

Volatility Options / Gruenbichler and Longstaff (1996)

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Contents

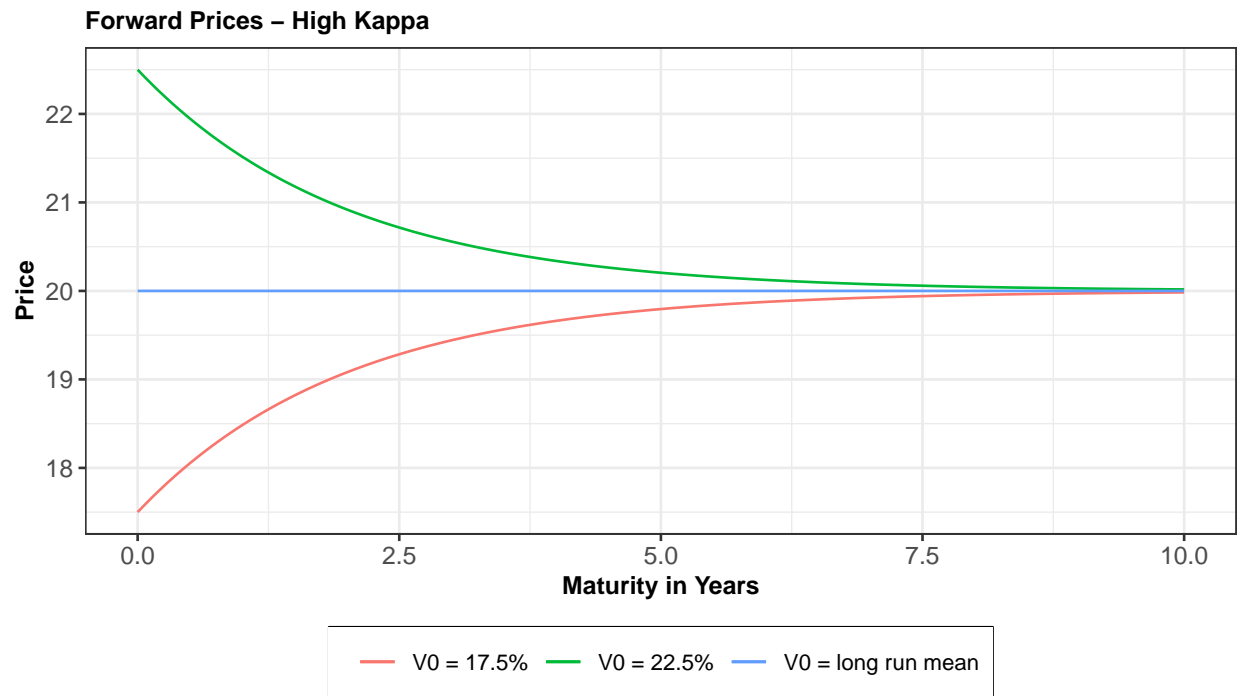
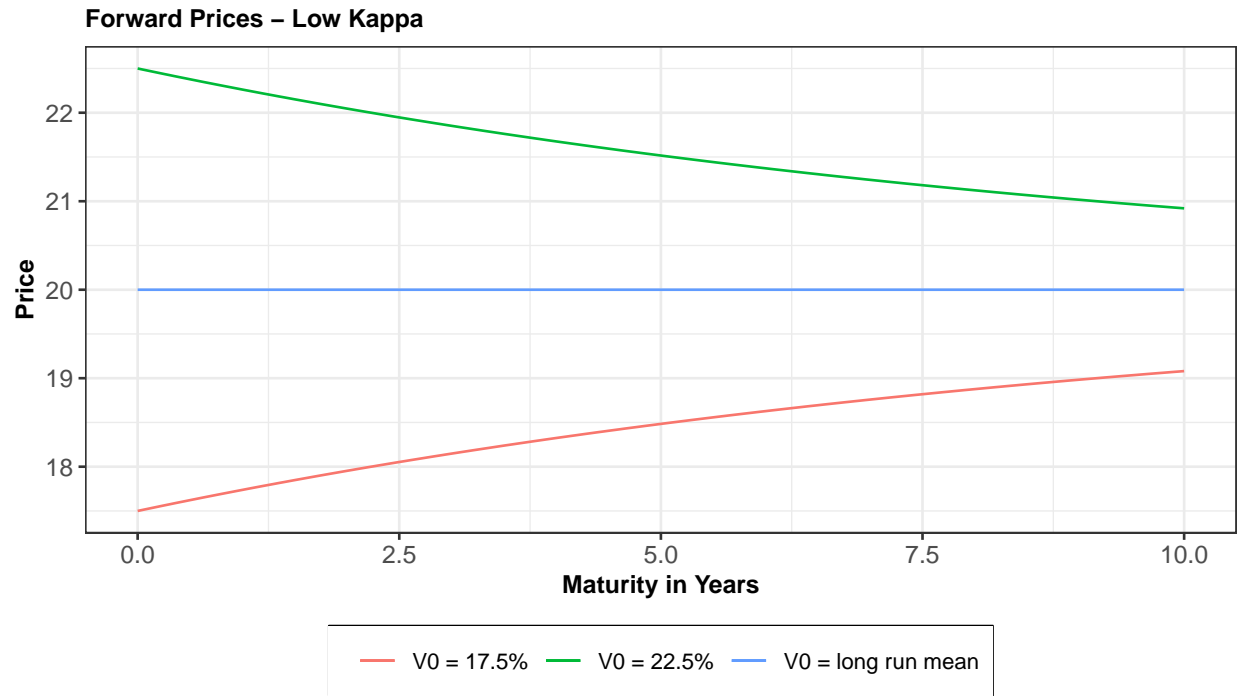
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1 Data Import

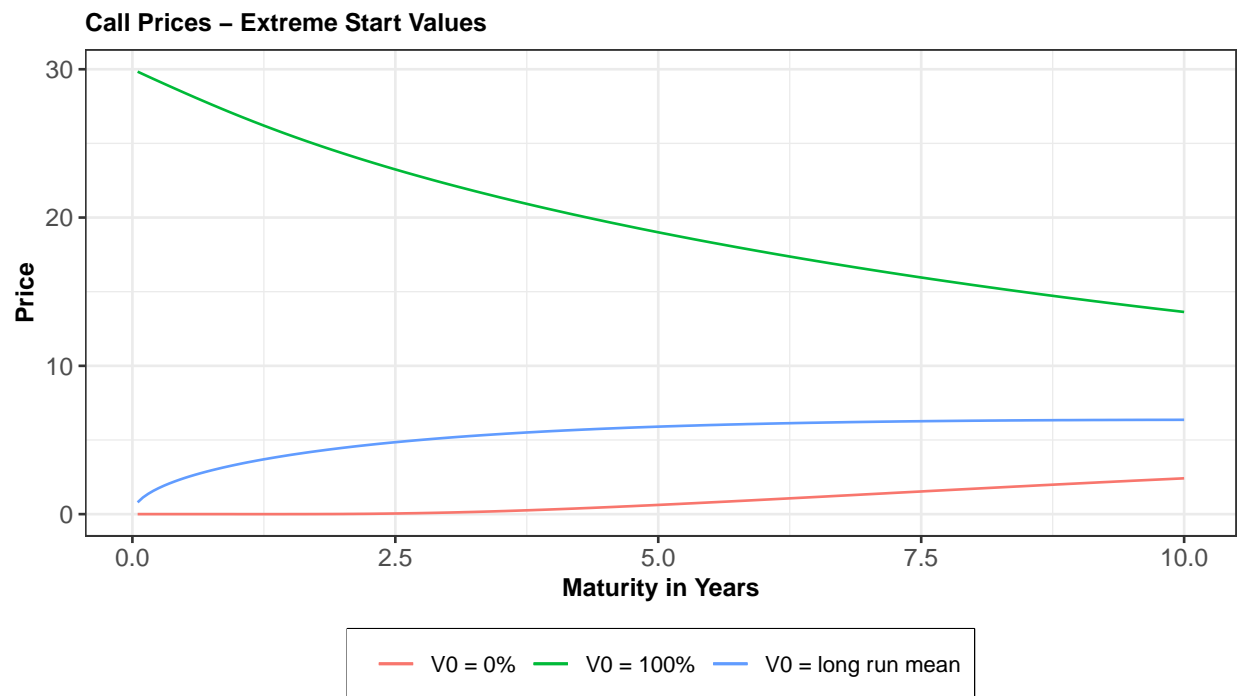
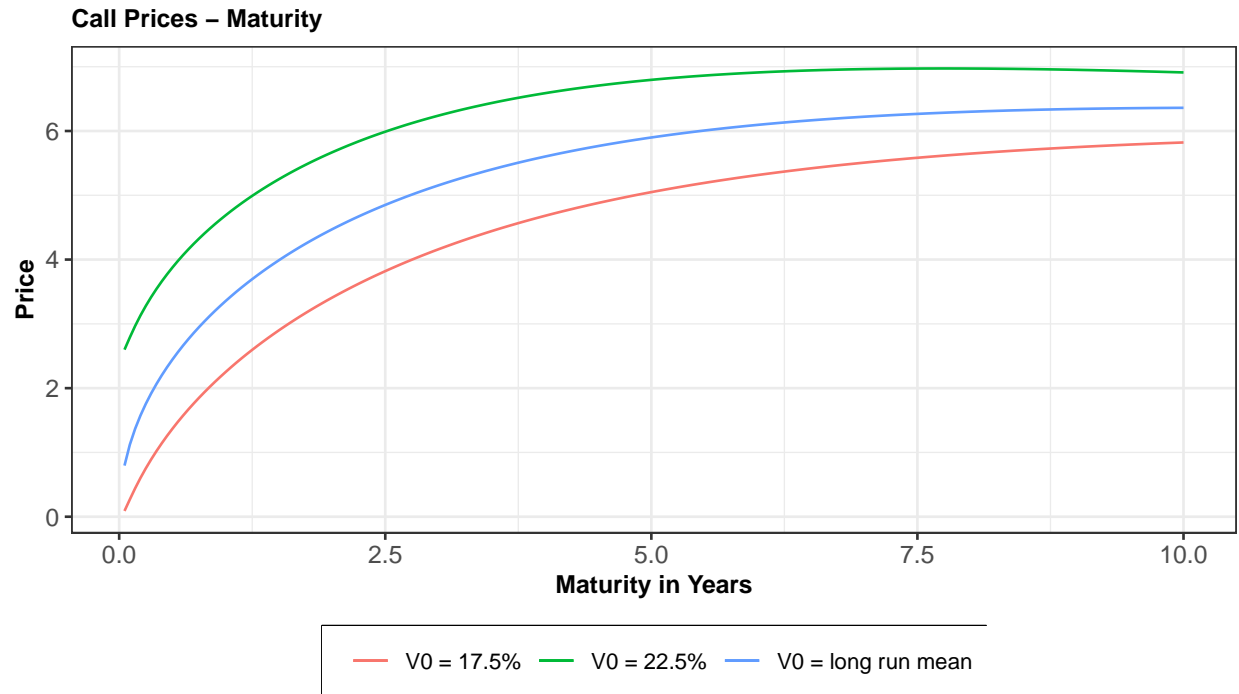
2 Gruenbichler / Longstaff Volatility Option Pricing model

