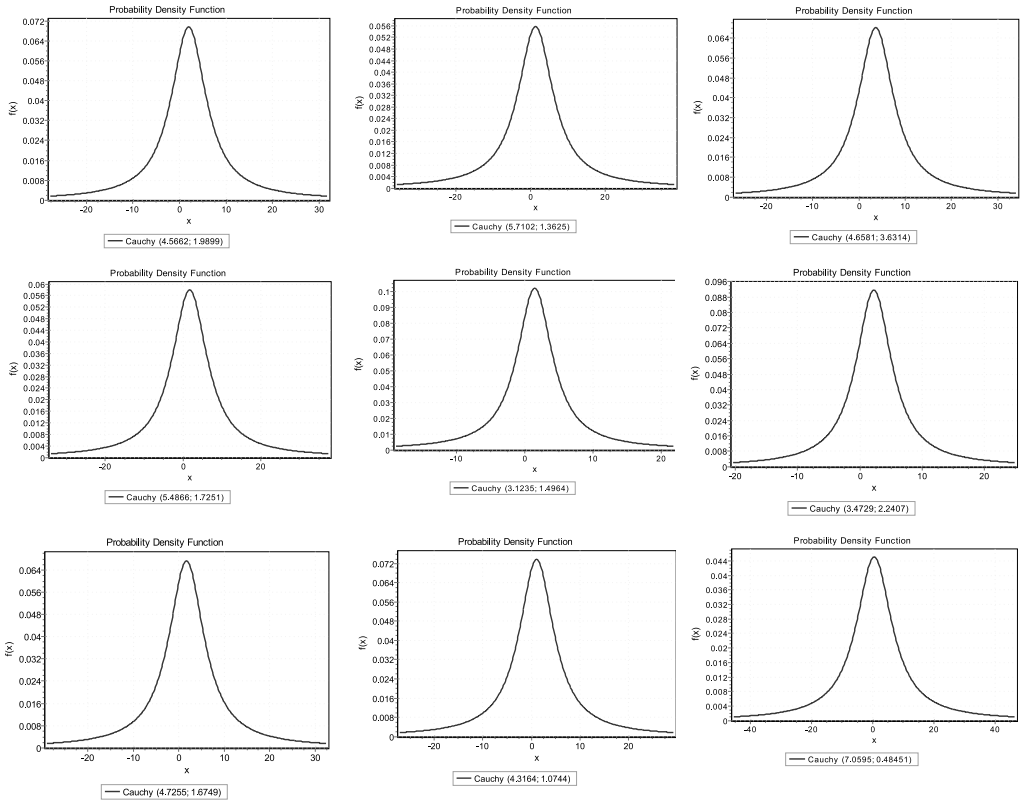
Table 2: Test of normality- Chi-Squared test

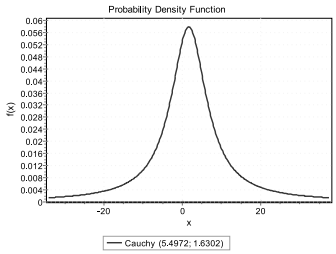
Industries	Cauchy	Error	Error Function	Gumble Max	Gumble Min	Hyperbolic Secant	Johnson's SU	Laplace	Logistic	Normal	Student's T
Automobile	3.2778	1.1956	4.4145	5.3025	7.3035	0.99979	1.0813	5.213	0.64316	3.2957	56.864
Bank	3.9129	0.67297	5.4963	8.7262	1.8928	1.5336	1.6553	6.3966	1.9009	4.7297	41.545
Consumer durable	6.3596	5.1748	17.409*	17.653*	9.2044	0.04831	5.2024	5.1748	12.219	16.409*	17.533
Capital Goods	11.001	5.5007	11.243	13.207	5.1694	3.3584	7.47	5.5007	5.4421	9.8251	32.382
FMCG	2.6196	5.9011	8.3167	5.435	6.7943	3.5776	4.3797	3.8351	2.1596	5.0399	104.35*
Health care	3.6892	7.9727	8.6001	7.6346	1.7139	7.0553	4.4059	5.9254	8.9813	10.752	52.39
IT	2.1946	1.3548	2.8434	5.1072	1.677	3.1418	2.8192	5.3816	1.5399	5.189	61.363
PSU	3.5921	3.65	9.5606	6.98	7.7403	4.1297	5.2292	3.65	5.9691	9.8972	96.072*
Metal	4.7039	6.7775	6.2361	8.8572	12.368	5.4307	1.1389	6.7804	25,264	3.6366	53.019
Oil & Gas	10.633	1.8194	6.5228	7.7415	5.4356	2.3394	0.84447	5.9995	0.4725	0.78897	153.3*
Power	4.6284	5.7337	7.9217	10.824	8.7973	2.3182	6.9601	7.1933	3.4819	5.9875	146.33*
Realty	2.3712	5.1153	5.759	4.9608	11.535	3.3607	5.3363	4.6573	1.5056	4.2421	136.79*
Telecommunication	2.608	5.4465	5.6738	11.344	5.2363	3.0882	No Fit	3.5381	4.3869	4.7162	113.86*

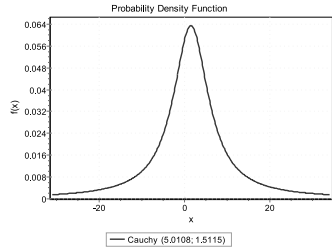
*p-value<0.0

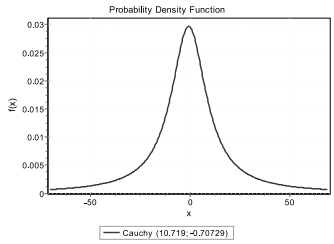
Table 3: Fitted parameters of Cauchy distribution for selected Industries returns

Industry	parameters	
	σ (scale)	μ (location)
Automobile	4.5662	1.9899
Bank	5.7102	1.3625
Consumer durable	4.6581	3.6314
Capital Goods	5.4866	1.7251
FMCG	3.1235	1.4964
Health care	3.4729	2.2407
IT	4.7255	1.6749
PSU	4.3164	1.0744
Metal	7.0595	0.48451
Oil & Gas	5.4972	1.6302
Power	5.0108	1.5115
Realty	10.719	-0.70729
Telecommunication	4.0392	1.913









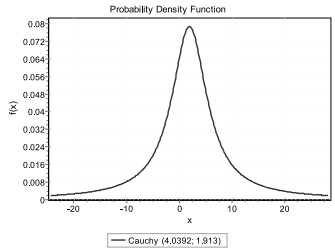
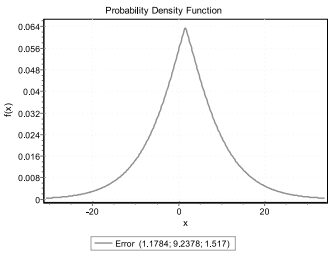
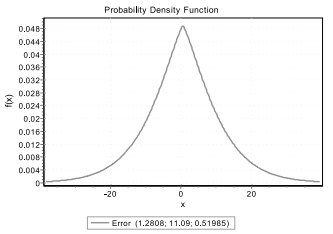
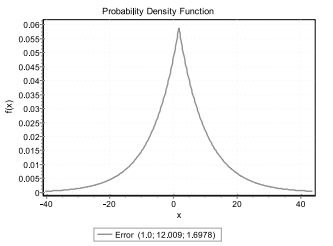


