

# MA374 Financial Engineering lab: 08

Name: Naman Goyal

Roll No. 180123029

- To execute my .py file  
Run `$python3 180123029_NamanGoyal.py` on the terminal. The snapshot is shown below:

Ques.1

- The historical Volatility of the stocks for a period of 20 Working days in a month is shown below:

```
~/Desktop/IITG_SEMVI/FE_Labs/lab08
> python3 180123029_NamanGoyal.py
-----Q1-----

For BSE Companies
Historical Volatility for Bharat-Airtel : 0.43864
Historical Volatility for CoalIndia : 0.14542
Historical Volatility for Infosys : 0.26847
Historical Volatility for Asian Paints : 0.24283
Historical Volatility for State Bank of India : 0.24923
Historical Volatility for Wipro : 0.29060
Historical Volatility for Reliance : 0.22426
Historical Volatility for Axis Bank : 0.24174
Historical Volatility for Tata Motors : 0.39140
Historical Volatility for Tata Steel : 0.26135

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For NSE Companies
Historical Volatility for BHEL : 0.29109
Historical Volatility for Bank of Baroda : 0.30860
Historical Volatility for Britannia : 0.22613
Historical Volatility for Colgate : 0.22512
Historical Volatility for Dabur : 0.30637
Historical Volatility for Godrej : 0.37628
Historical Volatility for Reliance : 0.22153
Historical Volatility for Asian Paints : 0.22988
Historical Volatility for Berger Paints : 0.30350
Historical Volatility for MuthootFinance : 0.23235
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```

## Ques.2

- The BSM price of European Call and Put Options at  $t = 0$  are calculated using sigma (calculated using the data from the past 1 month) as the historical volatility and  $K = 50$ .

-----Q2-----

For BSE Companies ( $K = 50$ )

Bharat-Airtel

Call Price = 38.70297

Put Price = 31.59620

CoalIndia

Call Price = 13.19999

Put Price = 7.16820

Infosys

Call Price = 58.43612

Put Price = 41.98018

Asian Paints

Call Price = 108.44034

Put Price = 75.23464

State Bank of India

Call Price = 23.42734

Put Price = 16.40671

Wipro

Call Price = 22.84418

Put Price = 16.82875

Reliance

Call Price = 88.23904

Put Price = 59.39609

Axis Bank  
Call Price = 50.26802  
Put Price = 34.81820

Tata Motors  
Call Price = 20.88978  
Put Price = 16.64432

Tata Steel  
Call Price = 45.45249  
Put Price = 32.36057

