

COE782- ML - Lista2 - Parte prática - E31

Lei dos Grandes Números

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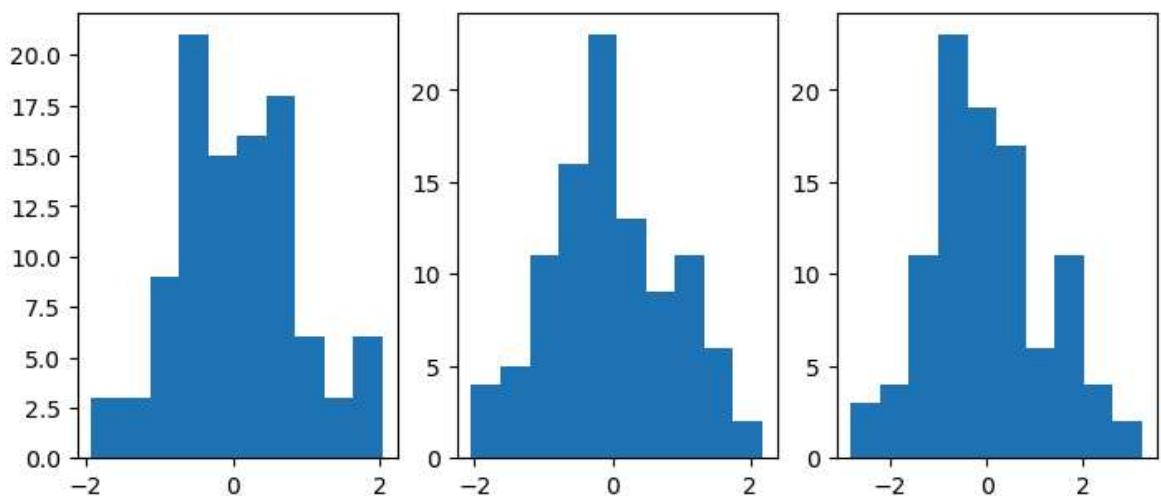
DRE:125228569

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In [1]: import numpy as np  
import matplotlib.pyplot as plt
```

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In [7]: #1) Definição das variáveis aleatórias com distribuição normal ( $\mu=0$  ,  $\text{std } =1$ )  
N = 500  
n = 100  
  
V = np.zeros((N,n)) #matriz zerada para receber as distribuições gaus
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In [8]: for i in range(N):  
    var = np.random.default_rng().standard_normal(size=n) #distribuição normal  
  
    #salva a variável matriz  
    for j in range(n):  
        V[i][j] = var[j]
```

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In [9]: fig, axs = plt.subplots(1, 3, figsize=(7, 3), layout='constrained')  
  
axs[0].hist(V[1], bins = 10)  
axs[1].hist(V[4], bins = 10)  
axs[2].hist(V[1]+V[4], bins = 10)  
plt.show()
```



```
In [10]: #2)verificação Lei dos Grandes Números  
Vt = np.zeros(n)  
x = np.linspace(-2.5, 2.5, num=50)  
  