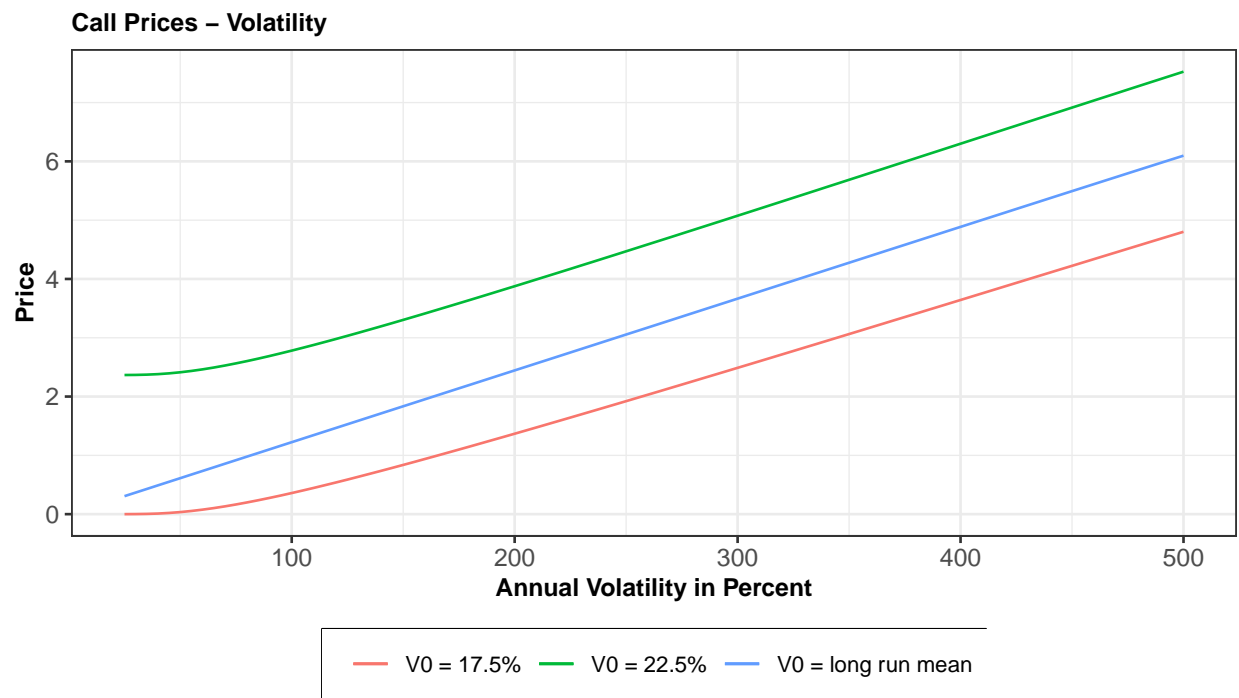
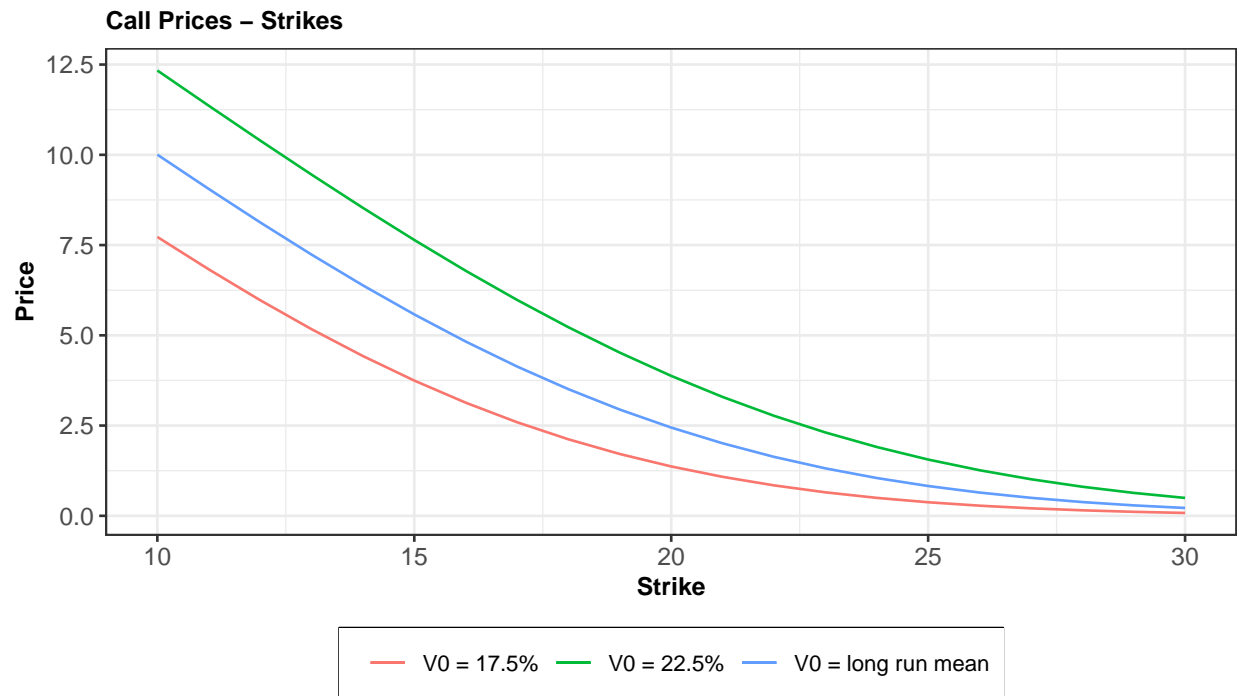
2.1 Example forward and option prices for different parameters