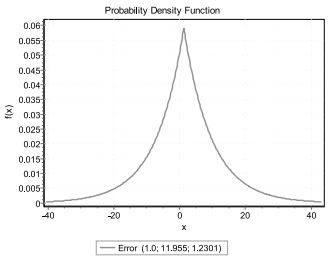
Table 4: Fitted parameters of Error distribution for selected Industries returns

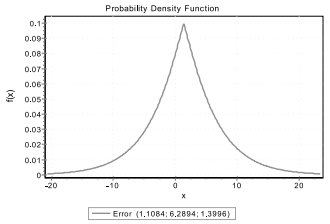
Industry	Parameter		
	σ (scale)	μ (location)	K (shape)
Automobile	9.2378	1.517	1.1784
Bank	11.09	0.51985	1.2808
Consumer durable	12.009	1.6978	1
Capital Goods	11.955	1.2301	1
FMCG	6.2894	1.3996	1.1084
Health care	7.0429	1.1573	1.1399
IT	8.2393	1.021	1.7403
PSU	9.885	0.92763	1
Metal	14.488	1.7429	1.0327
Oil & Gas	9.5557	1.3519	1.2637
Power	10.408	0.95167	1.0296
Realty	21.186	2.3234	1.1311
Telecommunication	7.5928	0.82069	1.8288

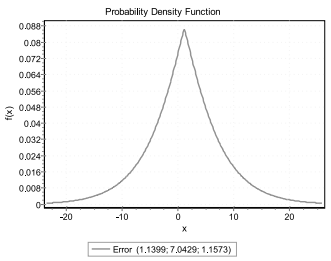


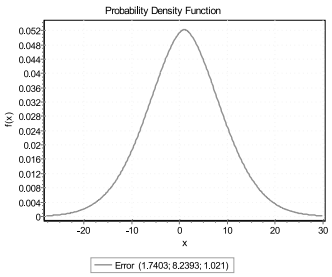





Probability Density Function
f(x)
x
Error (1.0; 11.955; 1.2301)


Probability Density Function
f(x)
x
Error (1.1084; 6.2894; 1.3996)


Probability Density Function
f(x)
x
Error (1.1399; 7.0429; 1.1573)


Probability Density Function
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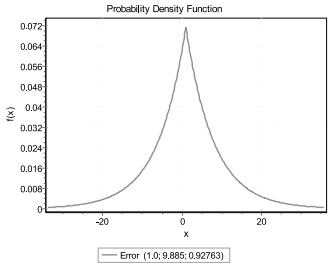
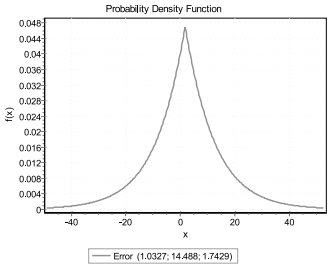
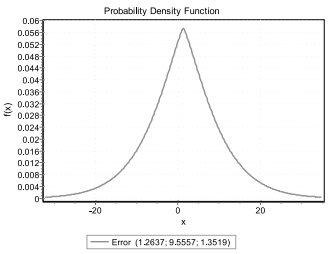
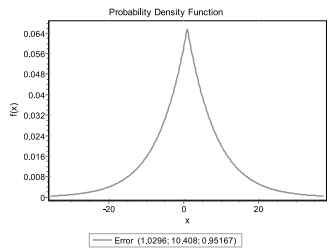
x
Error (1.7403; 8.2393; 1.021)


Probability Density Function
f(x)
x
Error (1.0; 9.885; 0.92763)


Probability Density Function
f(x)
x
Error (1.0327; 14.488; 1.7429)


Probability Density Function
f(x)
x
Error (1.2637; 9.5557; 1.3519)


Probability Density Function
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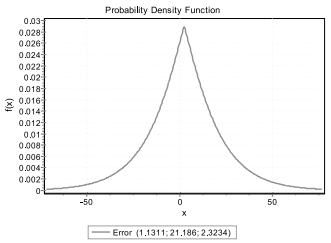
x
Error (1.0296; 10.408; 0.95167)


Probability Density Function
f(x)
x
Error (1.1311; 21.186; 2.3234)

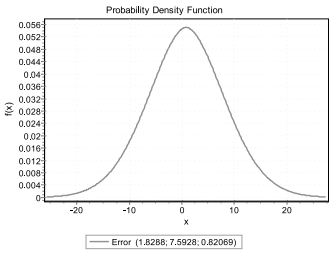
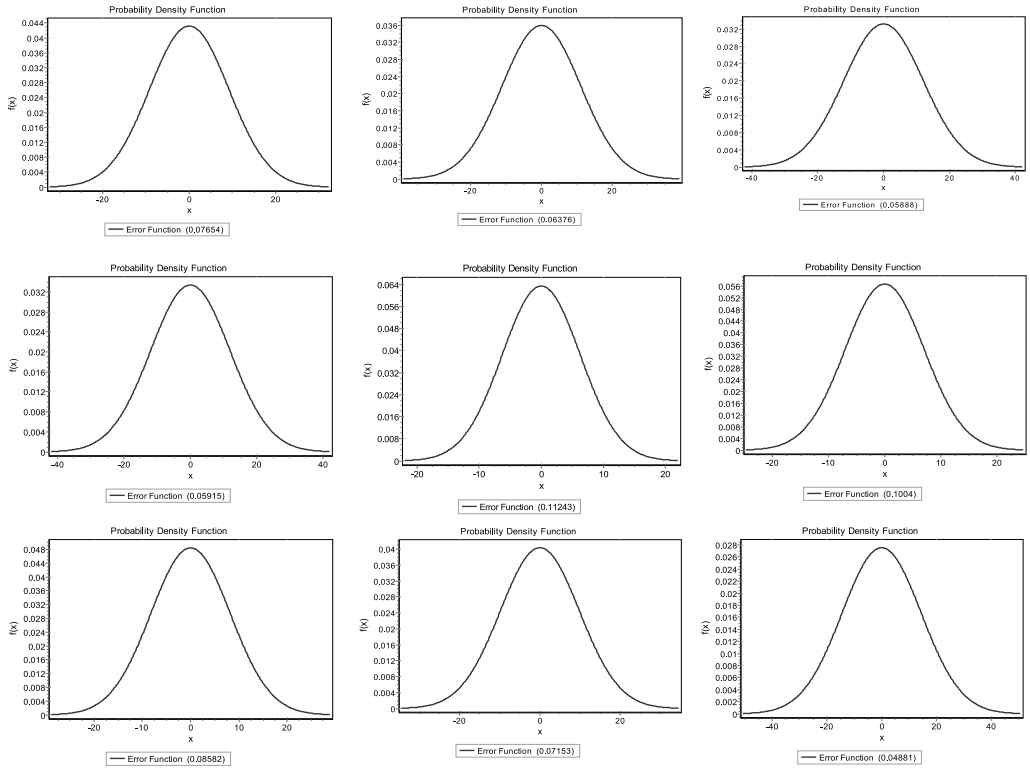