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For NSE Companies (K = 50)  
BHEL  
Call Price = 6.39913  
Put Price = 4.71650

Bank of Baroda  
Call Price = 10.36996  
Put Price = 7.77627

Britannia  
Call Price = 241.05121  
Put Price = 162.78980

Colgate  
Call Price = 92.41152  
Put Price = 62.29825

Dabur  
Call Price = 40.13371  
Put Price = 30.03299

Godrej  
Call Price = 77.81321  
Put Price = 61.43874

Reliance  
Call Price = 86.49477  
Put Price = 57.93855

```
Asian Paints
Call Price = 103.74100
Put Price = 70.50938
```

```
Berger Paints
Call Price = 31.12031
Put Price = 23.22442
```

```
MuthootFinance
Call Price = 35.19072
Put Price = 24.01598
```

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- Now the tables obtained for different stocks in BSE are shown:

#### ASIAN PAINTS

Strike	Call Price	Put Price
672.450012	689.053365848228	0.000503895398931
806.9400144	557.927101962923	0.043672419528031
941.4300168	427.585065732056	0.871068598095684
1075.9200192	302.293097936177	6.74853321165053
1210.4100216	192.245919486527	27.8707871714349
1344.900024	108.440335935496	75.2346360298379
1479.3900264	54.2454039914425	152.209136495219
1613.8800288	24.2980388901088	253.431203803319
1748.3700312	9.88519659072064	370.187793913366
1882.8600336	3.70830194775027	495.18033167983
2017.350036	1.30108308129322	623.942545222807

**AXIS BANK**

Strike	Call Price	Put Price
312.875	320.600125314913	0.000214040777262
375.45	259.589114846841	0.019221317878475
438.025	198.931963565287	0.392087781497455
500.6	140.590668756195	3.08081071757795
563.175	89.3134440871424	12.8336037936987
625.75	50.268020999698	34.818198451427
688.325	25.0571829830532	70.6373781799551
750.9	11.1697098239808	117.779922766056
813.475	4.51695429406585	172.157184981314
876.05	1.68262093651645	230.352869368937
938.625	0.58573470771117	290.286000885305

**BHARAT-AIRTEL**

Strike	Call Price	Put Price
143.919403	147.6888794854	0.21609376450018
172.7032836	120.556615268743	1.15703360366308
201.4871642	95.1806798942277	3.8543022849679
230.2710448	72.6653898398989	9.41221628645909
259.0549254	53.7677199097465	18.5877504121268
287.838806	38.7029664838177	31.5962010420179
316.6226866	27.2160925098608	48.1825311238812
345.4065672	18.7741675710787	67.813810240919
374.1904478	12.7520812694779	89.8649279951383