for i in range(N):  
    Vt = Vt+V[i] #soma
```

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#estimador
mu = np.mean(Vt/(i+1))
var = np.std(Vt/(i+1), ddof=1)**2

#printa média das distribuições
print('N = ', i+1, ' Média = ', mu, ' Variância = ', var)
fig, axs = plt.subplots(1, 1, figsize=(5, 3), layout='constrained')

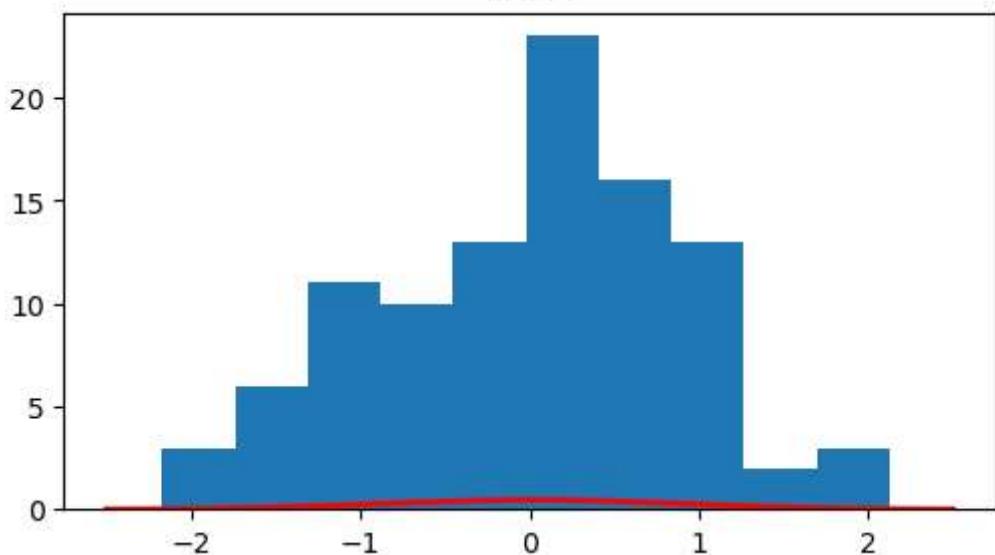
axs.hist(Vt/(i+1), bins = 10) #média
axs.plot(x, (1/np.sqrt(2 * np.pi * var)) * np.exp((-x - mu)**2) / (2 * var))
axs.set_title("N = "+ str(i+1))

plt.show()

```

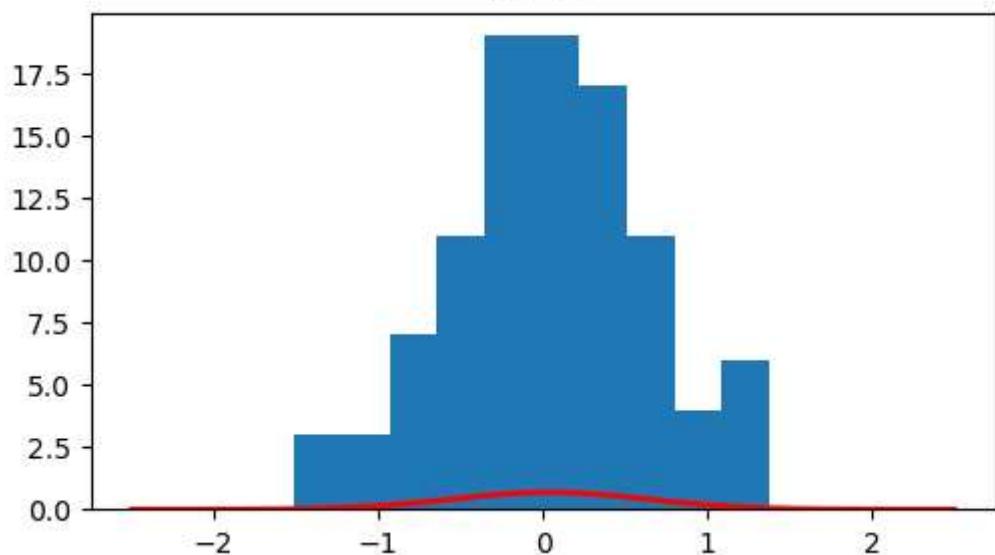
N = 1 Média = 0.019303151322531128 Variância = 0.7800454953226671

N = 1



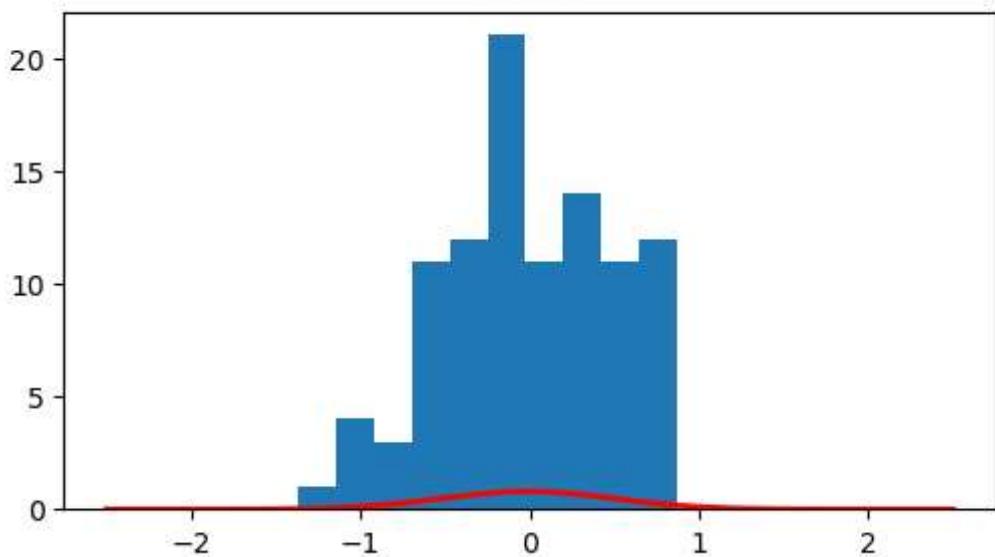
N = 2 Média = 0.03960671792323687 Variância = 0.34389402344776837