Probability Density Function
f(x)
x
Error (1.8288; 7.5928; 0.82069)

Table 5: Fitted Parameters of Error function distribution for selected Industries returns

Industry	Parameter
	***h* (scale)**
Automobile	0.07654
Bank	0.06376
Consumer durable	0.05888
Capital Goods	0.05915
FMCG	0.11243
Health care	0.1004
IT	0.08582
PSU	0.07153
Metal	0.04881
Oil & Gas	0.074
Power	0.06794
Realty	0.03338
Telecommunication	0.09313



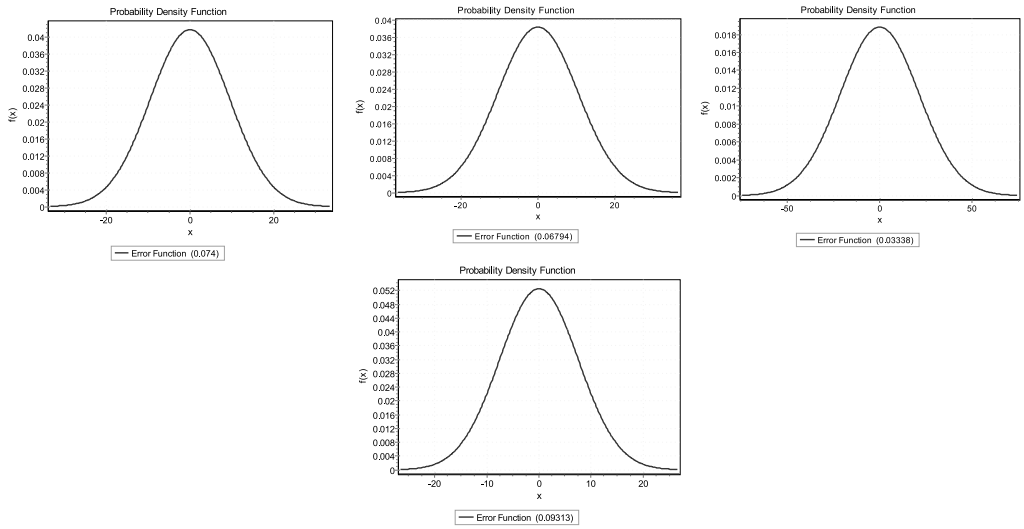
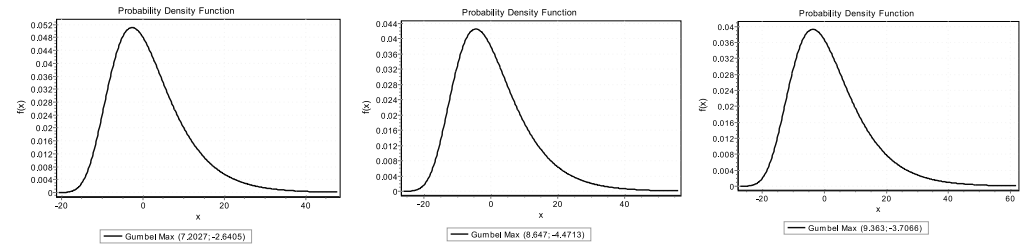
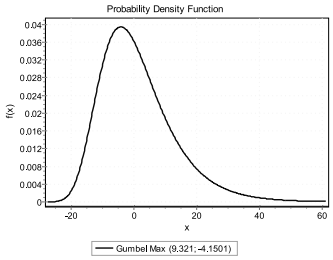
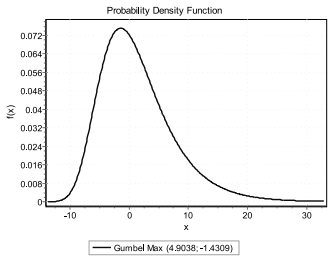


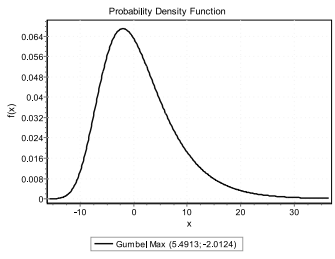
Table 6: Fitted Parameters of Gumble max distribution for selected Industries returns

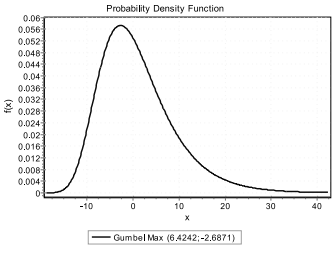
Industry	Parameter	
	σ (scale)	μ (location)
Automobile	7.2027	-2.6405
Bank	8.647	-4.4713
Consumer durable	9.363	-3.7066
Capital Goods	9.321	-4.1501
FMCG	4.9038	-1.4309
Health care	5.4913	-2.0124
IT	6.4242	-2.6871
PSU	7.7073	-3.5211
Metal	11.296	-4.7774
Oil & Gas	7.4506	-2.9487
Power	8.1152	-3.7325
Realty	16.519	-7.2114
Telecommunication	5.9201	-2.5965

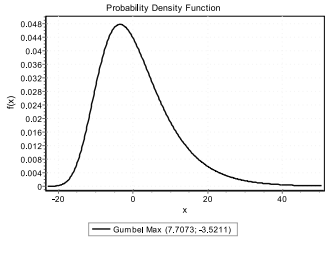


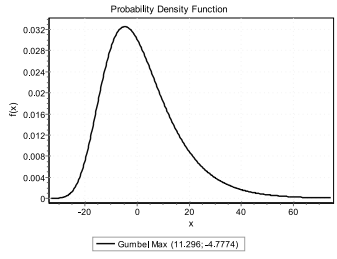

Probability Density Function
f(x)
x
Gumbel Max (9.321; -4.1501)

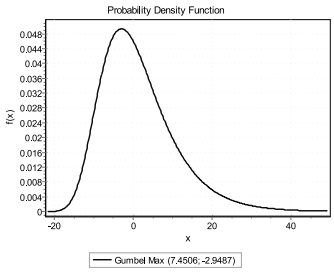

Probability Density Function
f(x)
x
Gumbel Max (4.9038; -1.4309)

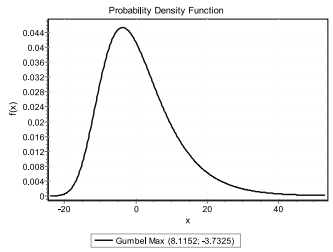

Probability Density Function
f(x)
x
Gumbel Max (5.4913; -2.0124)

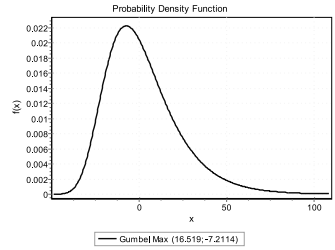

Probability Density Function
f(x)
x
Gumbel Max (6.4242; -2.6871)


Probability Density Function
f(x)
x
Gumbel Max (7.7073; -3.5211)


Probability Density Function
f(x)
x
Gumbel Max (11.296; -4.7774)


Probability Density Function
f(x)
x
Gumbel Max (7.4506; -2.9487)


Probability Density Function
f(x)
x
Gumbel Max (8.1152; -3.7325)