402.9743284	8.55676759956762	113.742818381048
431.758209	5.68796232593013	138.947217163231

**COAL INDIA**

Strike	Call Price	Put Price
122.1500015	125.165895782778	3.4593539189808E-12
146.5800018	101.339074663368	3.24038287153943E-07
171.0100021	77.5127642999869	0.00051140410288
195.4400024	53.7433622144927	0.057930762053762
219.8700027	31.0045644980259	1.14595448903214
244.300003	13.1999920646435	7.1682034990948
268.7300033	3.81787687229127	21.6129097501878
293.1600036	0.742821267546514	42.3646755888881
317.5900039	0.10093046127874	65.5496062260655
342.0200042	0.010104305876035	89.285601514108
366.4500045	0.000786212167532	113.103104863845

**INFOSYS**

Strike	Call Price	Put Price
333.25	341.479581960614	0.001610144056149
399.9	276.541575906812	0.068009726941954
466.55	212.328962268952	0.859801725770721
533.2	151.460575678657	4.99582077216343
599.85	98.7384118576808	17.2780625878761
666.5	58.4361230215641	41.9801793884477
733.15	31.4919855256104	80.0404475291824
799.8	15.5952110660231	129.148078706283
866.45	7.17941903023835	185.736692307187
933.1	3.10902352994732	246.670702443584
999.75	1.28035102001246	309.846435570338

**RELIANCE**

Strike	Call Price	Put Price
584.0999755	598.521533063933	7.77845890089181E-05
700.9199706	484.599044109151	0.013287973938104
817.7399657	371.056867329407	0.406810338326129
934.5599608	260.835024234542	4.12066638759224
1051.3799559	162.805277825792	20.0266191229736
1168.199951	88.2390447118874	59.3960851531997
1285.0199461	41.349944450444	126.442684035888
1401.8399412	16.9168783750697	215.945317104644
1518.6599363	6.14345360810621	319.107591481812
1635.4799314	2.01714528721309	428.91698230505
1752.2999265	0.609371651930426	541.444907813899

**STATE BANK OF INDIA**

Strike	Call Price	Put Price
142.175003	145.685494580625	0.000178249183118
170.6100036	117.965026560275	0.012648162544783
199.0450042	90.4417075025225	0.222267038503591
227.4800048	64.0767026463467	1.59020011603932
255.9150054	41.0081580948727	6.25459349827691
284.350006	23.4273365810341	16.4067099181499
312.7850066	11.9572810087536	32.669592279581
341.2200072	5.50493787715787	53.9501870816968
369.6550078	2.31707174785327	78.4952588861038
398.0900084	0.904391418094441	104.815516490057
426.525009	0.331711982870389	131.975774988544

**TATA MOTORS**

Strike	Call Price	Put Price