[1] 17.6219

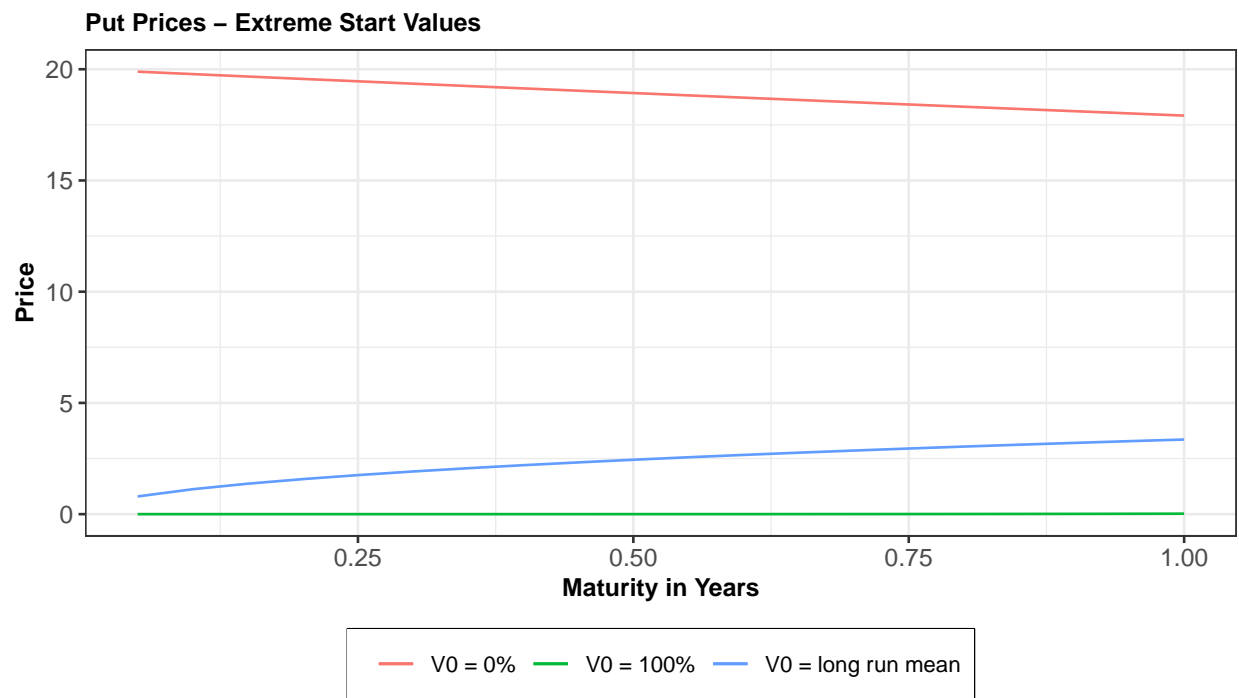
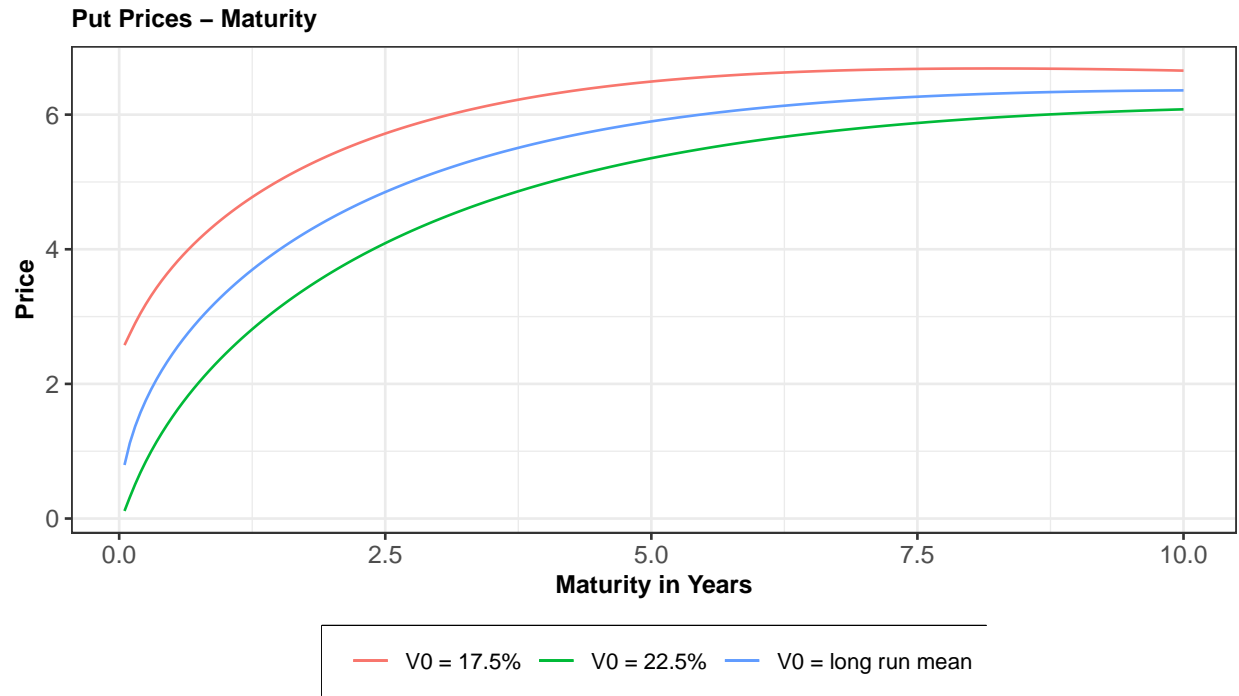


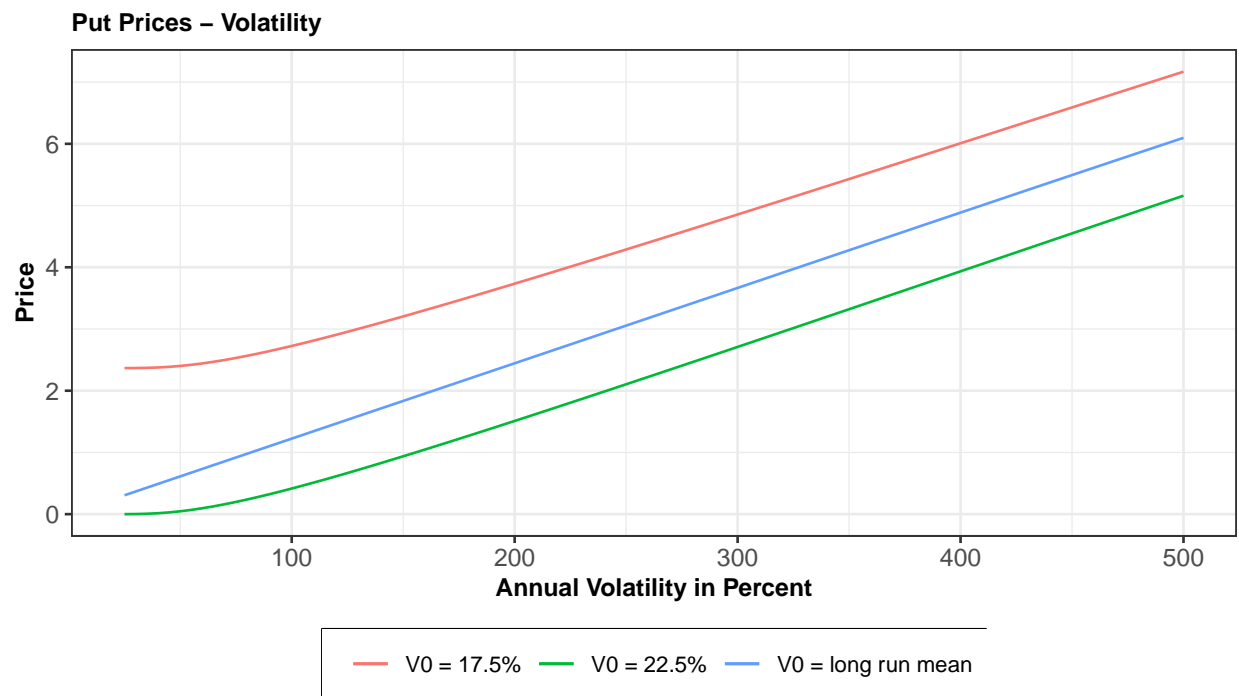
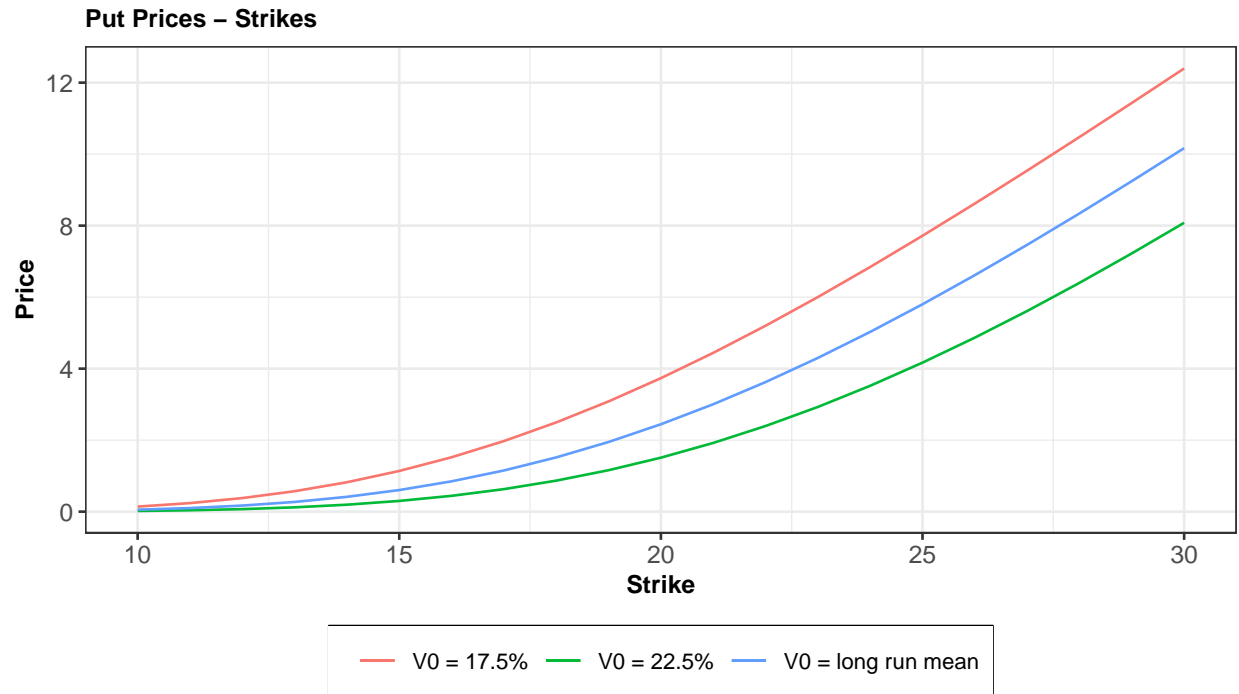
[1] 1.36809