Probability Density Function
f(x)
x
Gumbel Max (16.519; -7.2114)

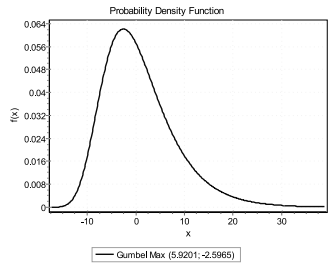
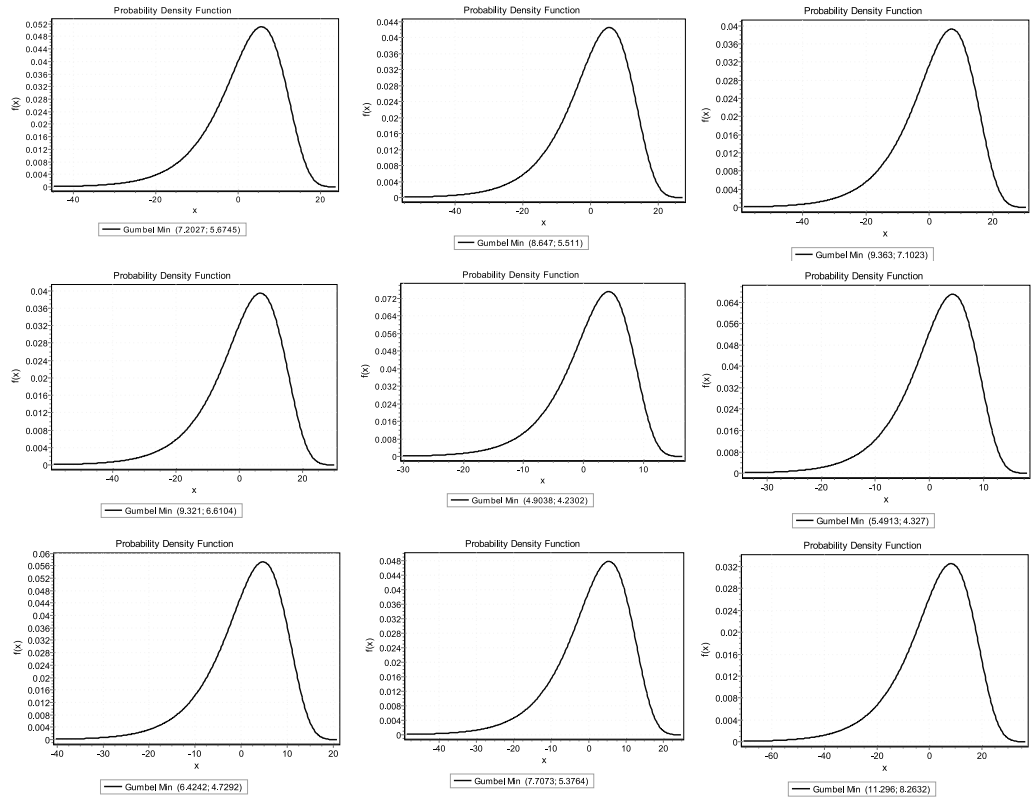

Probability Density Function
f(x)
x
Gumbel Max (5.9201; -2.5965)

Table 7: Fitted Parameters of Gumble min distribution for selected Industries returns

Industry	Parameter	
	σ (scale)	μ (location)
Automobile	7.2027	5.6745
Bank	8.647	5.511
Consumer durable	9.363	7.1023
Capital Goods	9.321	6.6104
FMCG	4.9038	4.2302
Health care	5.4913	4.327
IT	6.4242	4.7292
PSU	7.7073	5.3764
Metal	11.296	8.2632
Oil & Gas	7.4506	5.6525
Power	8.1152	5.6359
Realty	16.519	11.858
Telecommunication	5.9201	4.2379



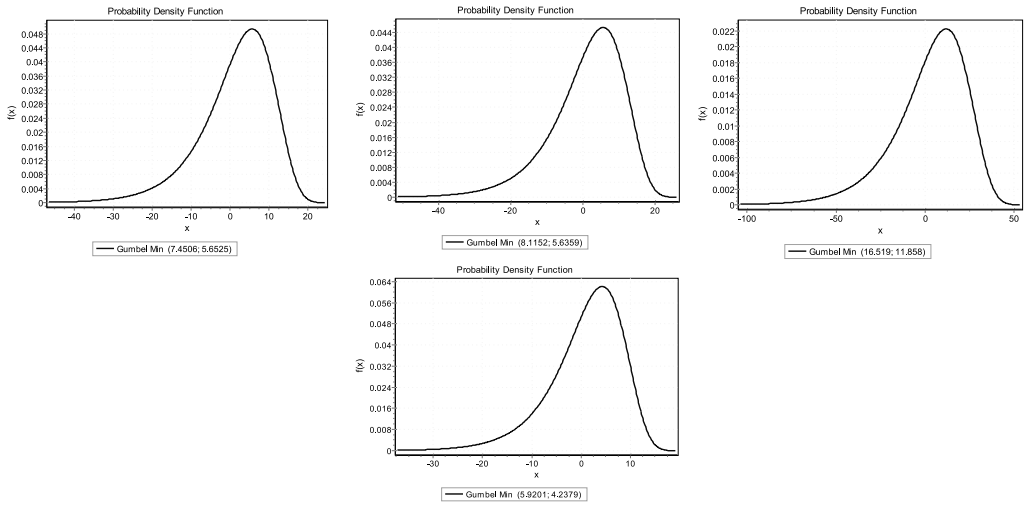
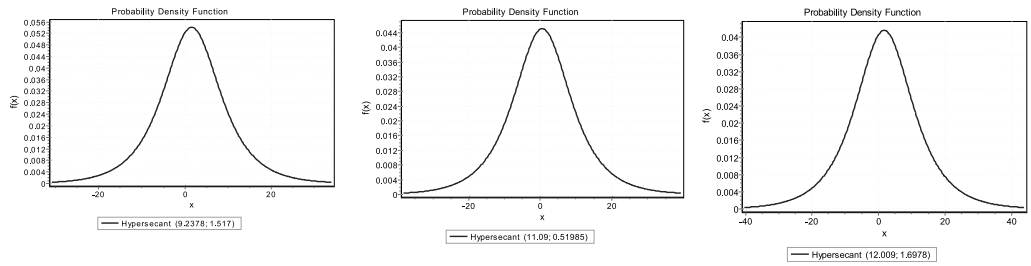
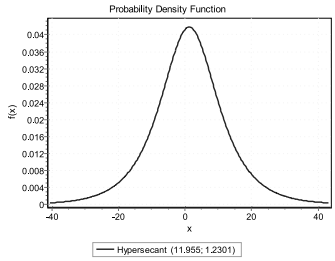
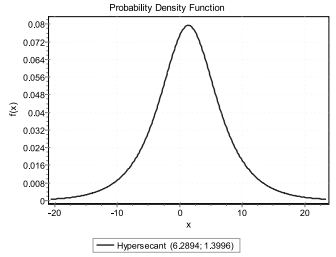