85.9749985	88.1467911069854	0.049062330656434
103.1699982	71.6908133142091	0.363538182614362
120.3649979	56.0562850705045	1.49946358364394
137.5599976	42.0097262011575	4.22335835903116
154.7549973	30.1960956897841	9.18018149239192
171.949997	20.8897818611358	16.6443213084778
189.1449967	13.9769545227865	26.5019476148627
206.3399964	9.09200560007734	38.3874523368878
223.5349961	5.77892967883903	51.8448300603837
240.7299958	3.60516759966061	66.4415216259395
257.9249955	2.21606747137975	81.8228751423928

**TATA STEEL**

Strike	Call Price	Put Price
265.125	271.671761921972	0.000802348483806
318.15	219.995681670825	0.040530182638591
371.175	168.813466401286	0.574122998401734
424.2	120.10865951862	3.58512420103909
477.225	77.7740446442089	12.9663174119299
530.25	45.4524896925877	32.3605705456109
583.275	24.0307558038174	62.654644742143
636.3	11.6010812585414	101.940778282169
689.325	5.17690797956148	147.232413088492
742.35	2.16254766838124	195.933860862614
795.375	0.855590651829953	246.342711931365



## WIPRO

Strike	Call Price	Put Price
121.818779	124.82857217486	0.002076804748708
146.1825348	101.118760902143	0.054478058009223
170.5462906	77.8103721937272	0.508301875571655
194.9100464	55.9737459289513	2.43388813677352
219.2738022	37.2342723131671	7.45662704696704
243.637558	22.8441825827583	16.8287498425361
268.0013138	12.9834466412924	30.730226427048
292.3650696	6.89334524255543	48.4023375542887
316.7288254	3.45271846346113	68.7239233011722
341.0925812	1.64738638248982	90.6808037461787
365.456337	0.75538438678166	113.551014276448

- Now the tables obtained for different stocks in NSE are shown:

**ASIAN PAINTS**

Strike	Call Price	Put Price
672.9749755	689.59094435242	0.000157504594196
807.5699706	558.340490716878	0.021536699487419
942.1649657	427.620101834155	0.572980647199433
1076.7599608	301.092237961018	5.31694960449669
1211.3549559	189.010809842541	24.507354316454
1345.949951	103.741004351392	70.5093816557404
1480.5449461	49.6437713433136	147.683981478097
1615.1399412	20.9150219315771	250.227064896795
1749.7349363	7.88145403113673	368.46532982679
1884.3299314	2.70286276988917	494.558571395977
2018.9249265	0.857482261931105	623.985023718454

**BANK OF BARODA**

Strike	Call Price	Put Price
52.5250015	53.8239450997684	0.002096692021388
63.0300018	43.6163219508036	0.040104461507294