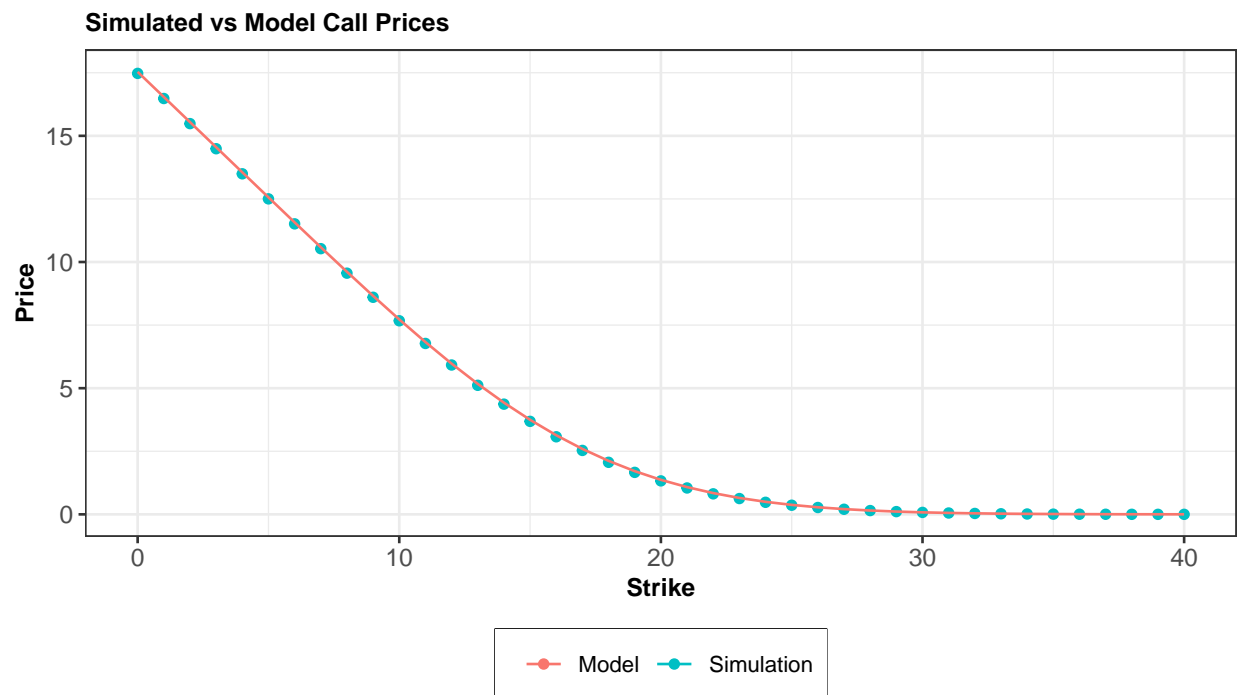
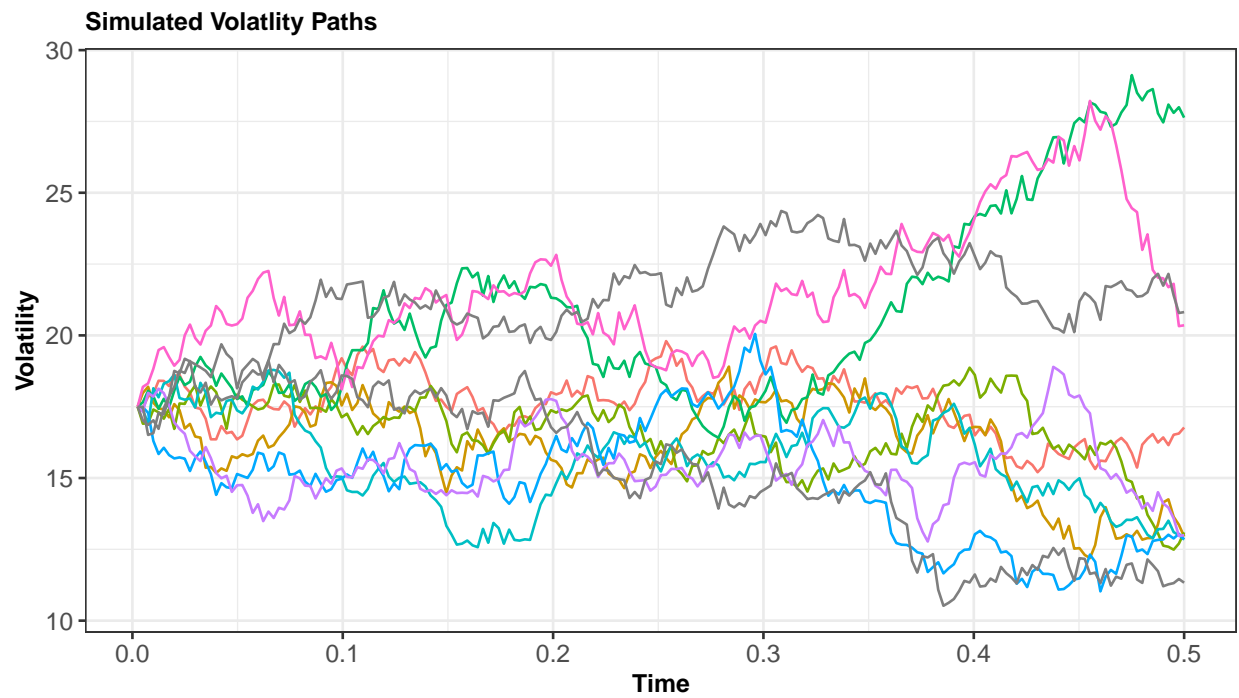