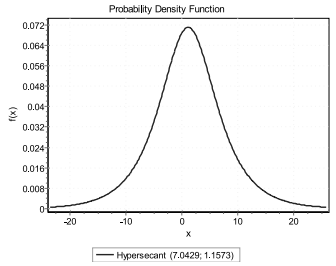
Table 8: Fitted Parameters of Hyperbolic Secant distribution for selected Industries returns

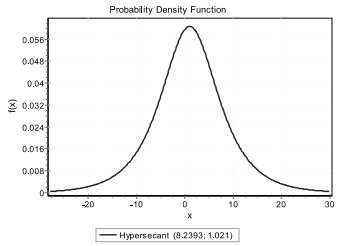
Industry	Parameter	
	σ (scale)	μ (location)
Automobile	9.2378	1.517
Bank	11.09	0.51985
Consumer durable	12.009	1.6978
Capital Goods	11.955	1.2301
FMCG	6.2894	1.3996
Health care	7.0429	1.1573
IT	8.2393	1.021
PSU	9.885	0.92763
Metal	14.488	1.7429
Oil & Gas	9.5557	1.3519
Power	10.408	0.95167
Realty	21.186	2.3234
Telecommunication	7.5928	0.82069

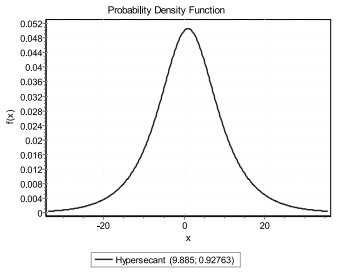


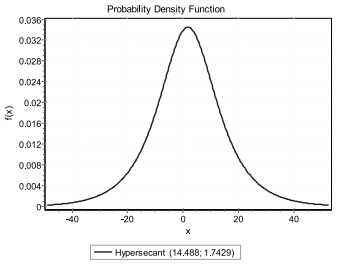

Probability Density Function
f(x)
x
Hypersecant (11.955; 1.2301)

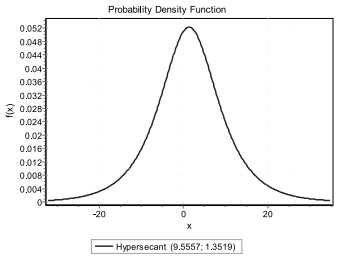

Probability Density Function
f(x)
x
Hypersecant (6.2894; 1.3996)

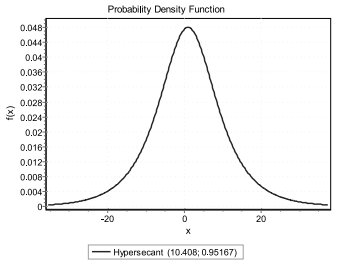

Probability Density Function
f(x)
x
Hypersecant (7.0429; 1.1573)

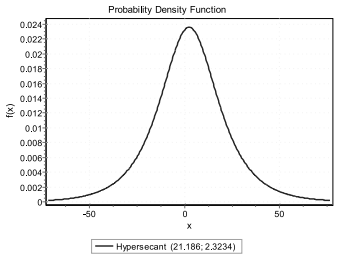

Probability Density Function
f(x)
x
Hypersecant (8.2393; 1.021)


Probability Density Function
f(x)
x
Hypersecant (9.885; 0.92763)


Probability Density Function
f(x)
x
Hypersecant (14.488; 1.7429)


Probability Density Function
f(x)
x
Hypersecant (9.5557; 1.3519)


Probability Density Function
f(x)
x
Hypersecant (10.408; 0.95167)


Probability Density Function
f(x)
x
Hypersecant (21.186; 2.3234)

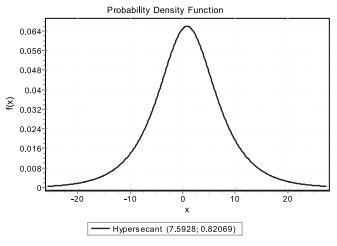
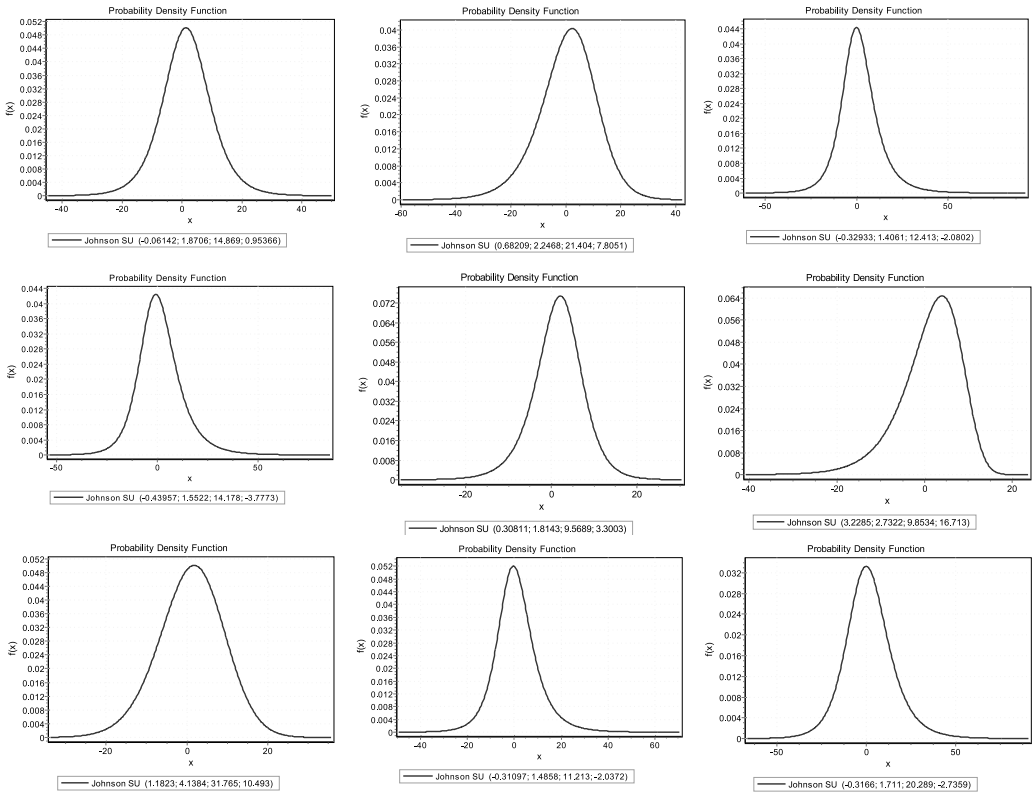

Probability Density Function
f(x)
x
Hypersecant (7.5928; 0.82069)

Table 9: Fitted parameters of Johnson's SU distribution for selected Industries returns

Industry	Parameter			
	ϒ (shape)	δ(shape)	λ (scale)	ξ (location)
Automobile	-0.06142	1.8706	14.869	0.95366
Bank	0.68209	2.2468	21.404	7.8051
Consumer durable	-0.32933	1.4061	12.413	-2.0802
Capital Goods	-43957	1.5522	14.178	-3.7773
FMCG	0.30811	1.8143	9.5689	3.3003
Health care	3.2285	2.7322	9.8534	16.713
IT	1.18233	4.1384	31.765	10.493
PSU	-0.31097	1.4858	11.213	-2.0372
Metal	-0.3166	1.711	20.289	-2.7359
Oil & Gas	0.2167	2.0434	17.132	3.4037
Power	-0.21068	1.6768	14.323	-1.2039
Realty	-2.2544	2.5198	33.821	-34.96
Telecommunication	No fit			