73.5350021	33.6362345335254	0.305647962679612
84.0400024	24.3702336608216	1.28527800842642
94.5450027	16.4655706086719	3.6262458747274
105.050003	10.3699624693945	7.77626865390057
115.5550033	6.11801732858768	13.7699544315444
126.0600036	3.40765376433285	21.3052217857401
136.5650039	1.80742417486665	29.9506231147245
147.0700042	0.920546811081328	39.3093766693898
157.5750045	0.453603728001698	49.0880645047608

**BERGER PAINTS**

Strike	Call Price	Put Price
159.899994	163.853023371704	0.005084453175359
191.8799928	132.763297927829	0.105768825594079
223.8599916	102.317818109536	0.850698823594842
255.8399904	73.9801265818936	3.70341711224706
287.8199892	49.7682149572385	10.6819153038861
319.799988	31.1203111151775	23.2244212781192
351.7799868	18.1755713713073	41.4700913505432
383.7599856	9.99397556662841	64.4789053621585
415.7399844	5.22012700761264	90.895466619437
447.7199832	2.61272244847123	119.47847187659
479.699982	1.26295676787342	149.319116012286

**BHEL**

Strike	Call Price	Put Price
34.075001	34.916911409713	0.000595637388326
40.8900012	28.2850575864771	0.01547905968756
47.7050014	21.7664056525021	0.143564371247632
54.5200016	15.6609033715444	0.684799335824946
61.3350018	10.4223031847607	2.09293639457635
68.150002	6.39912832790374	4.71649878325441
74.9650022	3.64086410568055	8.6049718065663
81.7800024	1.93576014488802	13.5466050913088
88.5950026	0.9712080190017	19.2287902109576
95.4100028	0.464281060235397	25.3686004977264
102.225003	0.213341582469768	31.7643982654958

**BRITANNIA**

Strike	Call Price	Put Price
1584.875	1624.00595890255	0.000255728451988
1901.85	1314.8973366018	0.040492792883487
2218.825	1006.8897401264	1.18175568266397
2535.8	708.177401994324	11.6182769157698
2852.775	442.867243792403	55.4569780790287
3169.75	241.051209152281	162.789802804087
3486.725	113.764207835851	344.651660852838
3803.7	47.0090002042755	587.045312586444
4120.675	17.2876284174883	866.472800164837
4437.65	5.76093740280314	1164.09496851533
4754.625	1.76961965572657	1469.25251013344

**COLGATE**

Strike	Call Price	Put Price
609.825012	624.881733905267	8.87116640100787E-05
731.7900144	505.942603632024	0.014634199699909
853.7550168	387.412556932618	0.43826326157423
975.7200192	272.399317918651	4.37870000888561
1097.6850216	170.171926312824	21.104984164338
1219.650024	92.4115170192512	62.2982506320448