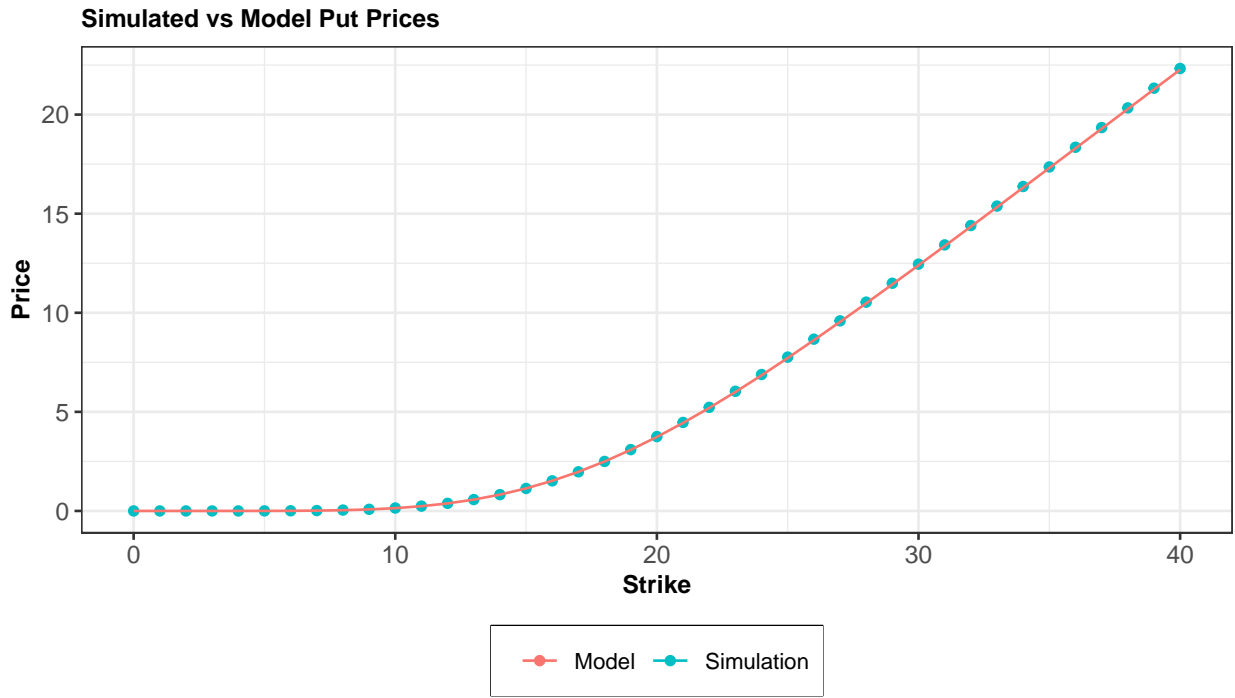
[1] 3.7343





2.2 Simulation Option Values (work in progress)



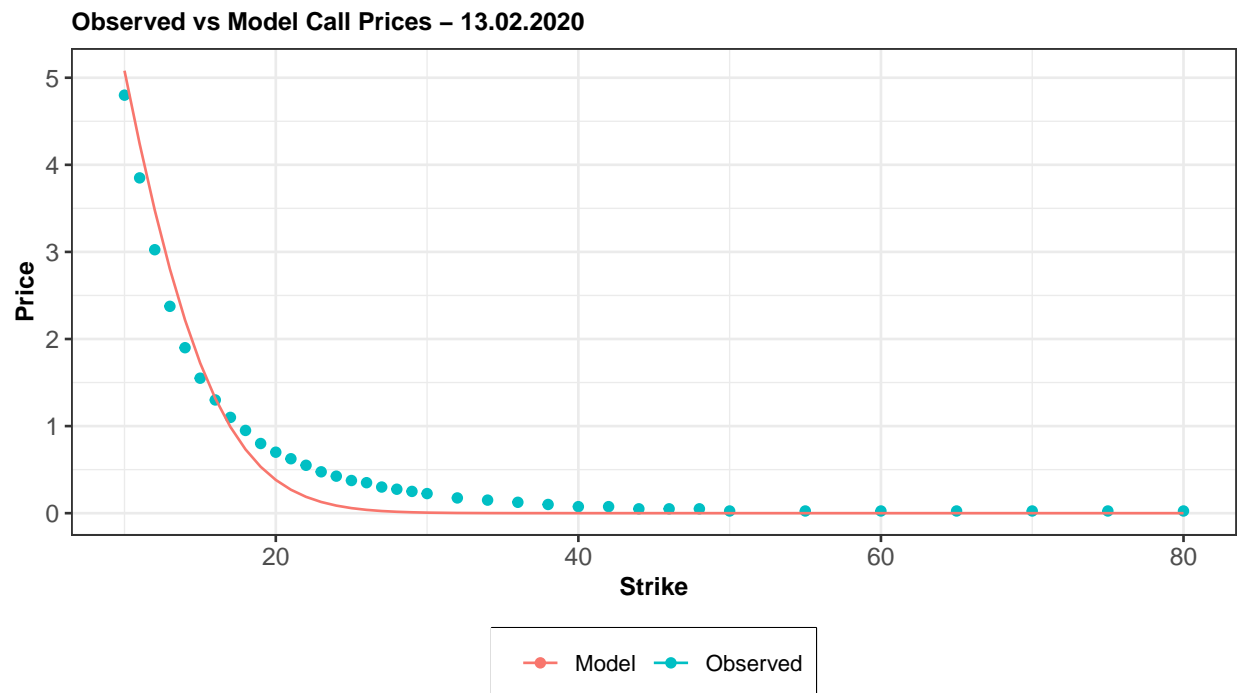


3 Model Calibration

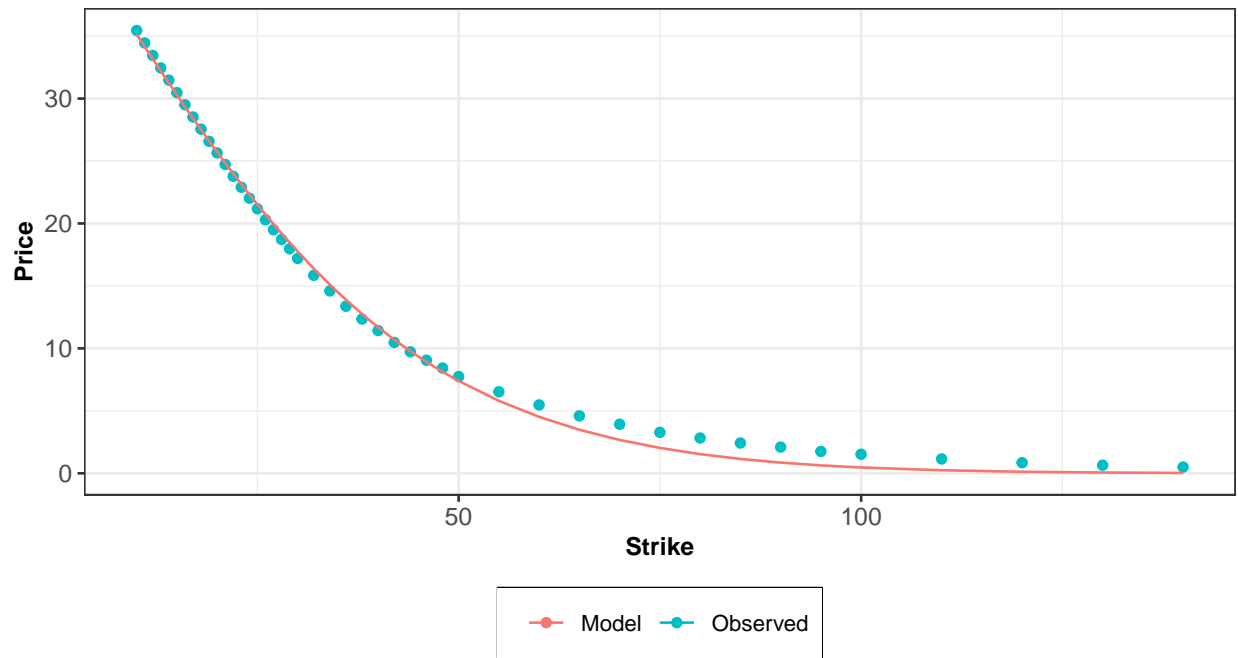
3.1 Data Cleaning