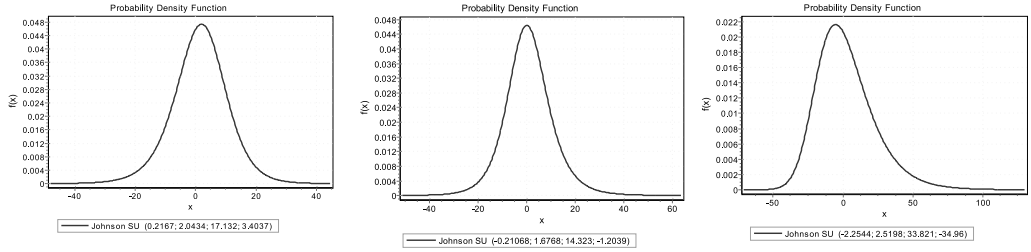
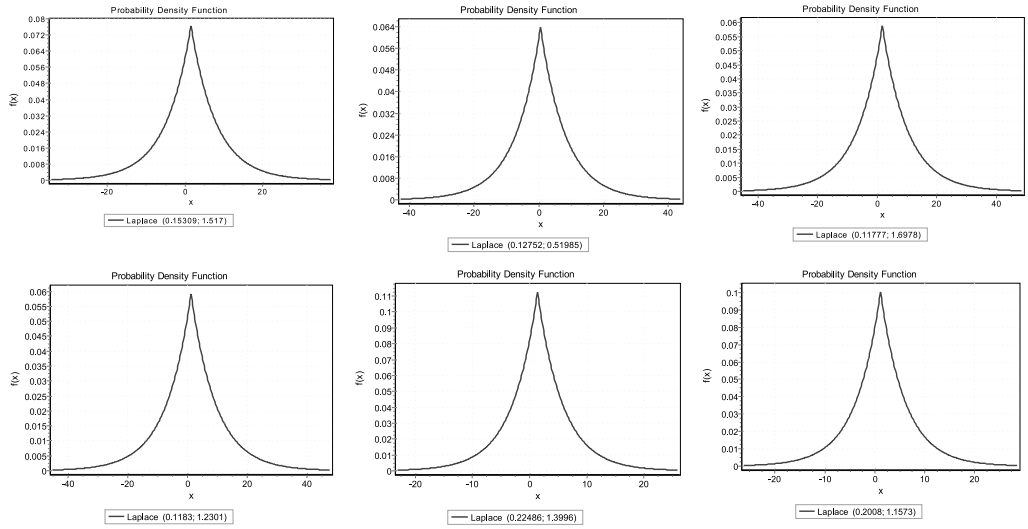


Table 10: Fitted Parameters of Laplace distribution for selected Industries returns

Industry	Parameter	
	μ (location)	λ (scale)
Automobile	1.517	0.15309
Bank	0.51985	0.12752
Consumer durable	1.6978	0.11777
Capital Goods	1.2301	0.1183
FMCG	1.3996	0.22486
Health care	1.1573	0.2008
IT	1.021	0.17164
PSU	0.92763	0.14307
Metal	1.7429	0.09761
Oil & Gas	1.3519	0.148
Power	0.95167	0.13588
Realty	2.3234	0.06675
Telecommunication	0.82069	0.18626



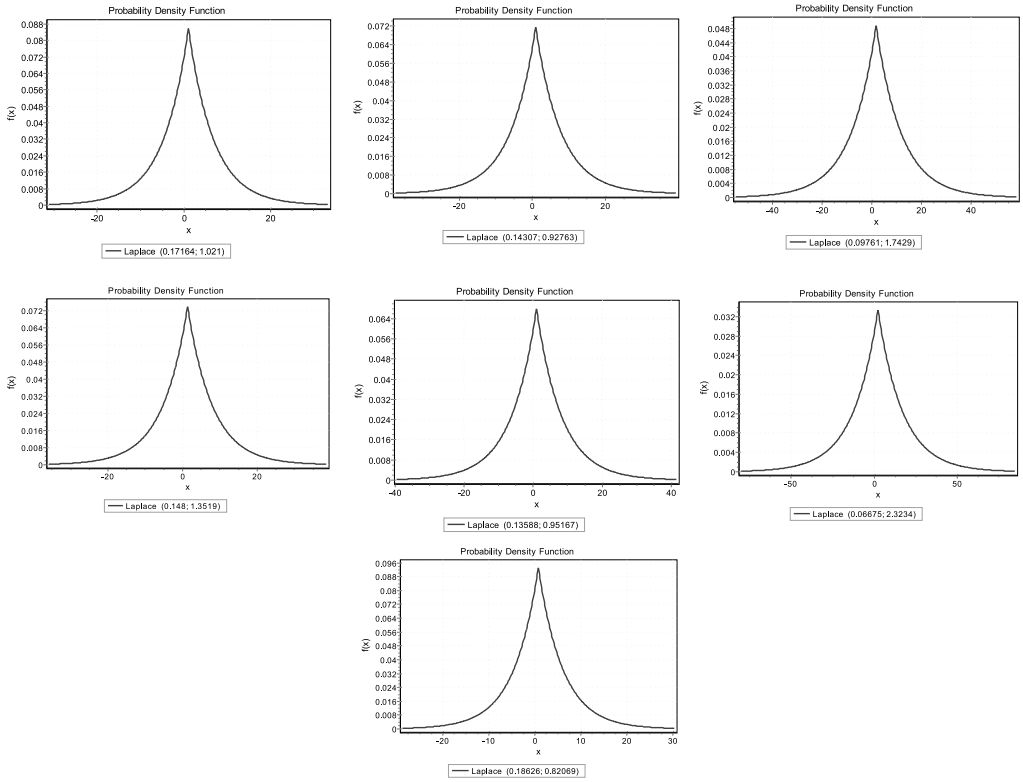
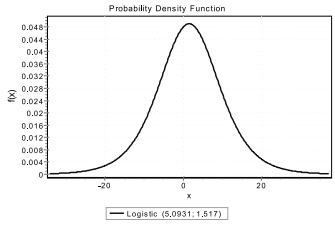
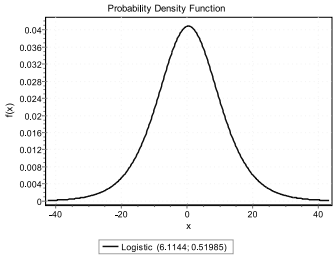
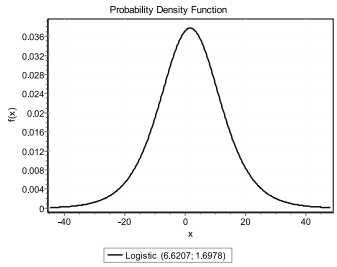


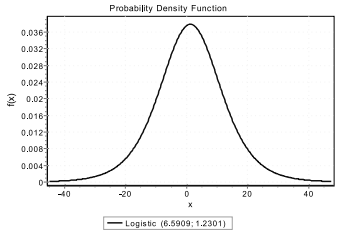
Table 11: Fitted parameters of Logistic for selected Industries returns