1341.6150264	43.4466774786412	132.287086852714
1463.5800288	17.856370482156	225.650455617508
1585.5450312	6.52226634077627	333.270027237408
1707.5100336	2.15617312848789	447.857609786399
1829.475036	0.656389760748203	565.311502179939

**DABUR**

Strike	Call Price	Put Price
204.550003	209.607763494916	0.007402926241198
245.4600036	169.84724006772	0.146808585309773
286.3700042	130.945620075565	1.14511767941989
327.2800048	94.7883263672242	4.88775305734448
368.1900054	63.9226693514421	13.9220251278273
409.100006	40.1337078710898	30.0329927337401
450.0100066	23.5747088629884	53.3739228119038
490.9200072	13.0580159719166	82.7571590070969
531.8300078	6.88033952843042	116.479411649876
572.7400084	3.47802319364286	152.977024401353
613.650009	1.69970312846412	191.09863342244

**GODREJ**

Strike	Call Price	Put Price
331.600006	339.917266166304	0.130026846758481
397.9200072	276.201208534306	1.09652375085116
464.2400084	215.343660099227	4.92152985186355
530.5600096	160.398308503497	14.6587327922247
596.8800108	114.123713119736	33.0666919445542
663.200012	77.8132107110173	61.4387440719264
729.5200132	51.0998685957993	99.4079564927993
795.8400144	32.5031487458471	145.493791178938
862.1600156	20.1353151373407	197.808512106522
928.4800168	12.2091642632348	254.564915768507
994.800018	7.27775757530522	314.316063616669

**MUTHOOT FINANCE**

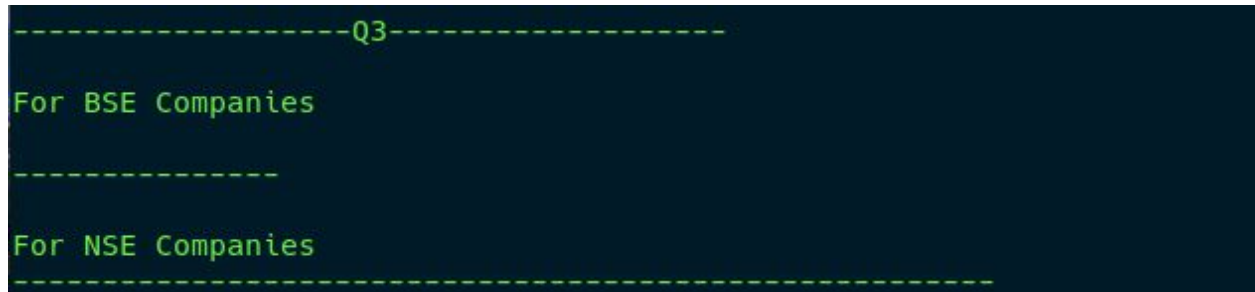
Strike	Call Price	Put Price
226.300003	231.887436991493	6.70094344900005E-05
271.5600036	187.753195462259	0.008352683788888
316.8200042	143.811927489757	0.209611914874706
362.0800048	101.335125296939	1.87533692564562
407.3400054	63.7719249525617	8.45466378485622
452.600006	35.1907166746167	24.0159827104995
497.8600066	16.989554860968	49.9573481004391
543.1200072	7.24638464184638	84.3567050849057
588.3800078	2.77318680462936	124.026034451277
633.6400084	0.968448638528798	166.363823488765
678.900009	0.313568541755024	209.851470595579

**RELIANCE**

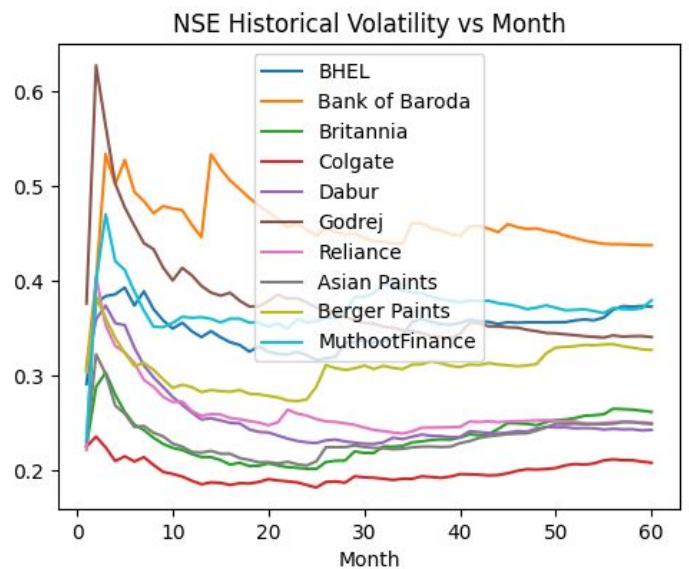
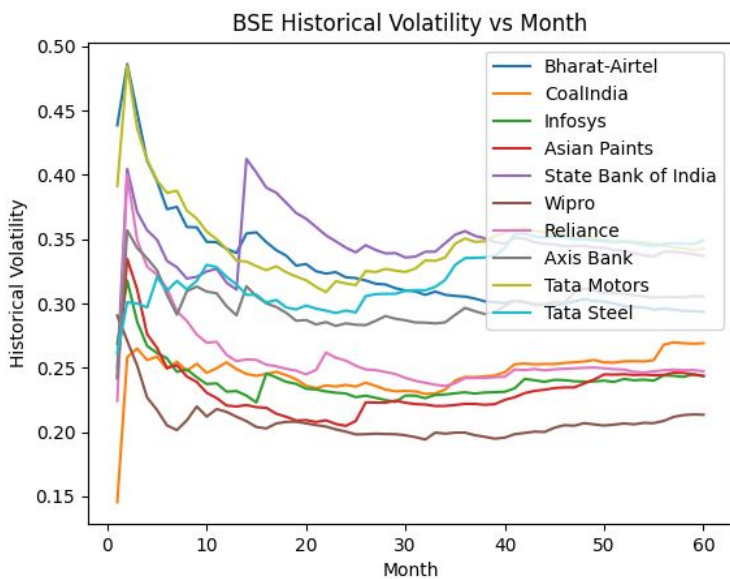
Strike	Call Price	Put Price
578.293335	592.57150601775	5.77031710843211E-05
693.952002	479.779455501456	0.011051523960701
809.610669	367.328978842697	0.363619202286703
925.269336	258.014610401007	3.85229509768067
1040.928003	160.595125633229	19.2358546669866