N = 2



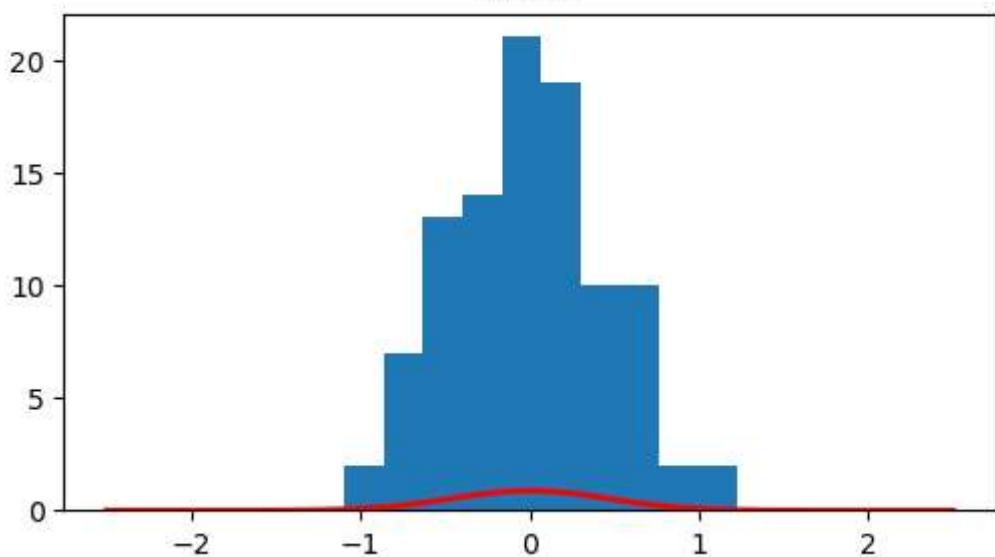
N = 3 Média = -0.011358001484082305 Variância = 0.2563900224570128

N = 3



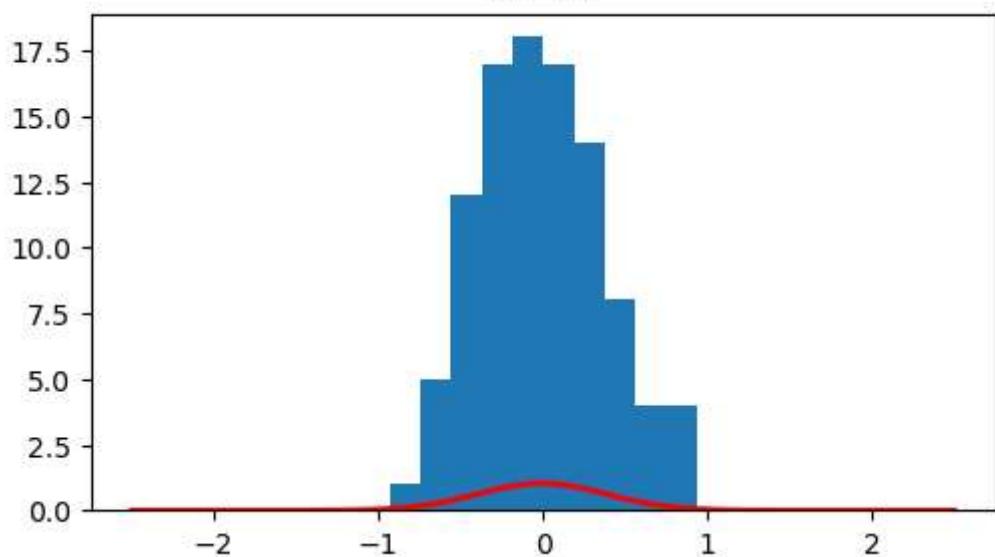
N = 4 Média = 0.0008482251728204543 Variância = 0.2077193977730554