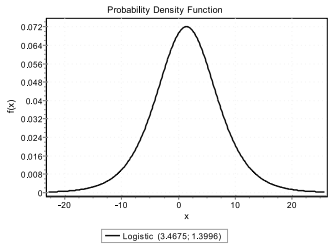
Industry	Parameter	
	σ (scale)	μ (location)
Automobile	5.0931	1.517
Bank	6.1144	0.51985
Consumer durable	6.6207	1.6978
Capital Goods	6.5909	1.2301
FMCG	3.4675	1.3996
Health care	3.883	1.1573
IT	4.5426	1.021
PSU	5.4499	0.92763
Metal	7.9876	1.7429
Oil & Gas	5.2684	1.3519
Power	5.7383	0.95167
Realty	11.68	2.3234
Telecommunication	4.1861	0.82069

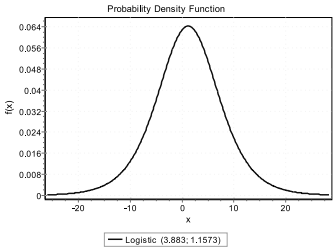

Probability Density Function
f(x)
x
Logistic (5.0931; 1.517)

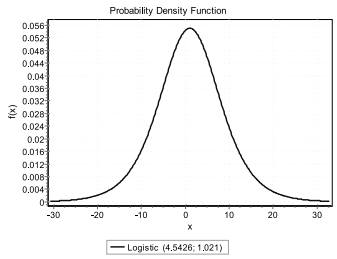

Probability Density Function
f(x)
x
Logistic (6.1144; 0.51985)

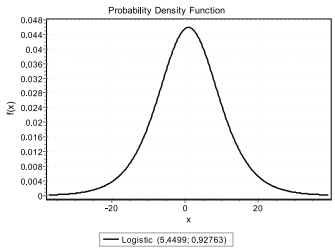

Probability Density Function
f(x)
x
Logistic (6.6207; 1.6978)

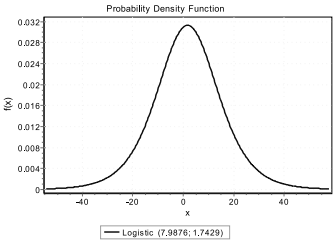

Probability Density Function
f(x)
x
Logistic (6.5909; 1.2301)

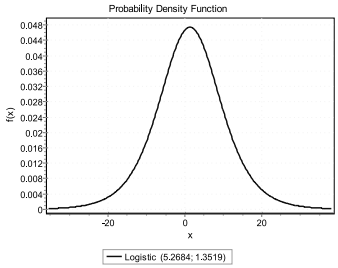

Probability Density Function
f(x)
x
Logistic (3.4675; 1.3996)

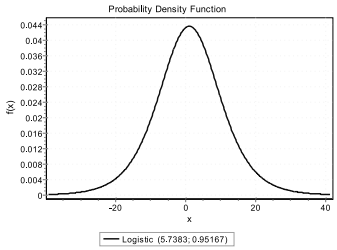

Probability Density Function
f(x)
x
Logistic (3.883; 1.1573)

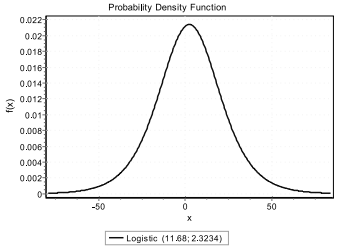

Probability Density Function
f(x)
x
Logistic (4.5426; 1.021)


Probability Density Function
f(x)
x
Logistic (5.4499; 0.92763)


Probability Density Function
f(x)
x
Logistic (7.9876; 1.7429)


Probability Density Function
f(x)
x
Logistic (5.2684; 1.3519)


Probability Density Function
f(x)
x
Logistic (5.7383; 0.95167)


Probability Density Function
f(x)
x
Logistic (11.68; 2.3234)

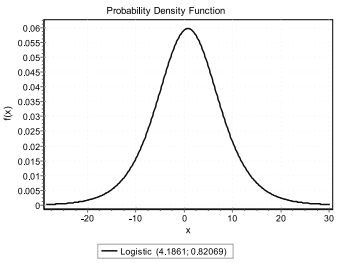
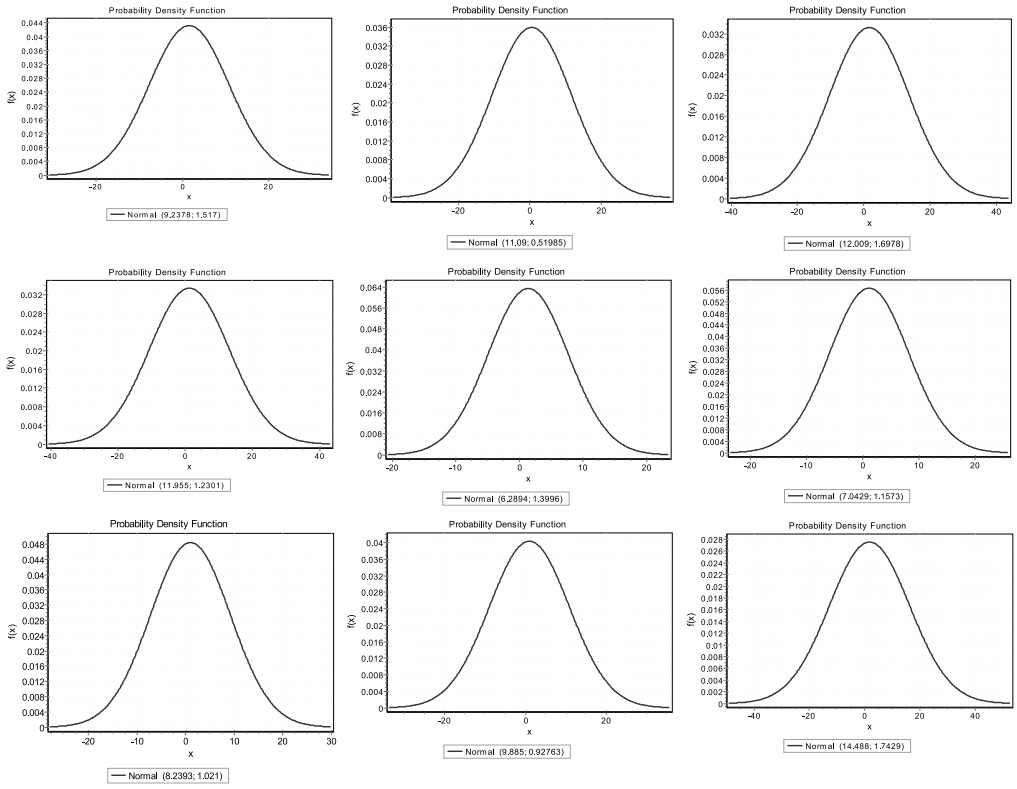

Probability Density Function
f(x)
x
Logistic (4.1861; 0.82069)

Table 12: Fitted parameters of Normal distribution for selected Industries returns