3.2 Parameter Calibration

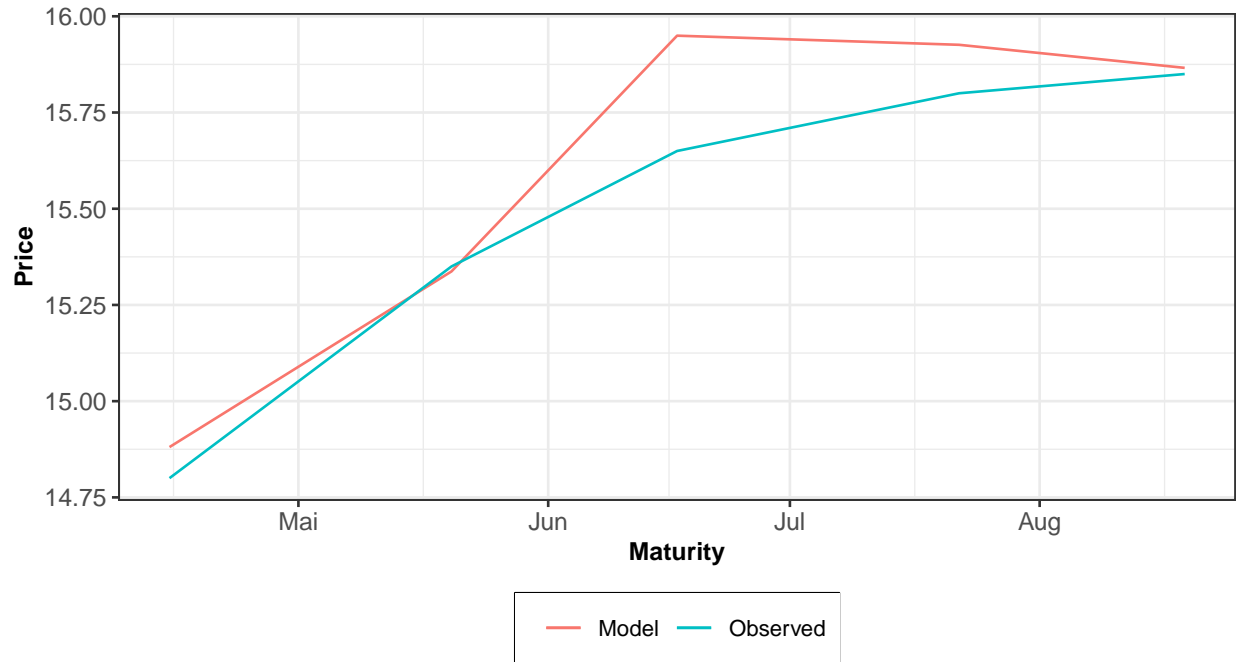
3.3 Results



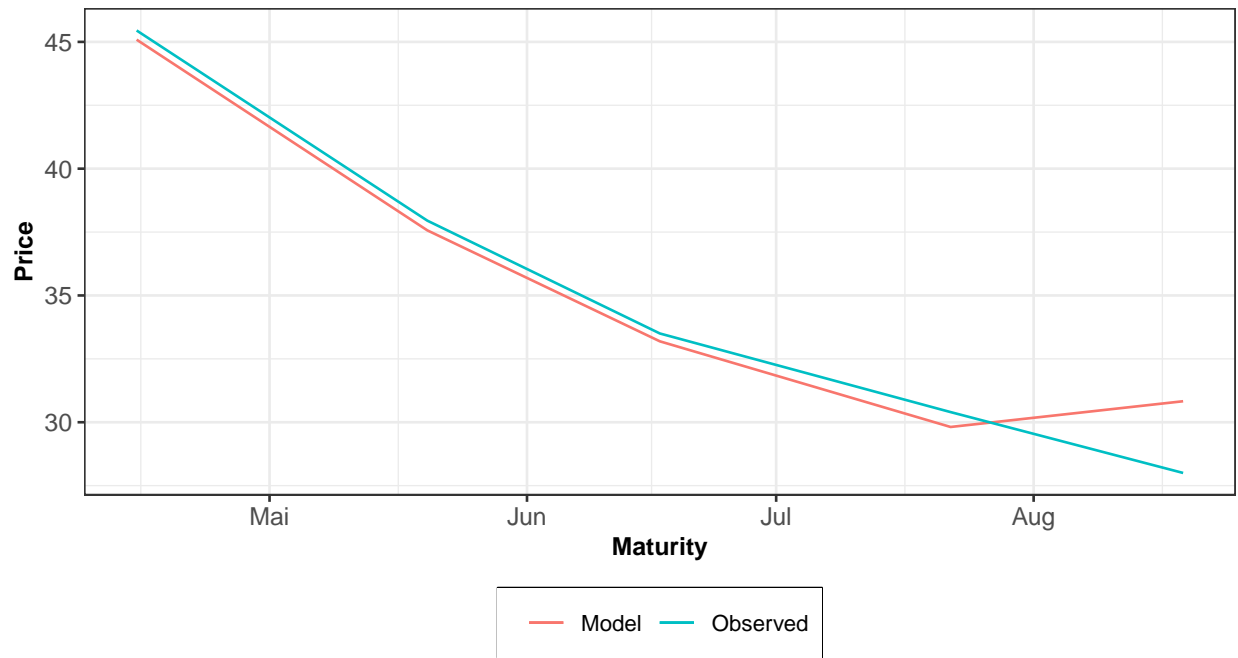
Observed vs Model Call Prices – 13.03.2020



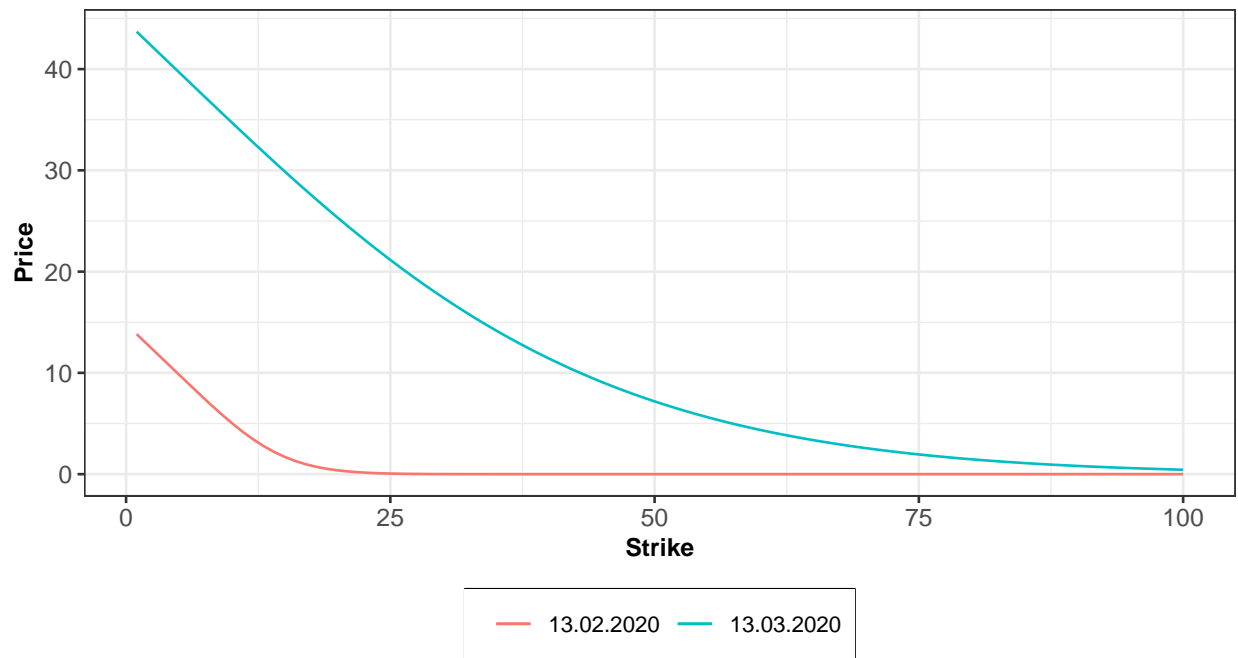
Observed vs Model Forward Prices – 13.02.2020