1156.58667	86.4947745249305	57.9385478957723
1272.245337	40.1051975395307	124.352015247457
1387.904004	16.1642483714452	213.214110416455
1503.562671	5.76029048787929	315.613196869974
1619.221338	1.84967735736184	424.505628076541
1734.880005	0.544935141933575	536.003930198197

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### Ques.3



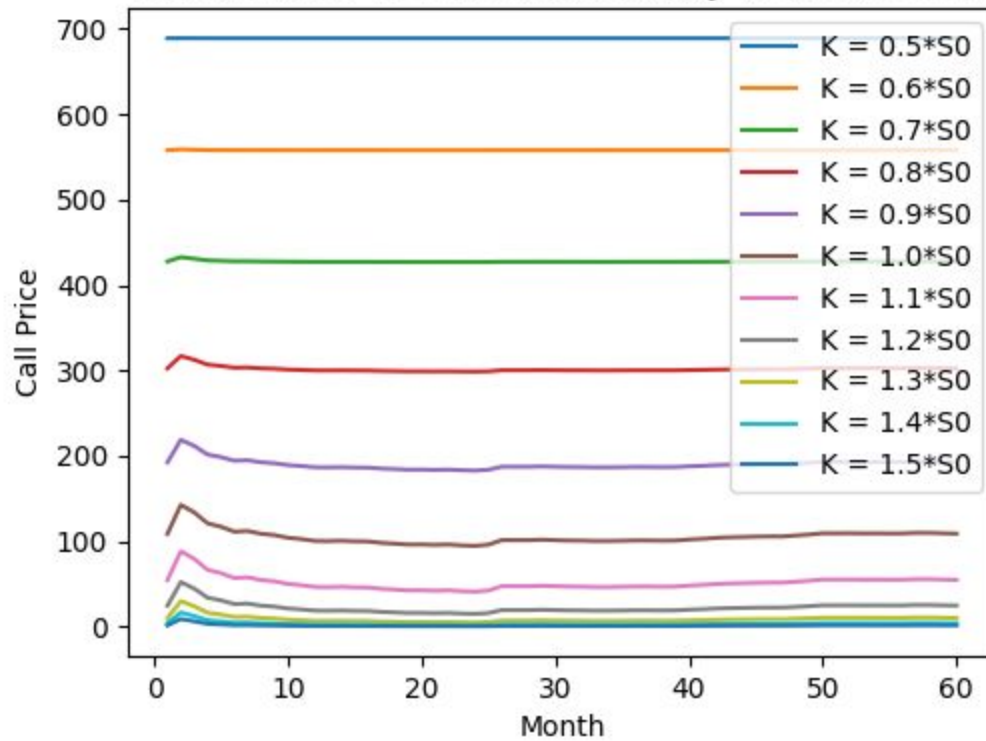
- The plots of **Historical Volatility v/s Month** is shown below for both **BSE & NSE**:



- Plots of **Option Prices v/s period** for **NSE & BSE** for both **Call and Put Option** shown below:

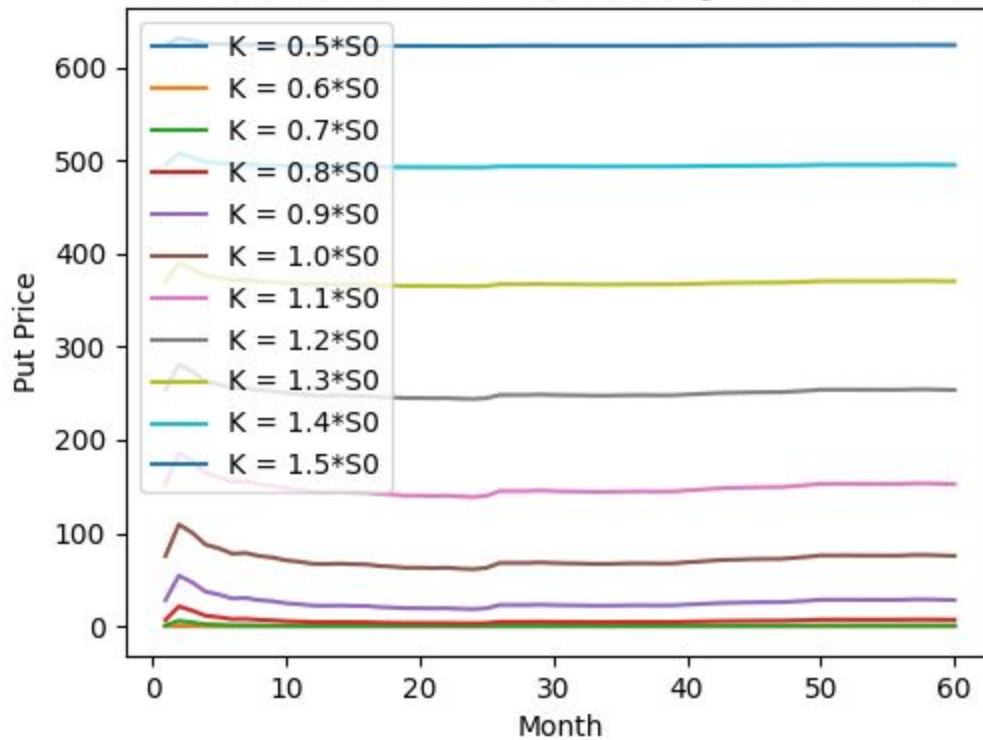
**BSE (SENSEX)**

BSE Call Price vs Historical Volatility for Asian Paints

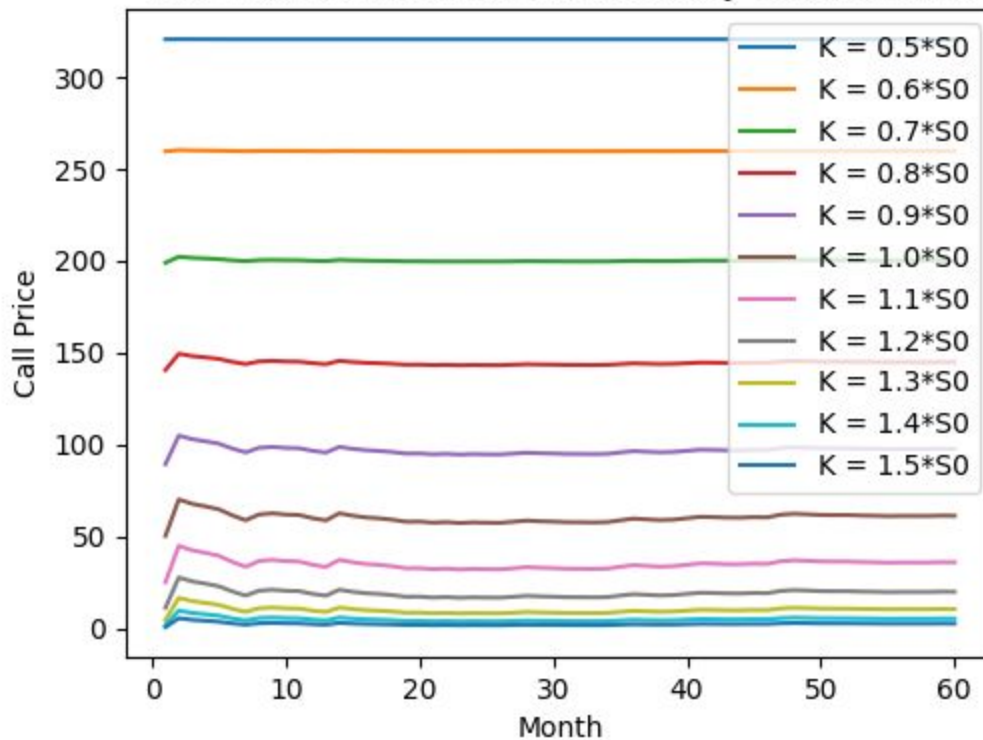




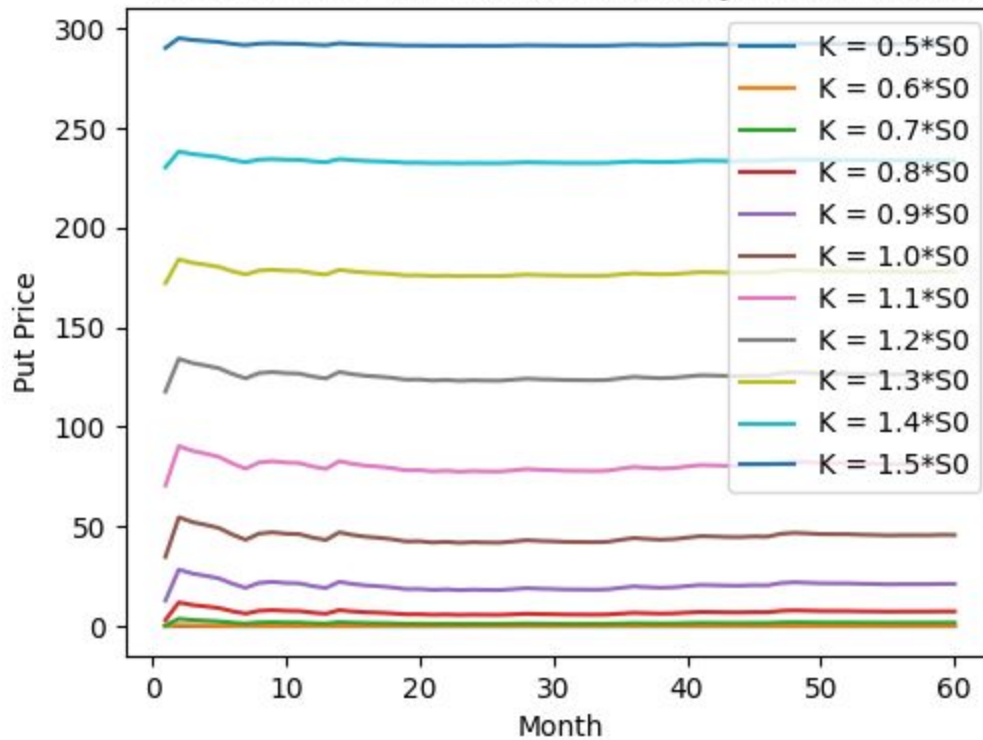
BSE Put Price vs Historical Volatility for Asian Paints



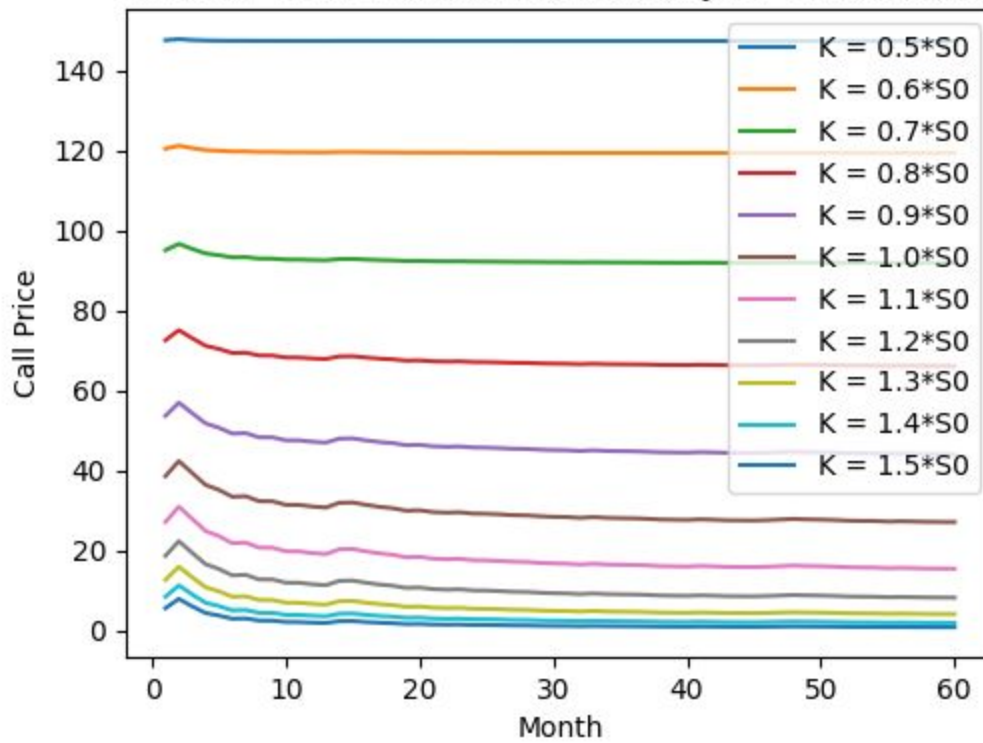
BSE Call Price vs Historical Volatility for Axis Bank



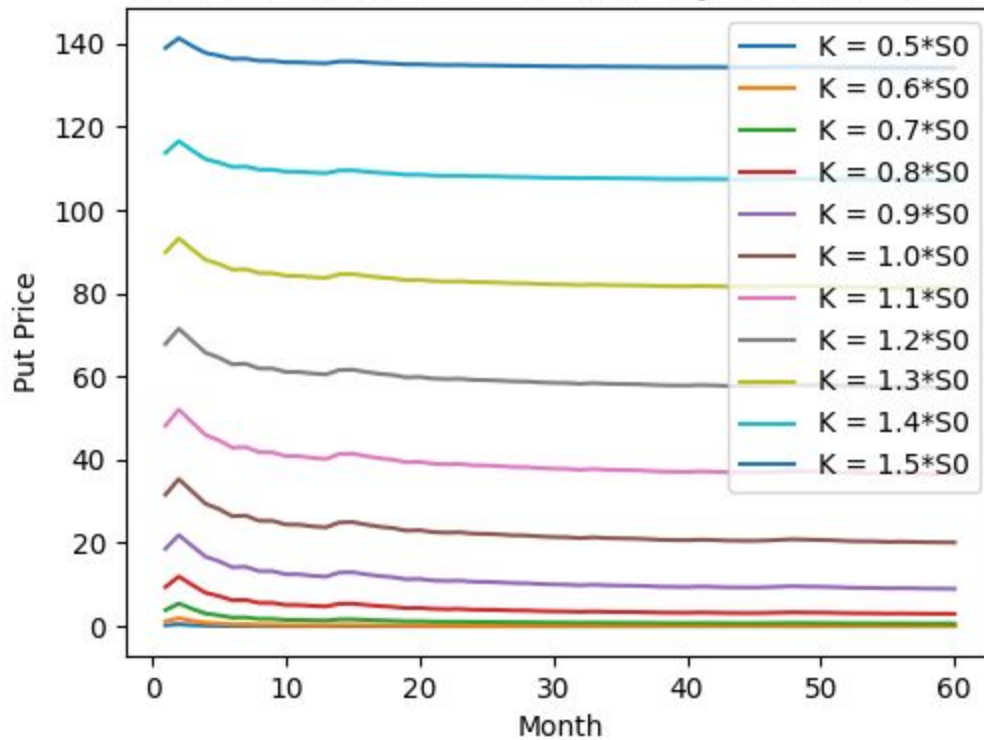
BSE Put Price vs Historical Volatility for Axis Bank



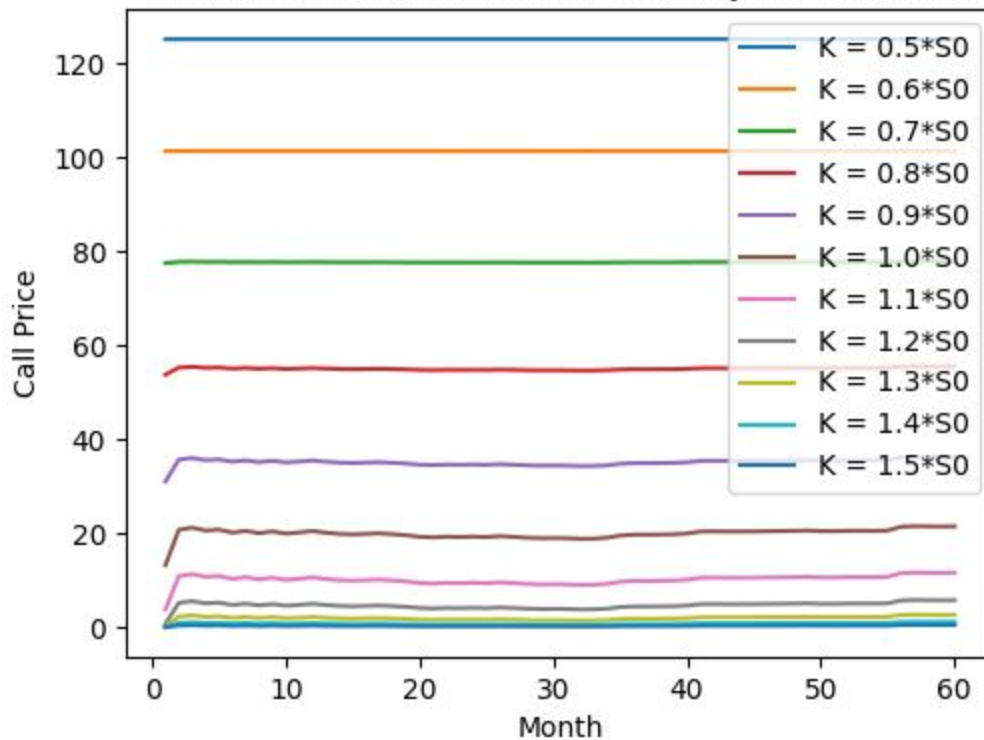
BSE Call Price vs Historical Volatility for Bharat-Airtel



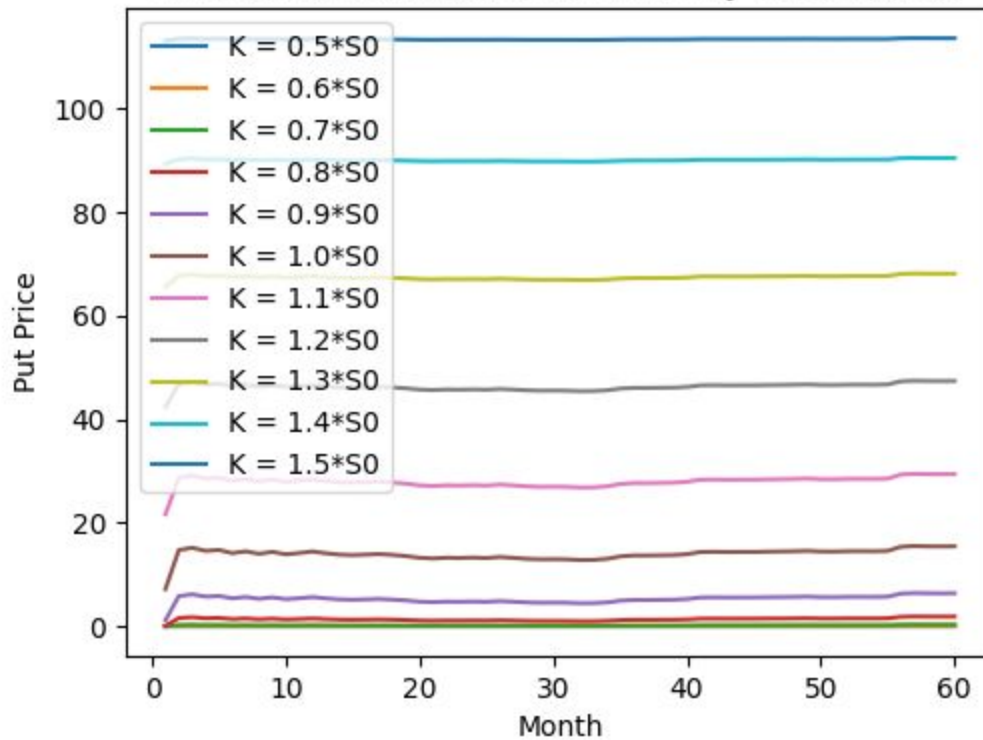
BSE Put Price vs Historical Volatility for Bharat-Airtel



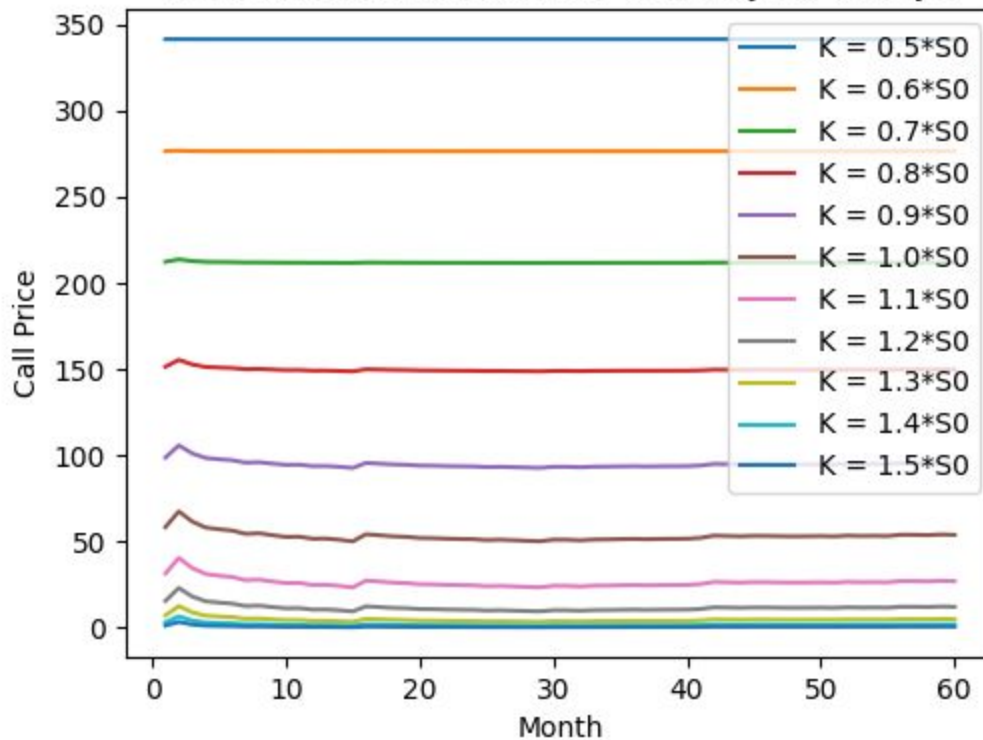
BSE Call Price vs Historical Volatility for CoalIndia



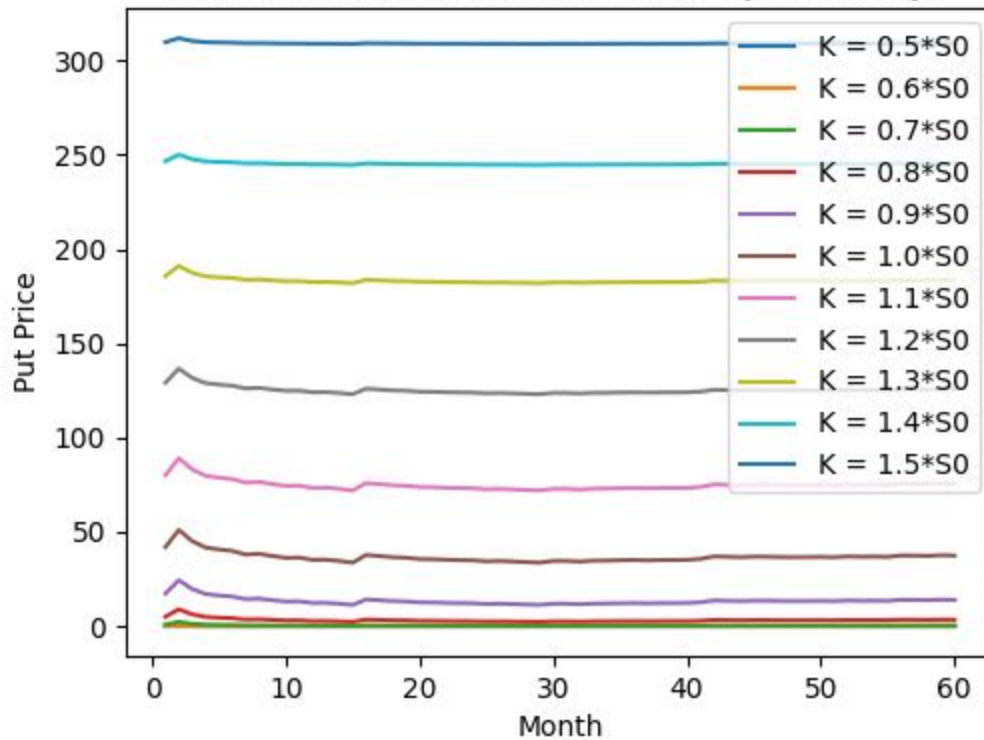
BSE Put Price vs Historical Volatility for CoalIndia



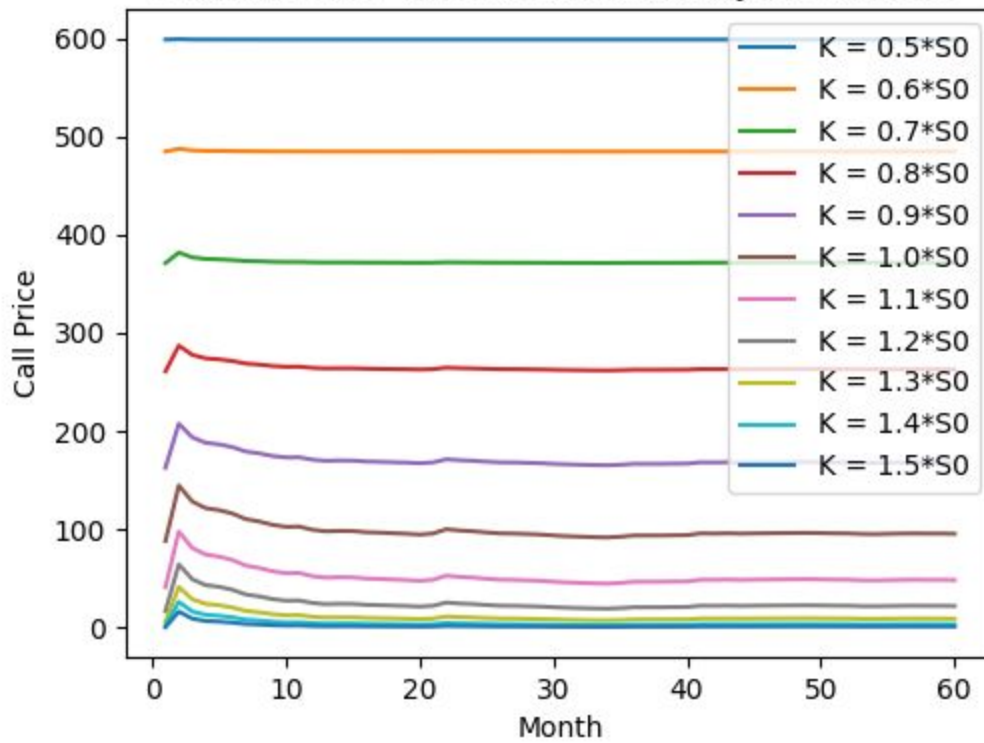
BSE Call Price vs Historical Volatility for Infosys



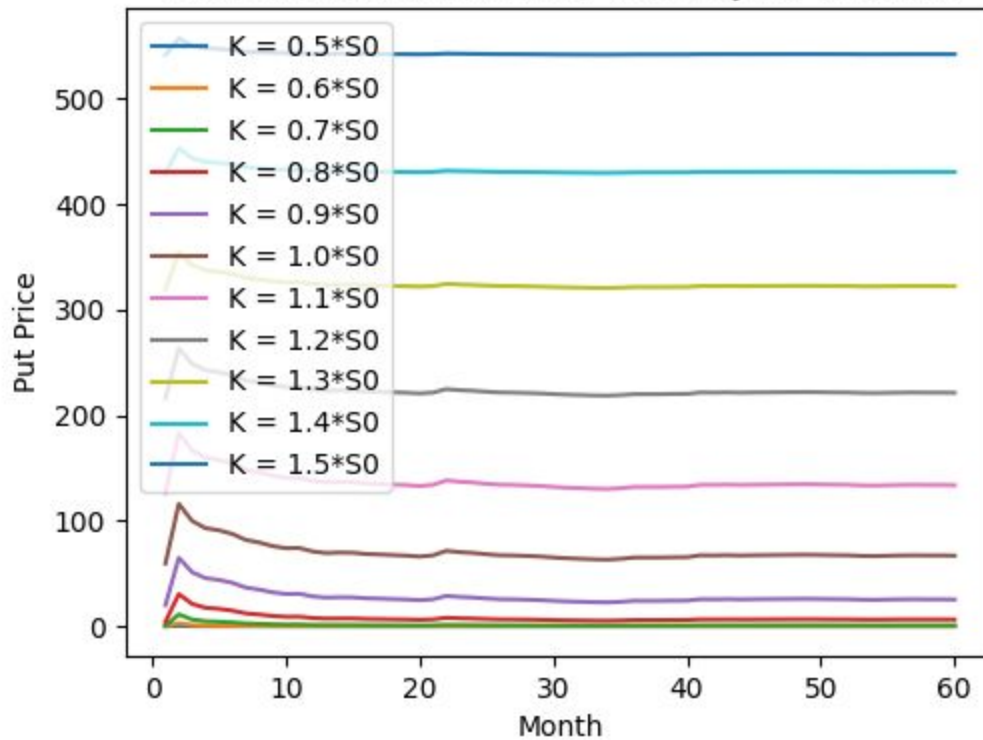
BSE Put Price vs Historical Volatility for Infosys



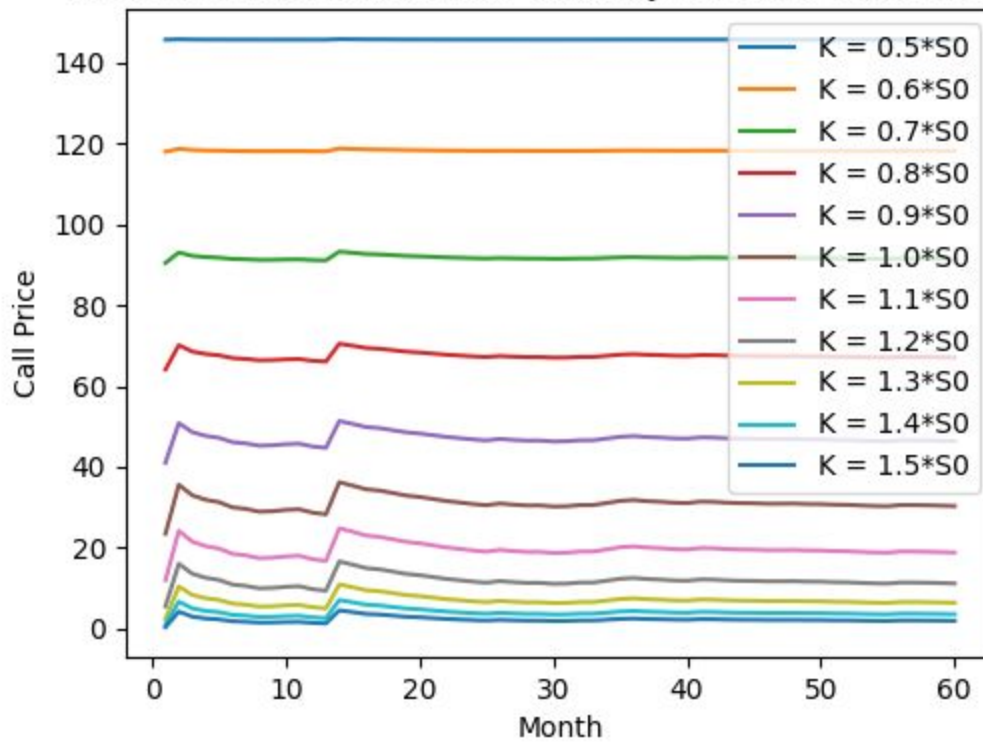
BSE Call Price vs Historical Volatility for Reliance



BSE Put Price vs Historical Volatility for Reliance

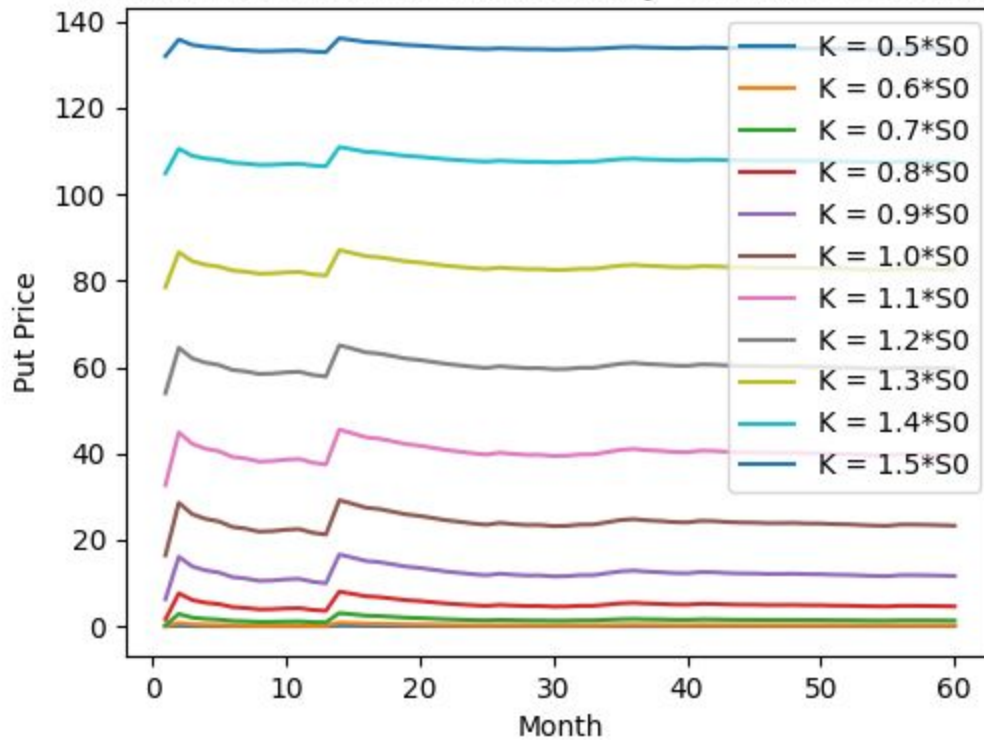


BSE Call Price vs Historical Volatility for State Bank of India

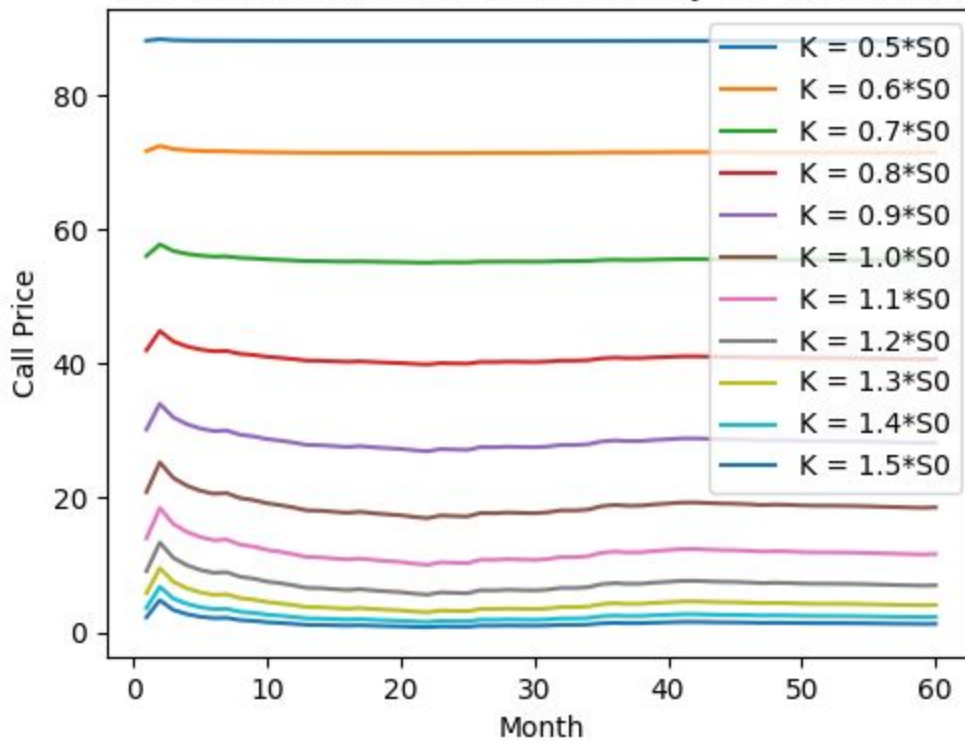




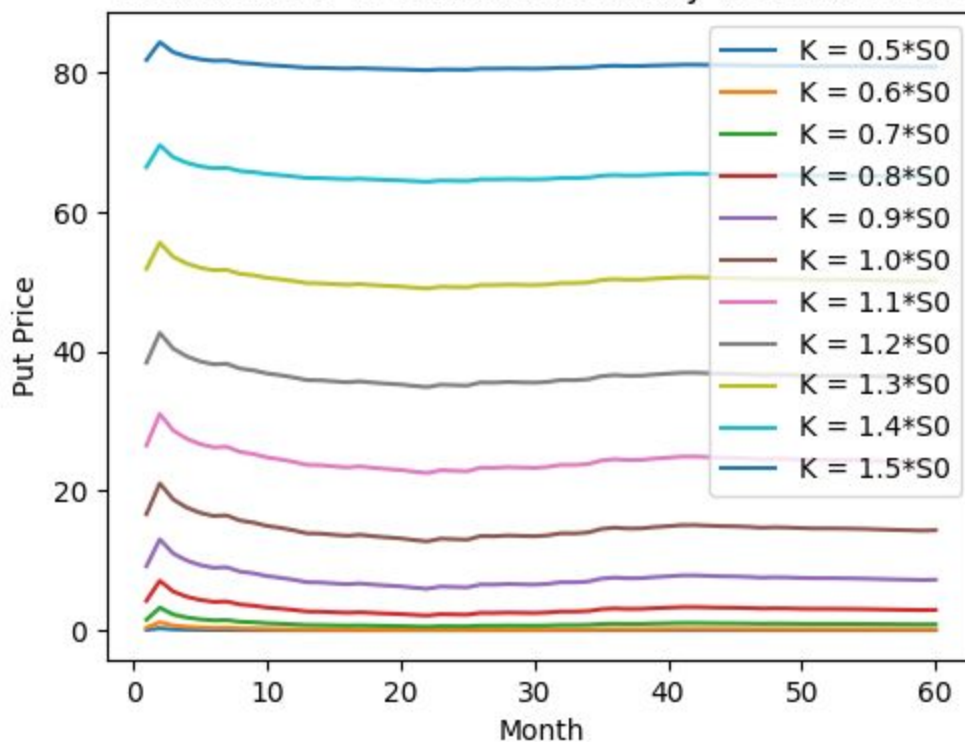
BSE Put Price vs Historical Volatility for State Bank of India



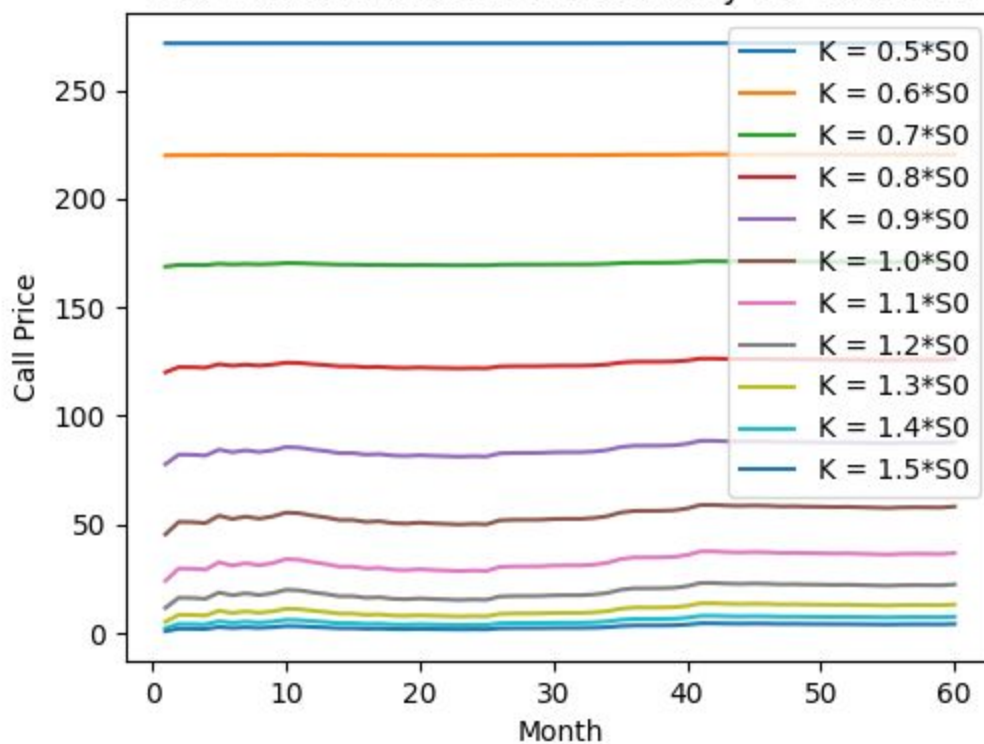
BSE Call Price vs Historical Volatility for Tata Motors



BSE Put Price vs Historical Volatility for Tata Motors

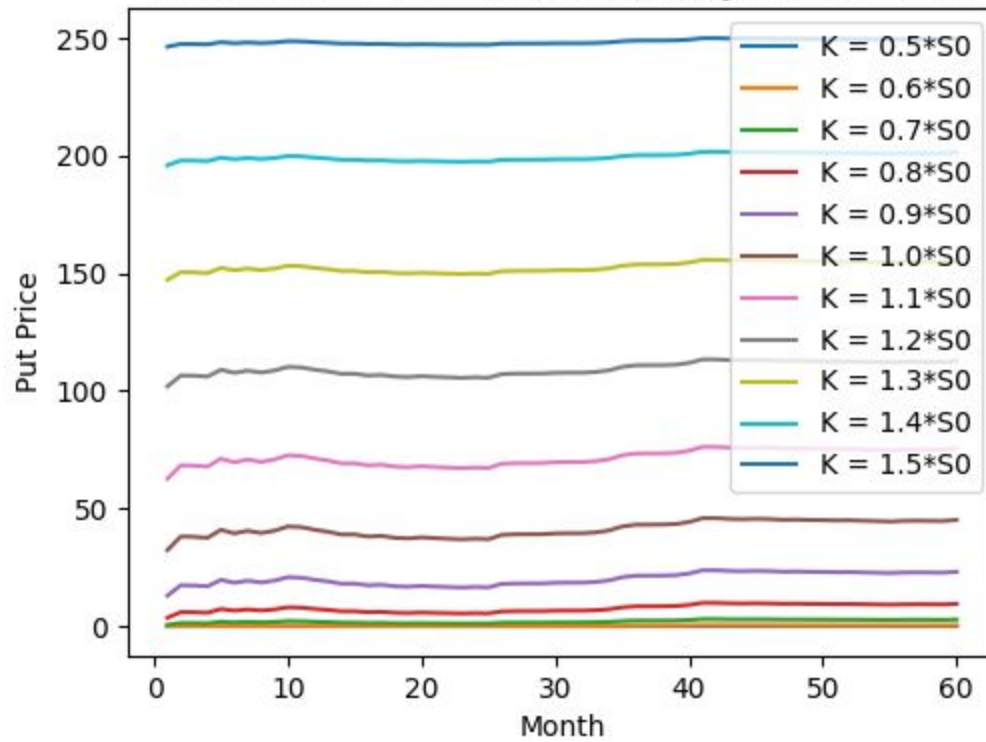


BSE Call Price vs Historical Volatility for Tata Steel

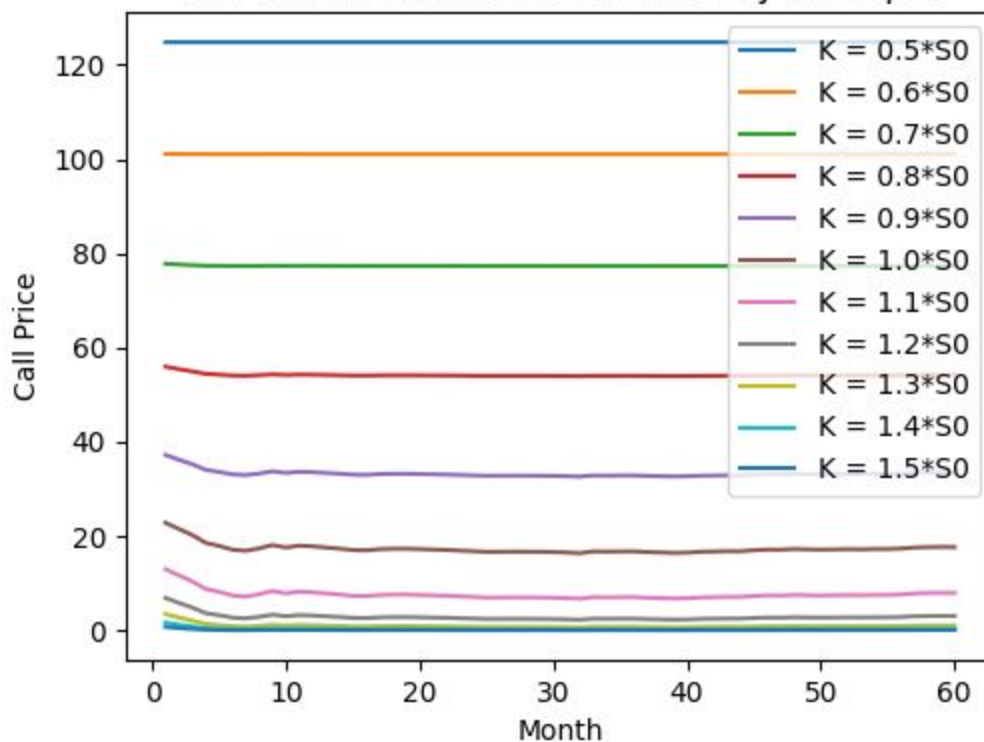