Industry	Parameter	
	σ (scale)	μ (location)
Automobile	9.2378	1.517
Bank	11.09	0.51985
Consumer durable	12.009	1.6978
Capital Goods	11.955	1.2301
FMCG	6.2894	1.3996
Health care	7.0429	1.1573
IT	8.2393	1.021
PSU	9.885	0.92763
Metal	14.488	1.7429
Oil & Gas	9.5557	1.3519
Power	10.408	0.95167
Realty	21.186	2.3234
Telecommunication	7.5928	0.82069



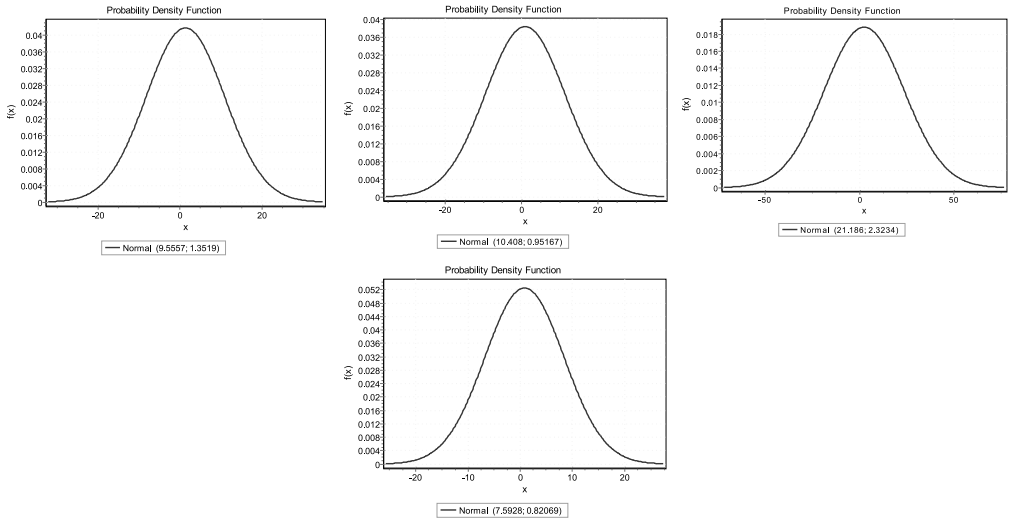


Table 13: Parameters of Student's T distribution for selected Industries

Industry	Parameter
	V (df)
Automobile	2
Bank	2
Consumer durable	2
Capital Goods	2
FMCG	2
Health care	2
IT	2
PSU	2
Metal	2
Oil & Gas	2
Power	2
Realty	2
Telecommunication	2

df - degrees of freedom

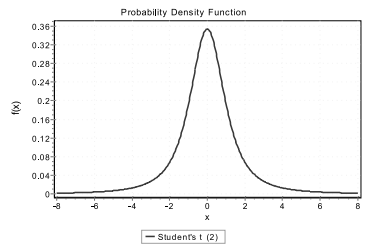


Table 14: Year-wise Risk and Return Oriented Consistency Index of Industry Returns

Year	Risk			Return		
	Consistency Index	Score (in %)	Rank	Consistency Index	Score (in %)	Rank
2010	0.7903	79.03	4	1.2653	126.53	4
2011	0.7084	70.84	3	1.4116	141.16	5
2012	0.4762	47.62	2	2.0998	209.98	6
2013	0.3819	38.19	1	2.6185	261.85	7
2014	0.8546	85.46	6	1.1702	117.02	2
2015	0.813	81.3	5	1.23	123	3
2016	1.1479	114.79	7	0.8712	87.12	1

Table 15: Industry-wise Risk and Return Oriented Consistency Index of Industry Returns

Industry	Risk				Return			
	Consistency Index	Score	Rank	Benchmark Industry	Consistency Index	Score	Rank	Benchmark Industry
Auto	0.6402	64.02	3	Capital Goods	1.5619	156.19	11	Capital Goods
Bank	0.8112	81.12	5	Capital Goods	1.2327	123.27	9	Capital Goods
Consumer Durable	0.5441	54.41	2	FMCG	1.8378	183.78	12	FMCG
Capital Goods	0.9116	91.16	7	Auto	1.097	109.7	7	Auto
FMCG	1.0268	102.68	8	Consumer Durable	0.9739	97.39	6	Consumer Durable
Health Care	1.2817	128.17	12	Bank	0.7802	78.02	2	Bank
IT	1.0675	106.75	9	Bank	0.9367	93.67	5	Bank
PSU	1.2762	127.62	11	Consumer Durable	0.7836	78.36	3	Consumer Durable
Metal	0.6737	67.37	4	Capital Goods	1.4844	148.44	10	Capital Goods
Oil&Gas	1.151	115.1	10	Metal	0.8688	86.88	4	Metal
Power	0.8564	85.64	6	Bank	1.1677	116.77	8	Bank
Realty	0.0997	9.97	1	Capital Goods	10.0305	1003.05	13	Capital Goods
Telecommunication	1.4471	144.71	13	Bank	0.691	69.1	1	Bank

The results of Table-3 to Table-13 explains the Parameter (location, Scale, and Shape) of each distribution that is fitted for each Industries returns. Table-14 visualize the Risk and Return-oriented consistency Index of Industries for the period from 2010 to 2016. In order to highlight the Risk oriented consistency Index, Mini-Min procedure is adopted and also non-parametric Data Envelopment Analysis is used. Among the Seven Periods, for the year 2013 the Risk oriented consistency Index is high (38.19%) followed by the years 2012 and 2011. This shows the Risk of the Indian Industry in BSE at the year 2013 has a low variance (less than one), and for the years 2016, the variance is high for Risk (more than one). Hence from this analysis it is clear that investments in securities from the above-selected industries need a close monitoring to avoid an immediate loss. The risk seems to be consistent and unfortunately, the risk for the year 2016 is relatively high and this gives a cautious call to the investors. Any sensitive information will create a sudden burst of a bubble in the market. Hence, the authors conclude that there is a high risk in the market for 2016. Table-15 visualize the return-oriented consistency Index of industries for the period 2010 to 2016. In order to highlight the Return-oriented consistency Index authors adopted Mini-Max procedure and Non parametric Data Envelopment Analysis. Among the Seven Periods for the year 2016 the Return-oriented consistency Index is high (87.12%) followed by the years 2014 and 2015. This shows that the Returns of the Indian Industry in BSE during the year 2016 was having low variance (less than one), and for the years 2014 and 2015 was having high variance returns (more than One). Hence from this analysis, we can conclude that the Indian investors and foreign investors can invest their funds and they are having the wide opportunity because of the consistency in Returns of Indian industries. Even though the return is expected to be high for the year the investor should also take account of the risk factor that prevails for the year. From table 14 the author found out there is a possibility of having a high risk for the same year. This brings the market with a nature of high risk and high return. When the investor is ready then it is good to take a high risk. Also, investing wisely and taking proper decisions will yield good returns over their invested amount.

6. Conclusion

The above study concludes that the author found out there is a possibility of investing in high risk investments wisely and taking proper decisions will yield good returns over their invested amount. Each industry follows a separate

statistical distribution which explains the nature of returns for each industry which differs from one another and consistency index gives an insight that the investors have a good opportunity to achieve good returns because of the consistency in the returns of Indian industries listed in BSE.

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