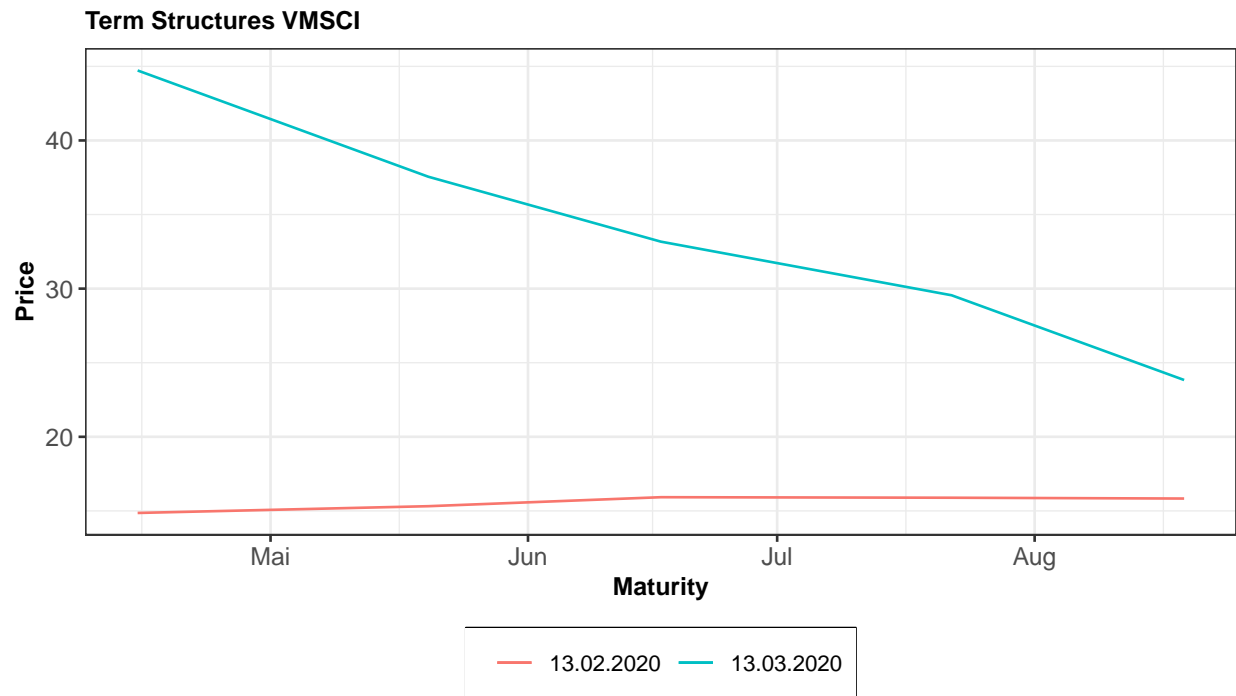


Observed vs Model Forward Prices – 13.03.2020



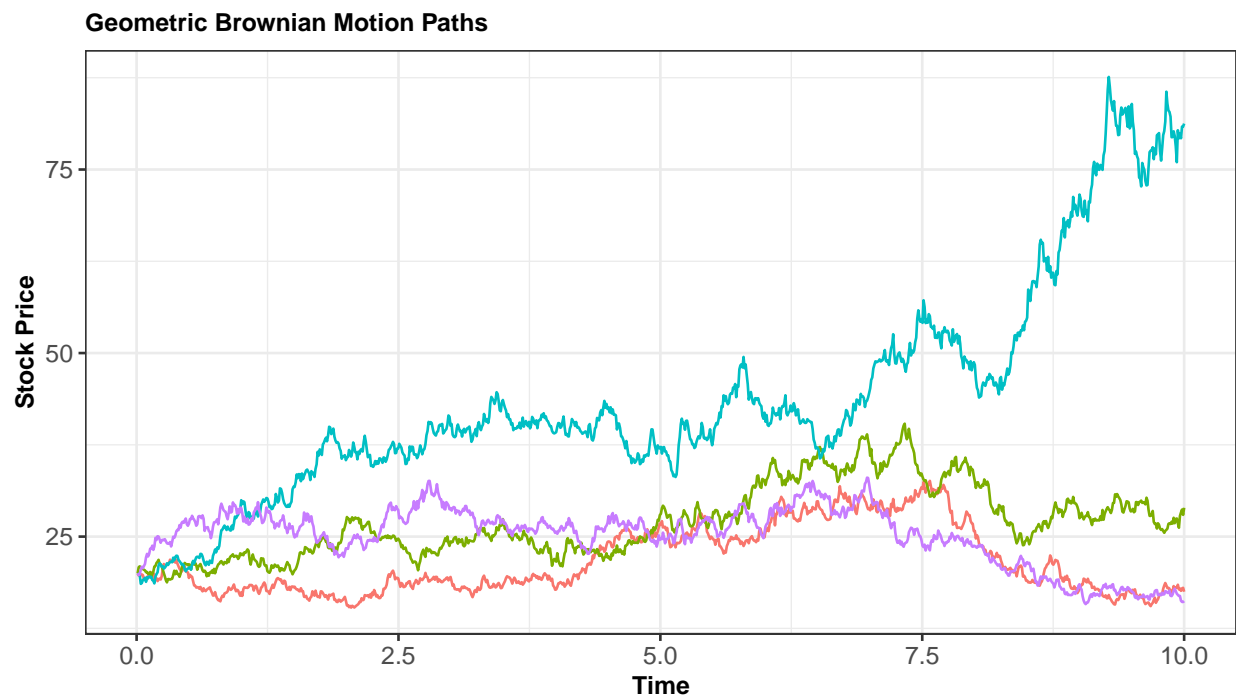
Call Options VMSCI

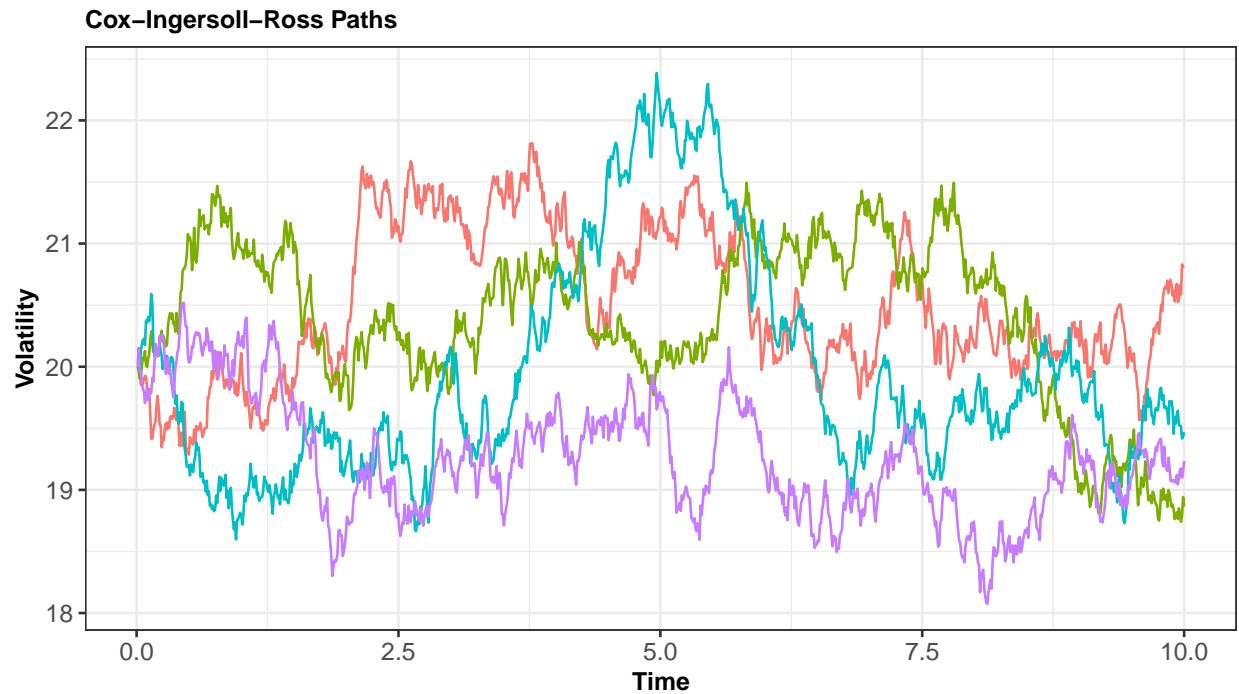




4 Additional Plot Presentation

4.1 Simulation plot GBM and CIR for intro Vola slide





4.2 Replication of Realized Variance Plot (work in progress)

- Replication not working at the moment
- need to calc price of logcontract in $t=0$, invest constant 1 dollar in stock, rest in riskfree (startvalue riskfree $\neq 0$)!!

```
## [1] 0.0614001
```

```
## [1] 0.24779
```

```
##      [,1]      [,2]      [,3]      [,4]      [,5]      [,6]      [,7]      [,8]      [,9]
## [1,]  20 20.0056 19.9419 20.0031 20.1812 20.2815 20.1949 20.1633 20.155
##      [,10]     [,11]     [,12]     [,13]     [,14]     [,15]     [,16]     [,17]     [,18]
## [1,] 20.0989 20.0354 20.0446 20.0912 20.116 20.2016 20.3498 20.3388 20.3922
##      [,19]     [,20]     [,21]     [,22]     [,23]     [,24]     [,25]     [,26]     [,27]
## [1,] 20.2679 20.2767 20.2806 20.1474 20.3377 20.3201 20.2818 20.1828 20.353
##      [,28]     [,29]     [,30]     [,31]     [,32]     [,33]     [,34]     [,35]     [,36]
## [1,] 20.2899 20.2908 20.2709 20.3974 20.5254 20.3955 20.1599 20.111 19.7714
##      [,37]     [,38]     [,39]     [,40]     [,41]     [,42]     [,43]     [,44]     [,45]
## [1,] 19.6604 19.7363 19.6491 19.5512 19.3771 19.5108 19.5114 19.5066 19.8266
##      [,46]     [,47]     [,48]     [,49]     [,50]     [,51]     [,52]     [,53]     [,54]
## [1,] 19.7684 19.7996 19.8139 19.8826 19.9085 20.057 20.3375 20.2773 20.335
##      [,55]     [,56]     [,57]     [,58]     [,59]     [,60]     [,61]     [,62]     [,63]
## [1,] 20.3878 20.3509 20.5191 20.5439 20.3394 20.1287 20.1077 20.1005 20.1835
##      [,64]     [,65]     [,66]     [,67]     [,68]     [,69]     [,70]     [,71]     [,72]
## [1,] 20.2468 20.1021 20.0962 20.0237 20.2315 20.1639 20.1276 20.3166 20.528
##      [,73]     [,74]     [,75]     [,76]     [,77]     [,78]     [,79]     [,80]     [,81]
## [1,] 20.5546 20.7166 20.9173 20.8783 21.0212 21.0906 21.0918 21.1237 20.9756
```

```

##      [,82] [,83] [,84] [,85] [,86] [,87] [,88] [,89] [,90]
## [1,] 21.2111 21.157 21.0676 21.0076 21.0748 20.9353 21.033 20.9012 20.8977
##      [,91] [,92] [,93] [,94] [,95] [,96] [,97] [,98] [,99]
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##      [,109] [,110] [,111] [,112] [,113] [,114] [,115] [,116] [,117]
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##      [,118] [,119] [,120] [,121] [,122] [,123] [,124] [,125] [,126]
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##      [,127] [,128] [,129] [,130] [,131] [,132] [,133] [,134] [,135]
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##      [,145] [,146] [,147] [,148] [,149] [,150] [,151] [,152] [,153]
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##	[326]	1.40414e-01	1.34158e-01	1.35393e-01	1.25242e-01	1.24096e-01
##	[331]	1.28606e-01	1.29698e-01	1.23530e-01	1.22561e-01	1.24981e-01
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##	[351]	1.32445e-01	1.30859e-01	1.33969e-01	1.38518e-01	1.35303e-01
##	[356]	1.31098e-01	1.35747e-01	1.40993e-01	1.42984e-01	1.28248e-01
##	[361]	1.29543e-01	1.22852e-01	1.17860e-01	1.08995e-01	1.04493e-01
##	[366]	1.05715e-01	1.02326e-01	9.74832e-02	1.01843e-01	9.87525e-02
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##	[376]	8.93111e-02	8.95646e-02	8.79388e-02	8.82649e-02	8.23149e-02
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##	[386]	6.35364e-02	5.96342e-02	5.88746e-02	5.26656e-02	5.03387e-02
##	[391]	5.37871e-02	4.90502e-02	4.86827e-02	5.86965e-02	5.81429e-02
##	[396]	5.53979e-02	6.17760e-02	6.60463e-02	5.60965e-02	4.90292e-02
##	[401]	5.12595e-02	5.31554e-02	4.86542e-02	5.04459e-02	4.83303e-02
##	[406]	5.39701e-02	5.11226e-02	5.39280e-02	4.49123e-02	4.05230e-02
##	[411]	4.31896e-02	3.41157e-02	3.66470e-02	3.97186e-02	4.64835e-02
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## [1186] -1.07664e-01 -1.01662e-01 -1.01662e-01 -1.00893e-01 -1.10313e-01
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## [1196] -1.02665e-01 -1.03452e-01 -1.00995e-01 -1.01061e-01 -9.76161e-02
## [1201] -1.10806e-01 -1.07638e-01 -1.08159e-01 -1.08492e-01 -1.11837e-01
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## [1211] -9.36247e-02 -9.52065e-02 -8.45090e-02 -8.35633e-02 -8.90636e-02
## [1216] -7.61046e-02 -7.65388e-02 -7.88297e-02 -8.95995e-02 -9.27895e-02
## [1221] -9.62388e-02 -9.58448e-02 -1.00109e-01 -9.92651e-02 -1.05696e-01
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## [1301] -1.65439e-01 -1.57001e-01 -1.56282e-01 -1.60406e-01 -1.58388e-01
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## [1671] -1.25474e-01 -1.37534e-01 -1.33127e-01 -1.31949e-01 -1.26967e-01
## [1676] -1.22007e-01 -1.16387e-01 -1.16364e-01 -1.13532e-01 -1.16317e-01
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## [1686] -1.26748e-01 -1.38572e-01 -1.29894e-01 -1.37201e-01 -1.39595e-01