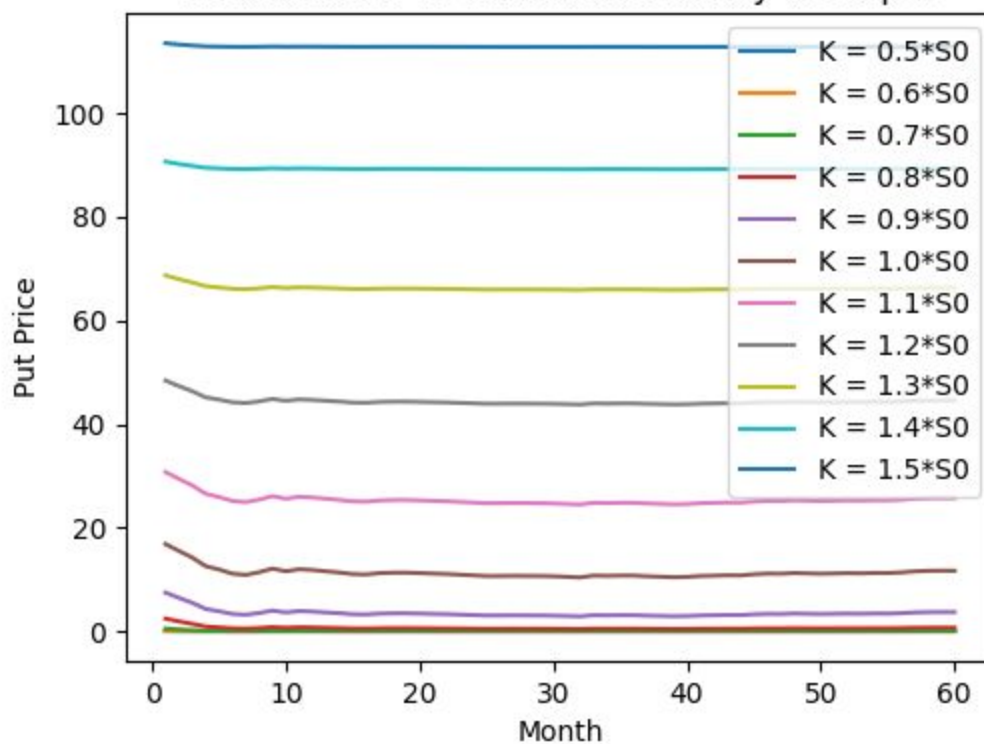
BSE Put Price vs Historical Volatility for Tata Steel



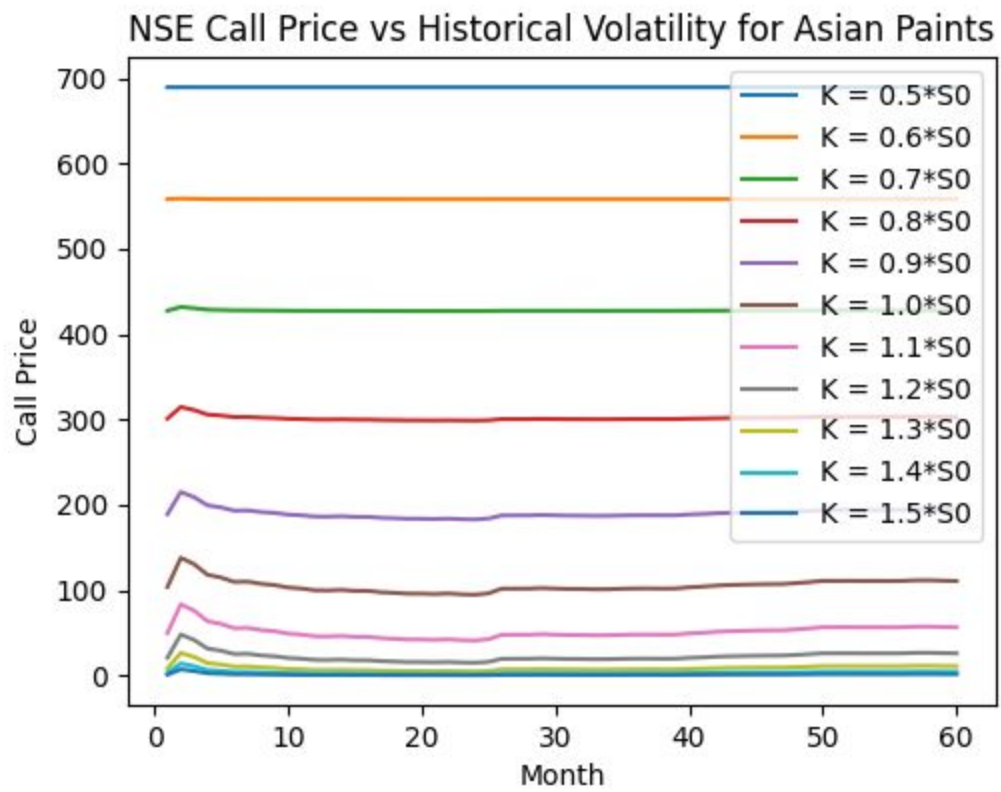
### BSE Call Price vs Historical Volatility for Wipro



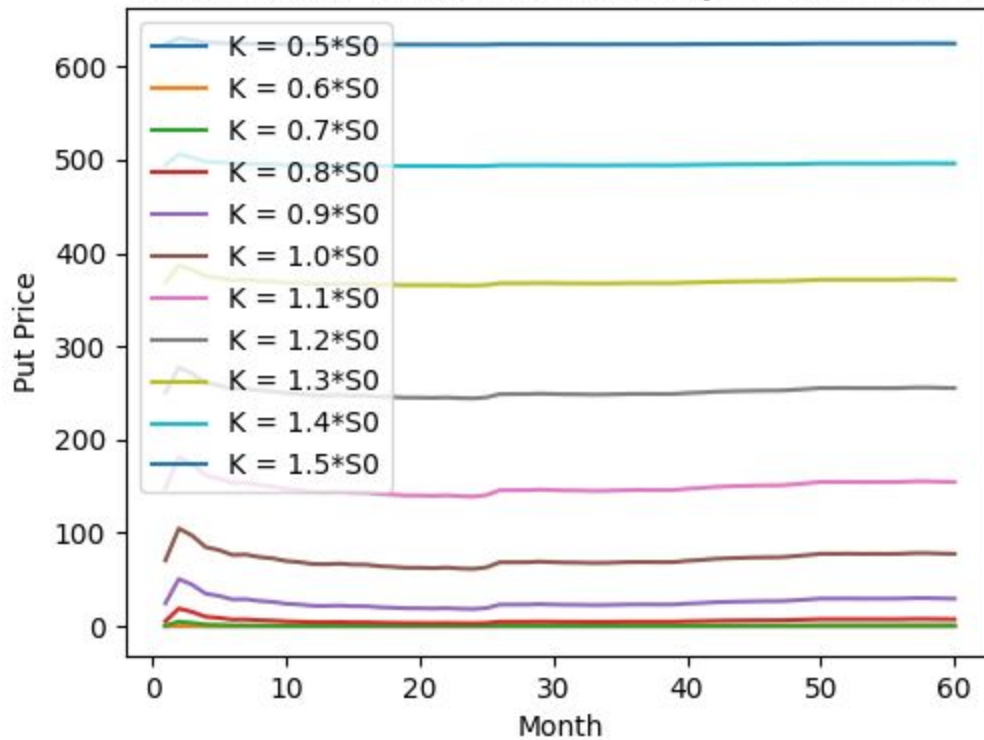
### BSE Put Price vs Historical Volatility for Wipro



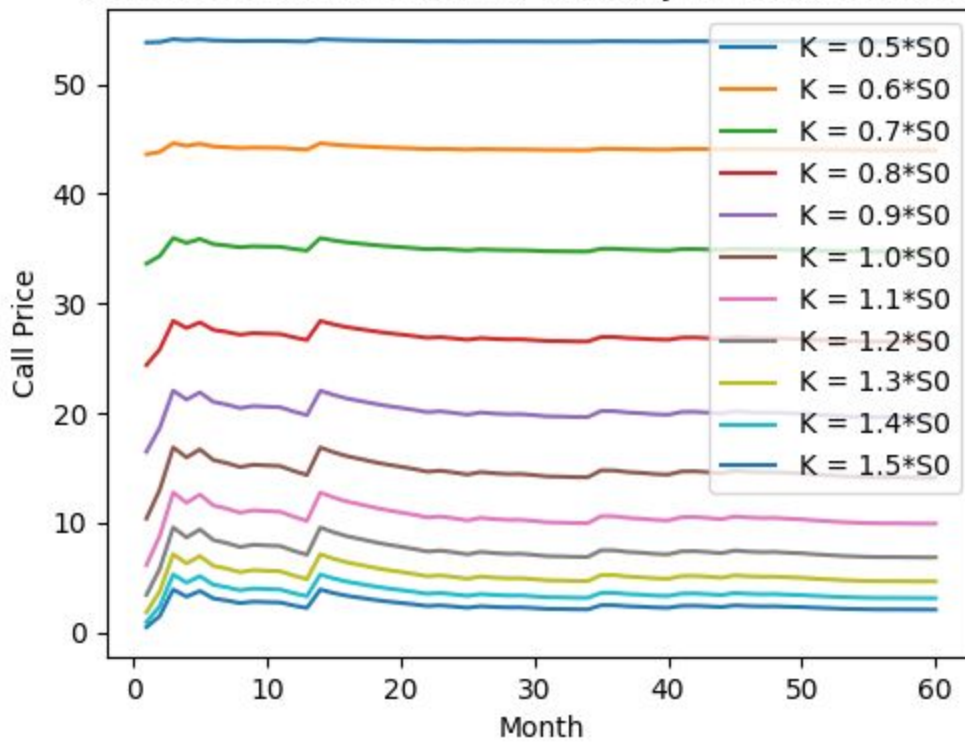
## NSE (NIFTY)



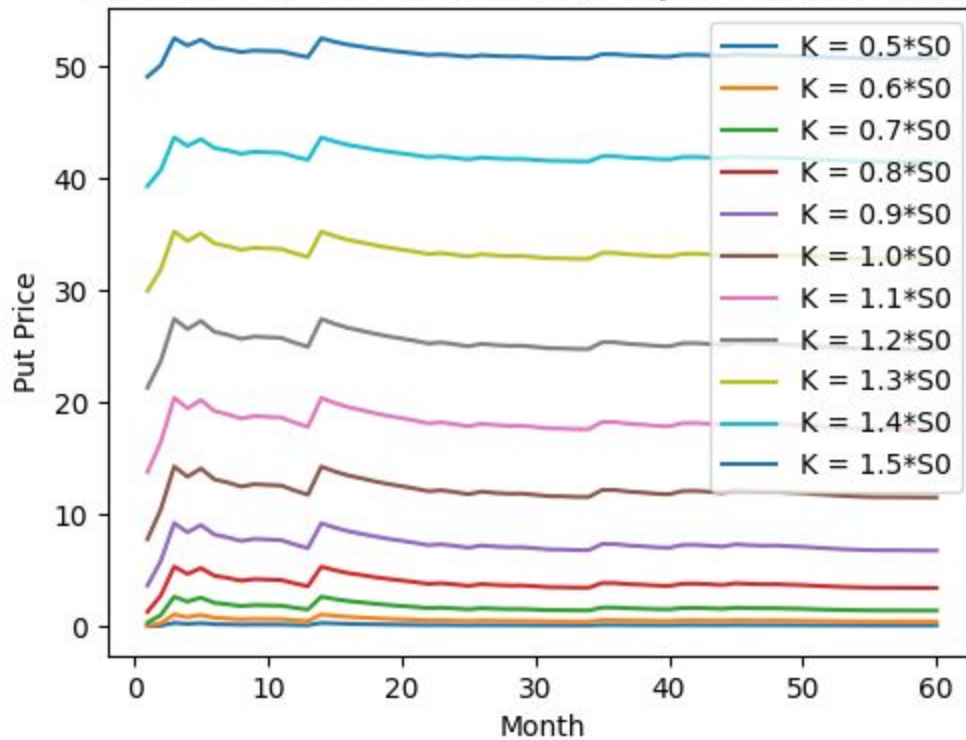
NSE Put Price vs Historical Volatility for Asian Paints



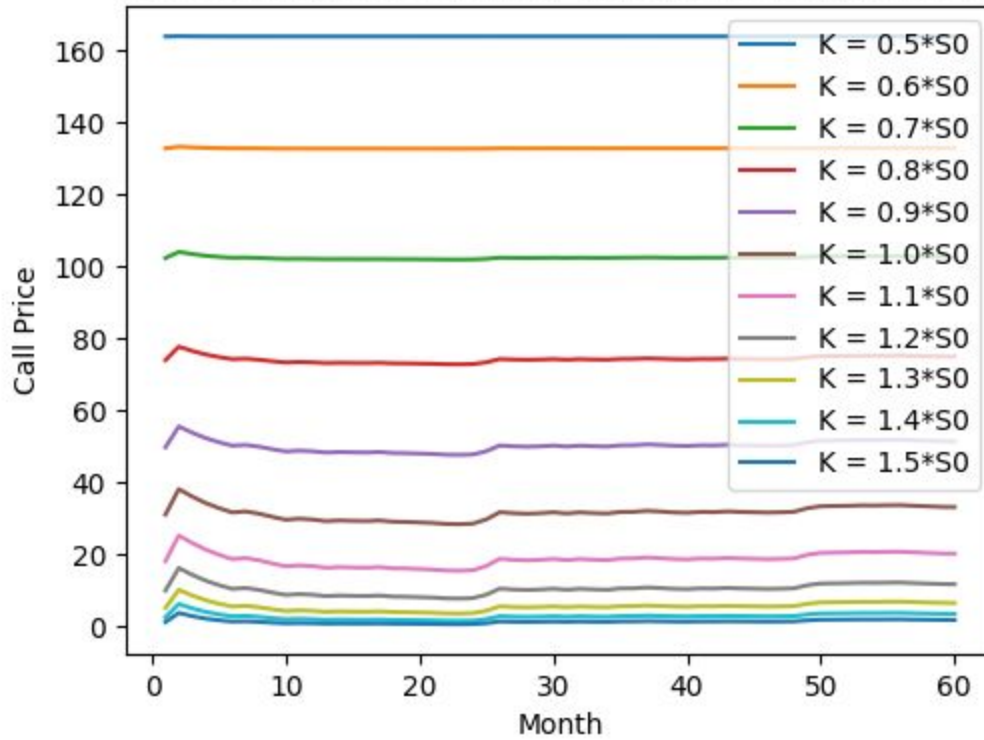
NSE Call Price vs Historical Volatility for Bank of Baroda



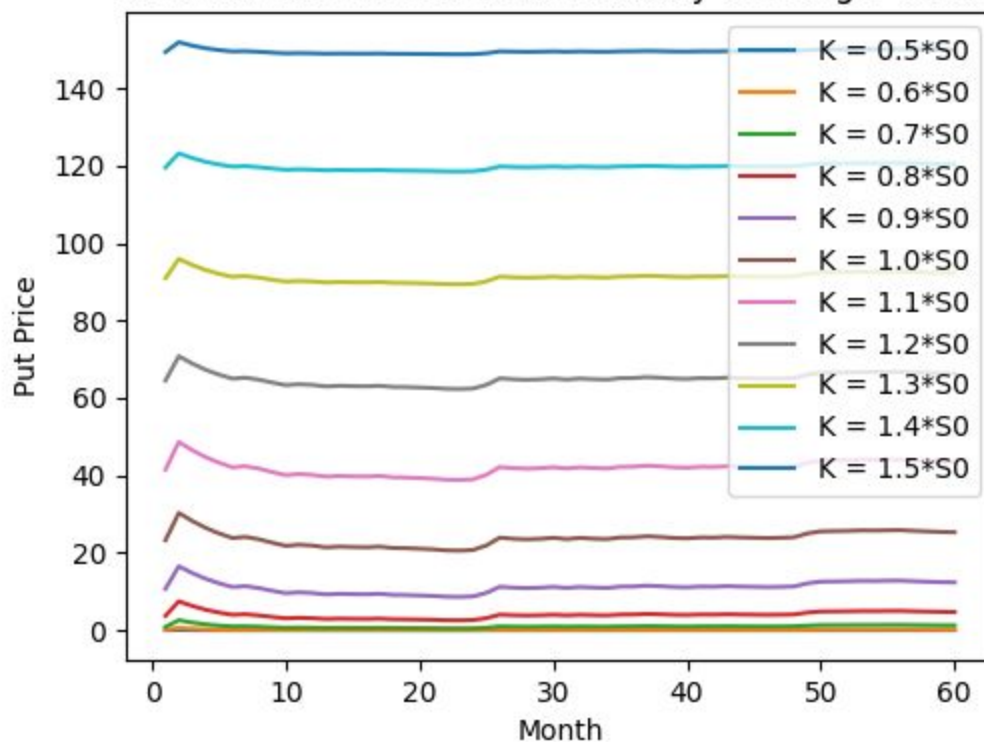
NSE Put Price vs Historical Volatility for Bank of Baroda



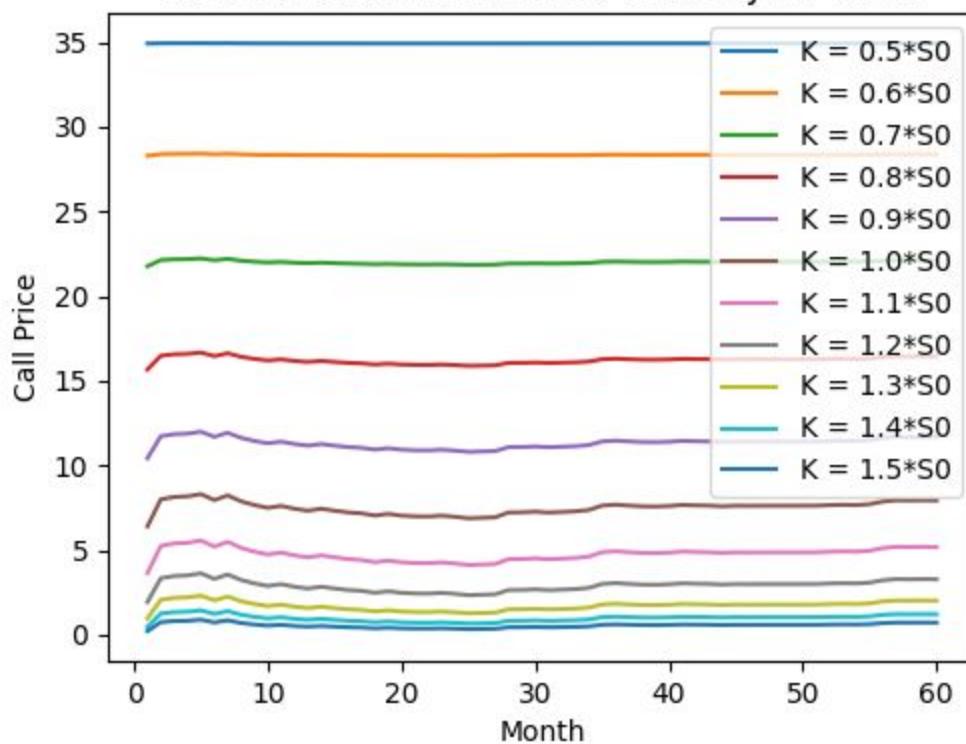
NSE Call Price vs Historical Volatility for Berger Paints



NSE Put Price vs Historical Volatility for Berger Paints

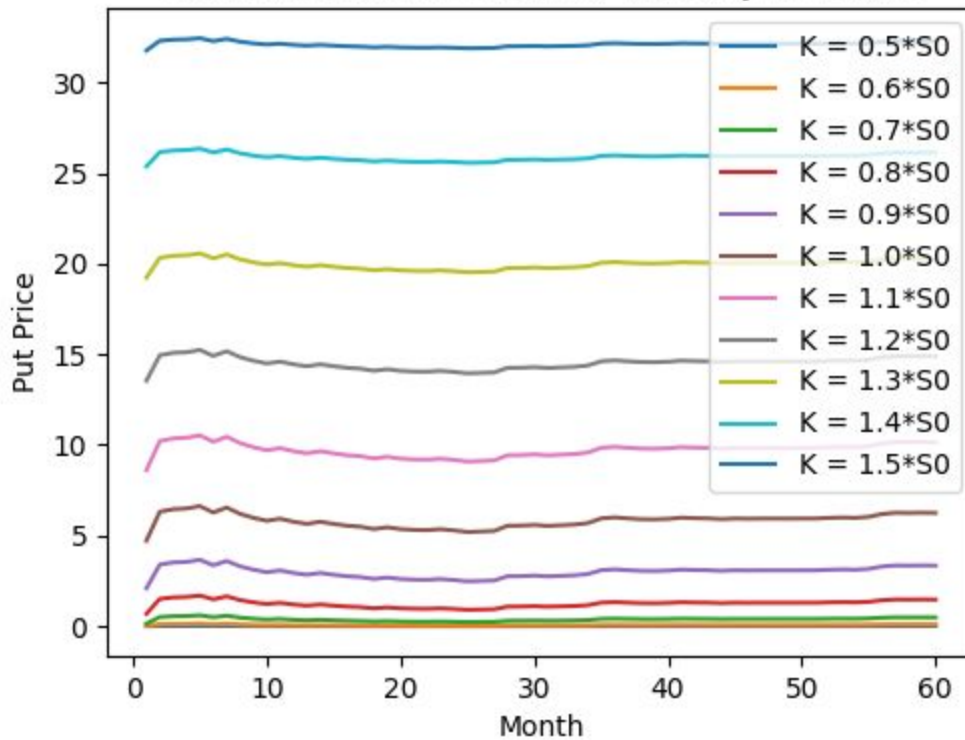


NSE Call Price vs Historical Volatility for BHEL

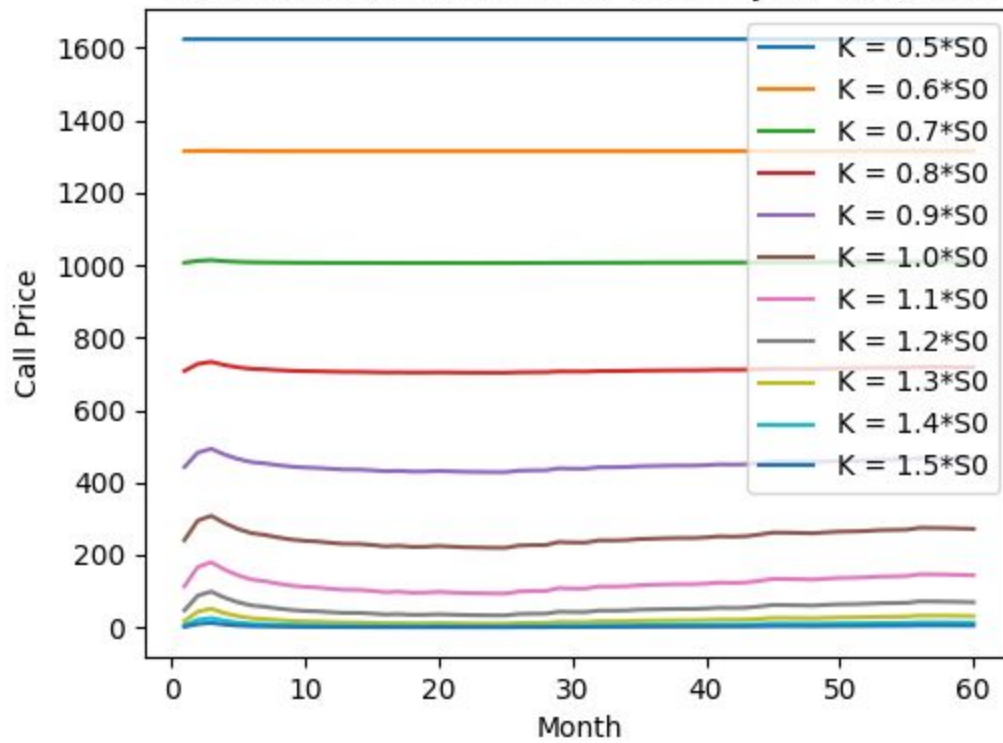




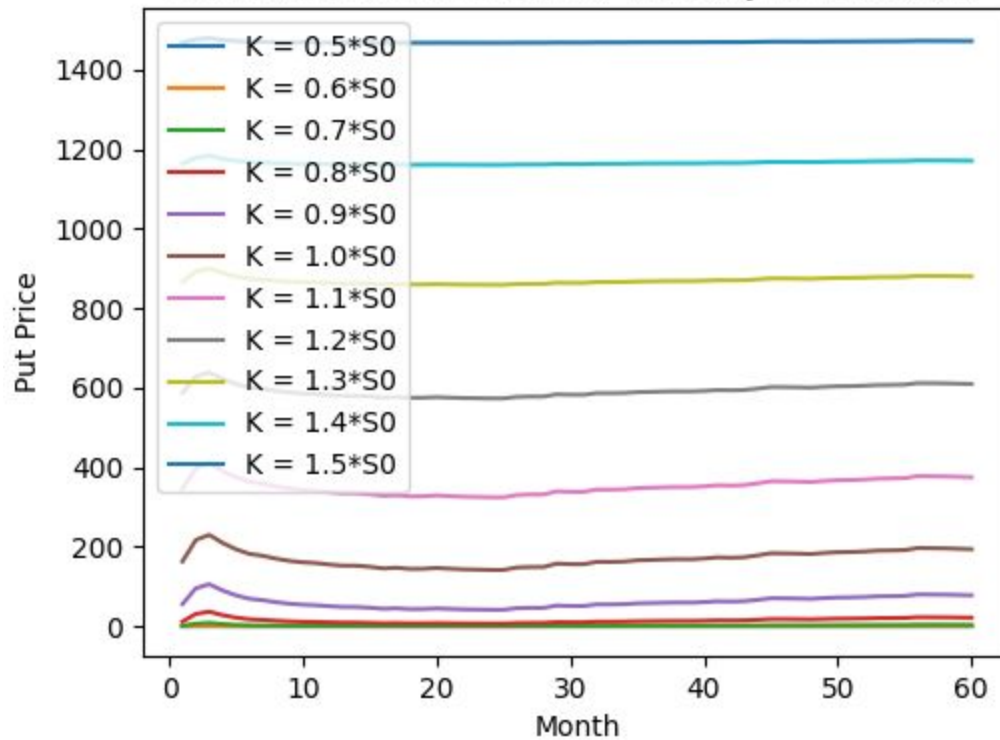
NSE Put Price vs Historical Volatility for BHEL



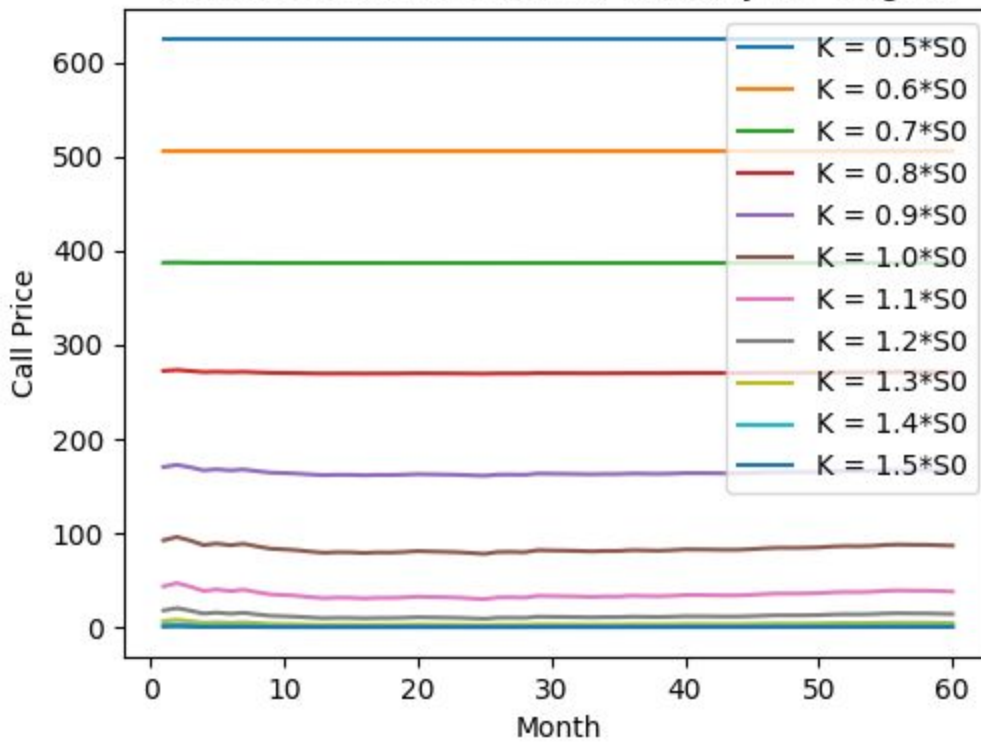
NSE Call Price vs Historical Volatility for Britannia



NSE Put Price vs Historical Volatility for Britannia

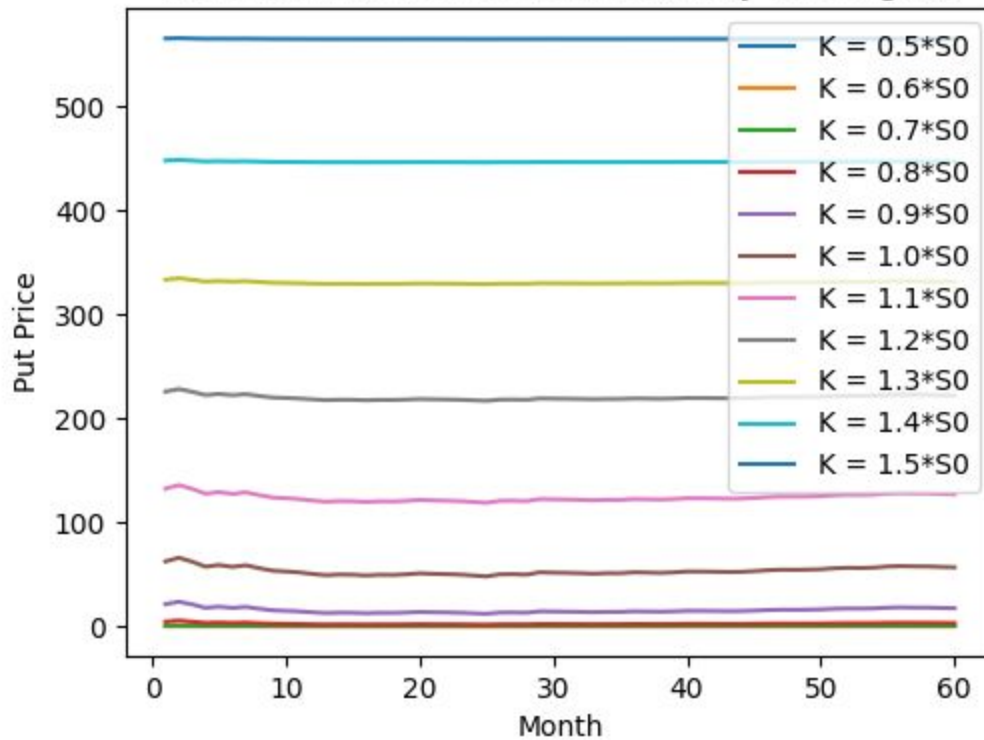


NSE Call Price vs Historical Volatility for Colgate

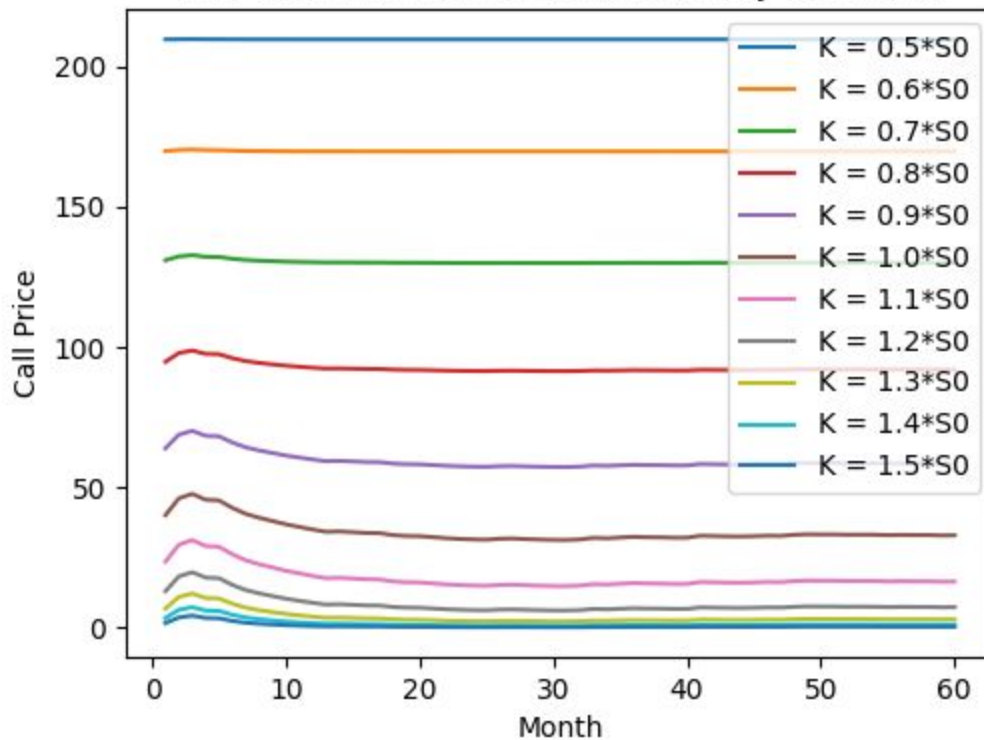




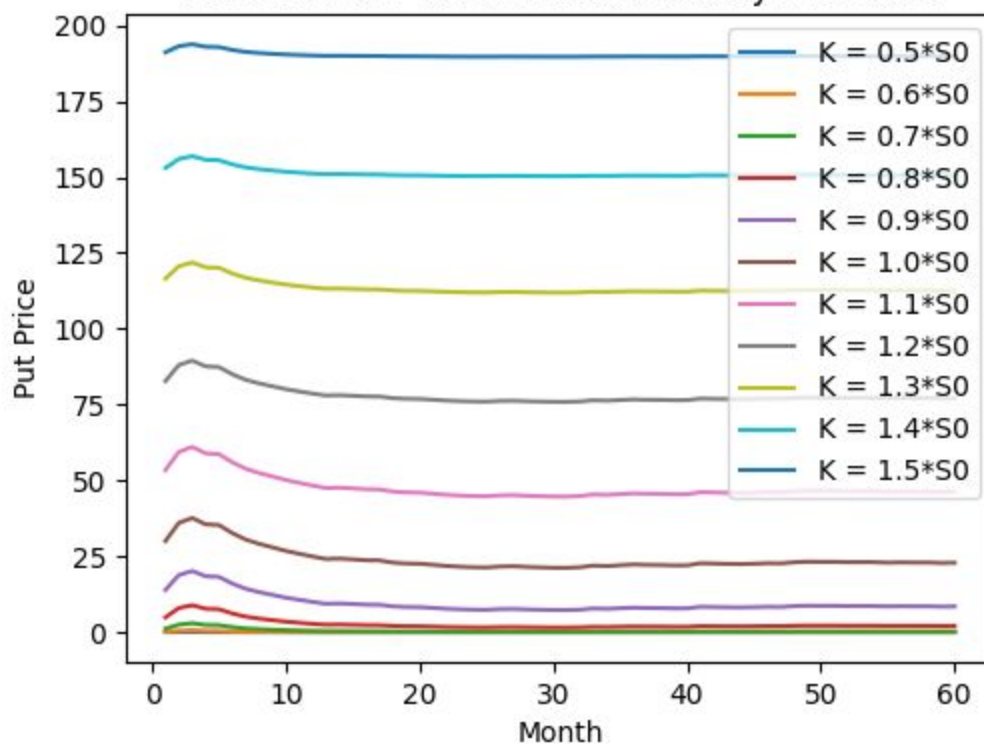
NSE Put Price vs Historical Volatility for Colgate



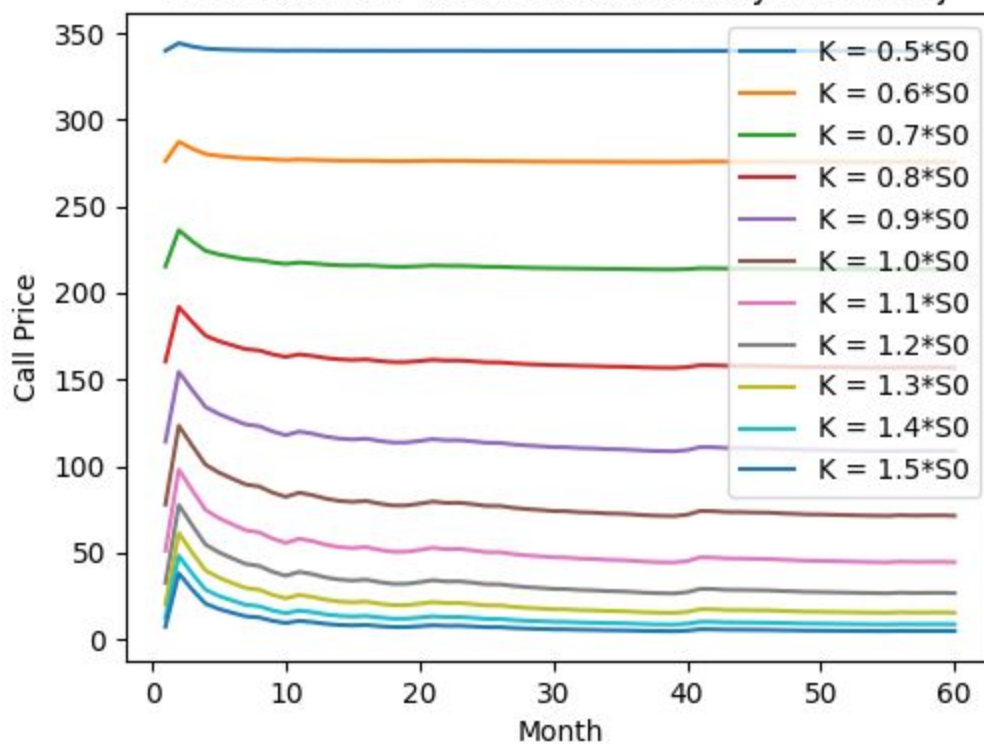
NSE Call Price vs Historical Volatility for Dabur



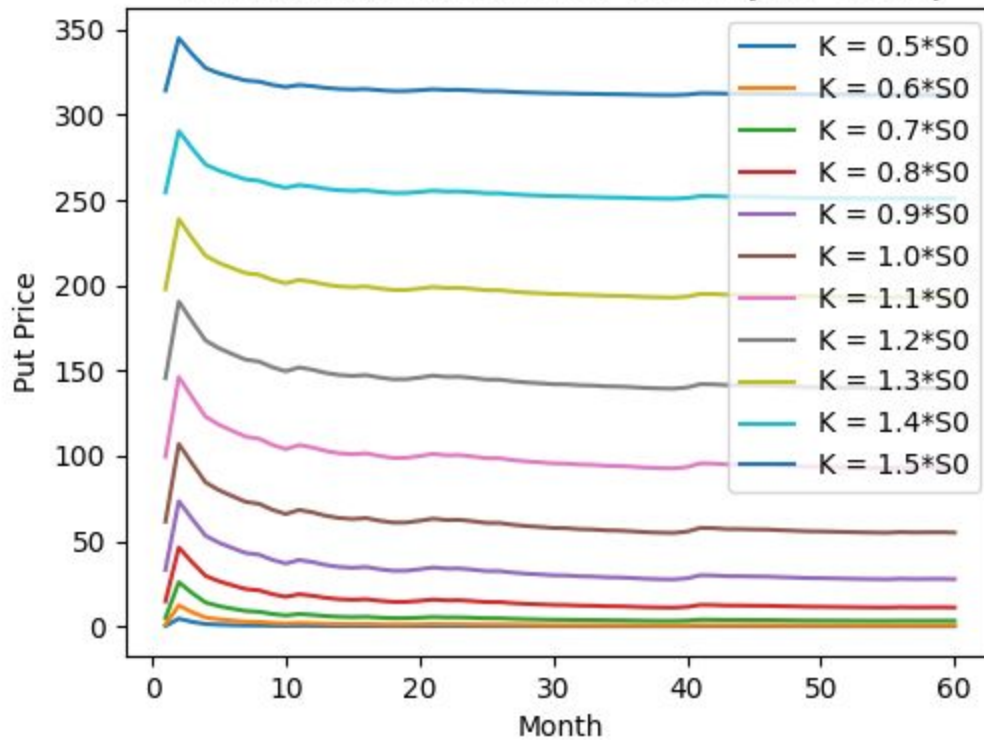
### NSE Put Price vs Historical Volatility for Dabur



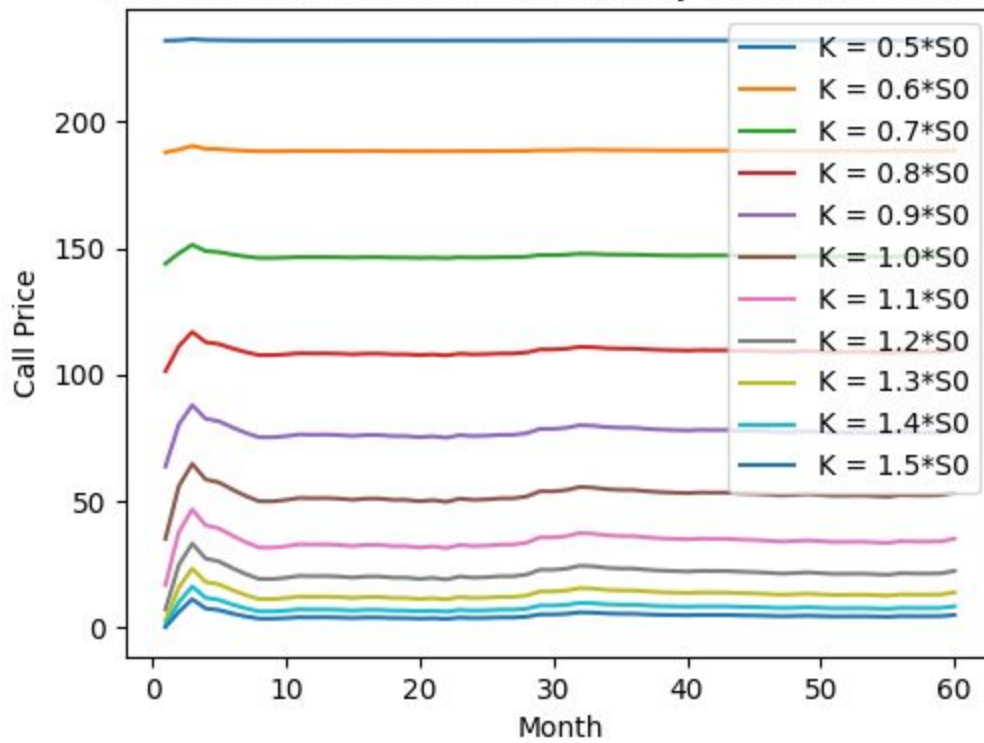
### NSE Call Price vs Historical Volatility for Godrej



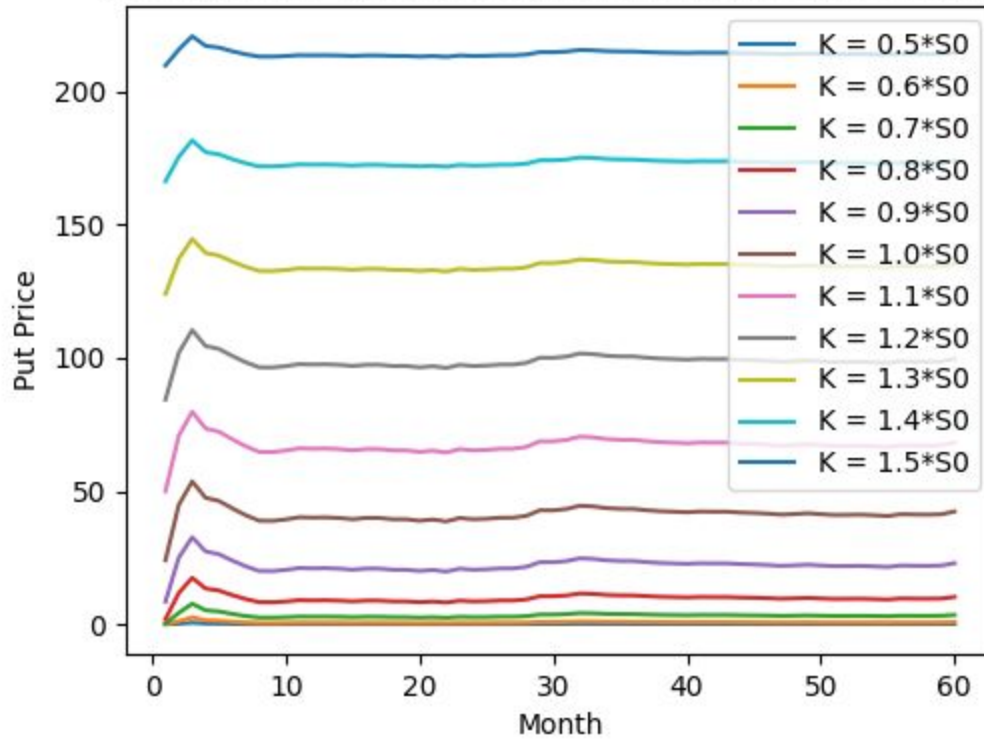
NSE Put Price vs Historical Volatility for Godrej



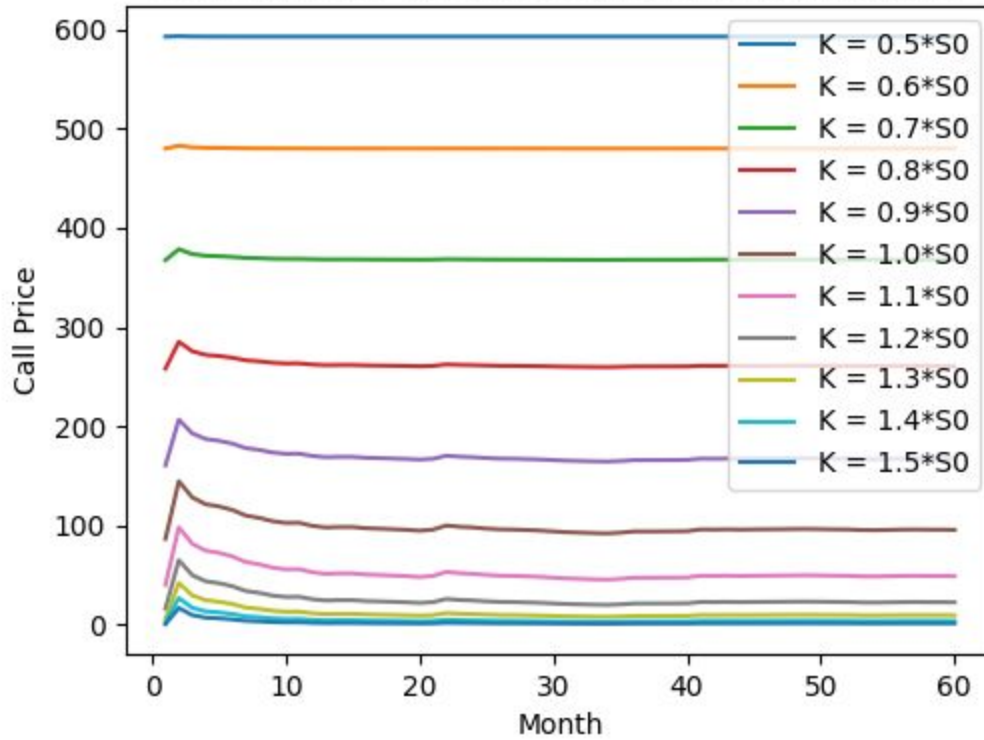
NSE Call Price vs Historical Volatility for MuthootFinance

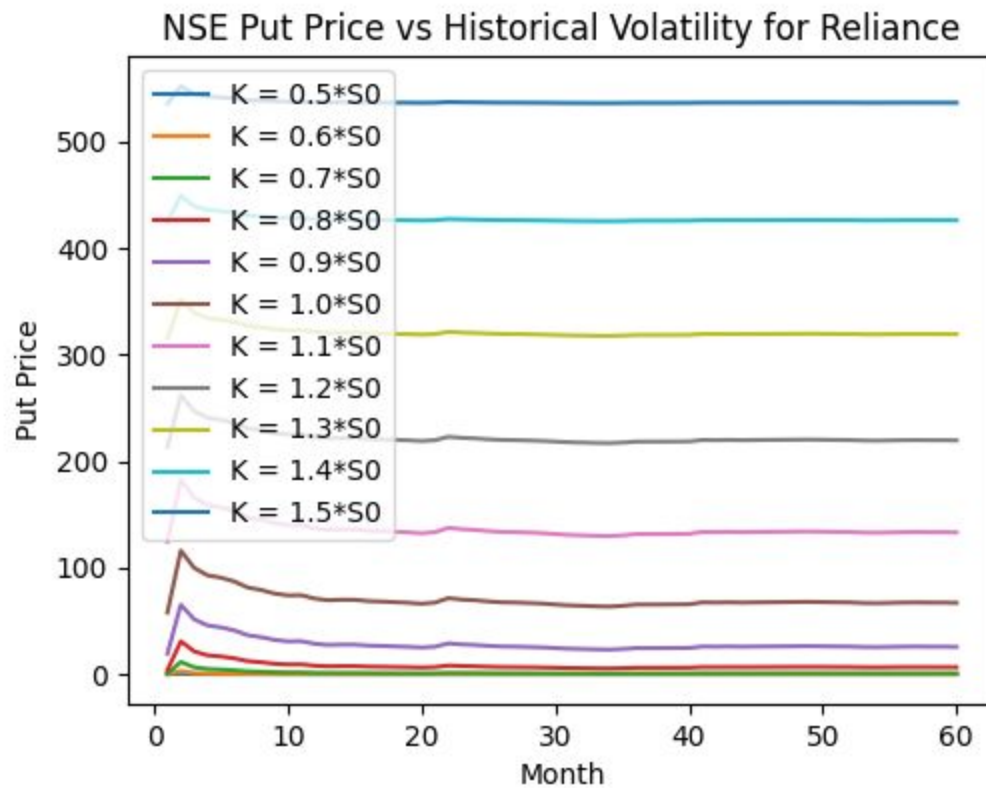


NSE Put Price vs Historical Volatility for MuthootFinance



NSE Call Price vs Historical Volatility for Reliance





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**Ques.4**

- The file obtained is submitted with the assignment itself. File Named: "NIFTYoptiondata.csv".
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