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## [1916] -1.77995e-01 -1.86151e-01 -1.99550e-01 -1.93892e-01 -1.98355e-01
## [1921] -1.93699e-01 -1.92871e-01 -1.92553e-01 -1.90251e-01 -1.91005e-01
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## [1941] -1.91233e-01 -2.03764e-01 -2.02442e-01 -1.97362e-01 -2.02440e-01
## [1946] -2.04696e-01 -2.01066e-01 -1.97740e-01 -1.96782e-01 -2.02284e-01
## [1951] -2.03635e-01 -1.99888e-01 -2.03979e-01 -2.08885e-01 -1.99870e-01
## [1956] -1.89489e-01 -1.82634e-01 -1.86639e-01 -1.81858e-01 -1.78721e-01
## [1961] -1.82746e-01 -1.82489e-01 -1.82854e-01 -1.80938e-01 -1.80485e-01
## [1966] -1.78199e-01 -1.78821e-01 -1.75057e-01 -1.67953e-01 -1.72727e-01
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## [1986] -1.59225e-01 -1.57246e-01 -1.57592e-01 -1.64689e-01 -1.63849e-01
## [1991] -1.64187e-01 -1.70139e-01 -1.73059e-01 -1.80389e-01 -1.88359e-01
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## [225] 0.0454840 0.0454664 0.0458918 0.0459099 0.0461314 0.0460245 0.0458716
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##	[253]	0.0452307	0.0454867	0.0451692	0.0453088	0.0454350	0.0451386	0.0451555
##	[260]	0.0453323	0.0454498	0.0452648	0.0449704	0.0451380	0.0446390	0.0443088
##	[267]	0.0437629	0.0439458	0.0441638	0.0444860	0.0446082	0.0446041	0.0444055
##	[274]	0.0444051	0.0441921	0.0442783	0.0441850	0.0441372	0.0439057	0.0440252
##	[281]	0.0440096	0.0441639	0.0439429	0.0442678	0.0438395	0.0439528	0.0438566
##	[288]	0.0441352	0.0442885	0.0441576	0.0437369	0.0437026	0.0434077	0.0433609
##	[295]	0.0430776	0.0429673	0.0430461	0.0428343	0.0430735	0.0430641	0.0428840
##	[302]	0.0429612	0.0429260	0.0429381	0.0427273	0.0427019	0.0429007	0.0429339
##	[309]	0.0429374	0.0431563	0.0428208	0.0428049	0.0427307	0.0429391	0.0428840
##	[316]	0.0430664	0.0430779	0.0426564	0.0427904	0.0429432	0.0433744	0.0435112
##	[323]	0.0436615	0.0435391	0.0436987	0.0436679	0.0439428	0.0438886	0.0443387
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##	[337]	0.0436867	0.0437782	0.0435807	0.0438762	0.0435817	0.0435300	0.0437843
##	[344]	0.0437502	0.0433387	0.0438192	0.0437988	0.0441544	0.0441694	0.0442946
##	[351]	0.0440350	0.0441050	0.0439683	0.0437692	0.0439103	0.0440958	0.0438917
##	[358]	0.0436626	0.0435759	0.0442276	0.0441704	0.0444679	0.0446910	0.0450908
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##	[372]	0.0461107	0.0461868	0.0464894	0.0460697	0.0459942	0.0459826	0.0460574
##	[379]	0.0460424	0.0463180	0.0465965	0.0469342	0.0476562	0.0476094	0.0474025
##	[386]	0.0472044	0.0473894	0.0474254	0.0477217	0.0478330	0.0476686	0.0478955
##	[393]	0.0479131	0.0474381	0.0474643	0.0475950	0.0472933	0.0470923	0.0475655
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##	[407]	0.0478057	0.0476720	0.0481057	0.0483178	0.0481893	0.0486305	0.0485077
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##	[428]	0.0501774	0.0498835	0.0500353	0.0500342	0.0501449	0.0500750	0.0501212
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##	[449]	0.0513735	0.0519629	0.0519090	0.0517709	0.0519866	0.0520827	0.0520409
##	[456]	0.0524159	0.0527002	0.0527570	0.0527959	0.0529372	0.0529979	0.0531351
##	[463]	0.0532752	0.0532719	0.0534673	0.0531637	0.0537875	0.0535156	0.0534973
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##	[477]	0.0549249	0.0543106	0.0539531	0.0538676	0.0540362	0.0534989	0.0540700
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##	[582]	0.0534804	0.0530360	0.0534345	0.0537281	0.0538507	0.0545715	0.0544921
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##	[610]	0.0538590	0.0539942	0.0535340	0.0533269	0.0531827	0.0532077	0.0530819

##	[617]	0.0531467	0.0524311	0.0530079	0.0530038	0.0531251	0.0537190	0.0538191
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##	[953]	0.0543358	0.0539993	0.0539198	0.0538505	0.0535087	0.0533341	0.0536549
##	[960]	0.0538742	0.0536561	0.0538561	0.0537527	0.0539483	0.0538256	0.0542035
##	[967]	0.0541841	0.0544025	0.0547961	0.0548322	0.0546559	0.0544625	0.0544411
##	[974]	0.0544301	0.0543599	0.0543938	0.0546061	0.0547460	0.0544883	0.0546248
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##	[1002]	0.0561678	0.0559584	0.0556546	0.0550884	0.0555927	0.0560838	0.0559398
##	[1009]	0.0558279	0.0558230	0.0556975	0.0558187	0.0562342	0.0555886	0.0560642
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##	[1065]	0.0585037	0.0585124	0.0586320	0.0584040	0.0580430	0.0583734	0.0585030
##	[1072]	0.0578639	0.0574406	0.0571817	0.0578404	0.0575593	0.0574678	0.0580253
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##	[1100]	0.0587997	0.0587757	0.0588312	0.0587844	0.0586470	0.0586614	0.0584664
##	[1107]	0.0582183	0.0580807	0.0574024	0.0574180	0.0576399	0.0577219	0.0578290
##	[1114]	0.0583500	0.0584621	0.0583683	0.0582597	0.0580685	0.0578485	0.0578635
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##	[1135]	0.0567111	0.0567610	0.0572200	0.0572640	0.0570125	0.0572137	0.0566979
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##	[1163]	0.0570623	0.0565479	0.0567707	0.0567034	0.0565033	0.0563354	0.0569244
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