N = 4



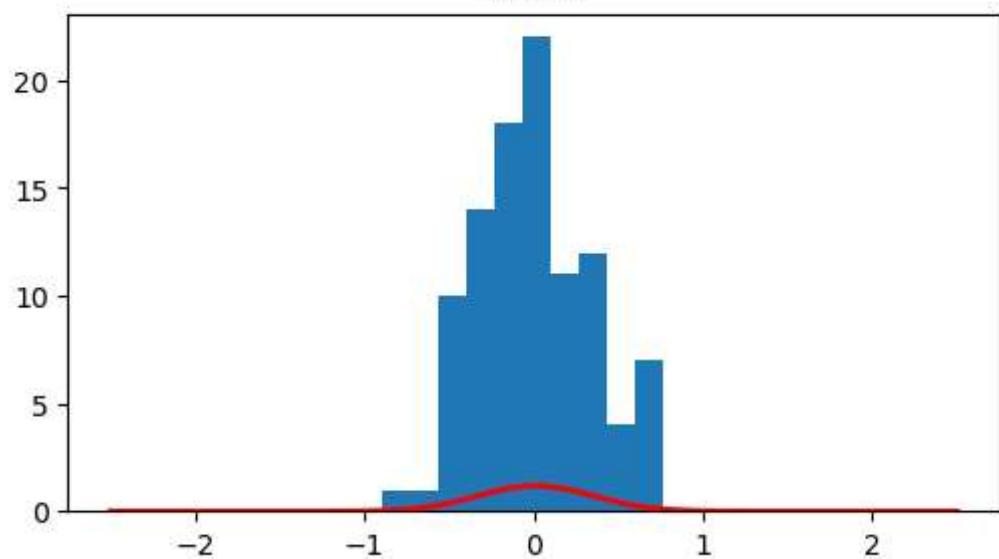
N = 5 Média = -0.006259435966017476 Variância = 0.1502896266214679

N = 5



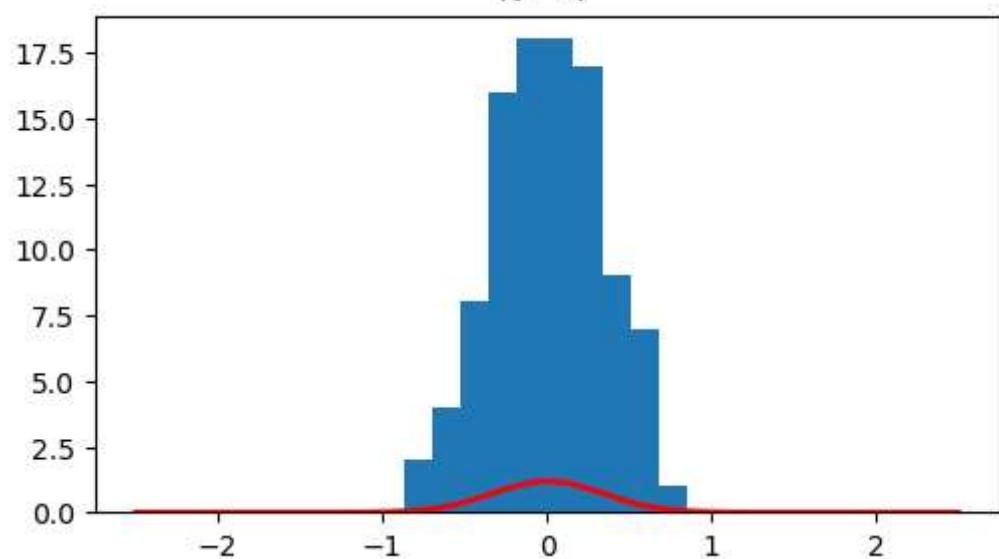
N = 6 Média = 0.01096013812953852 Variância = 0.1132251115209335

N = 6



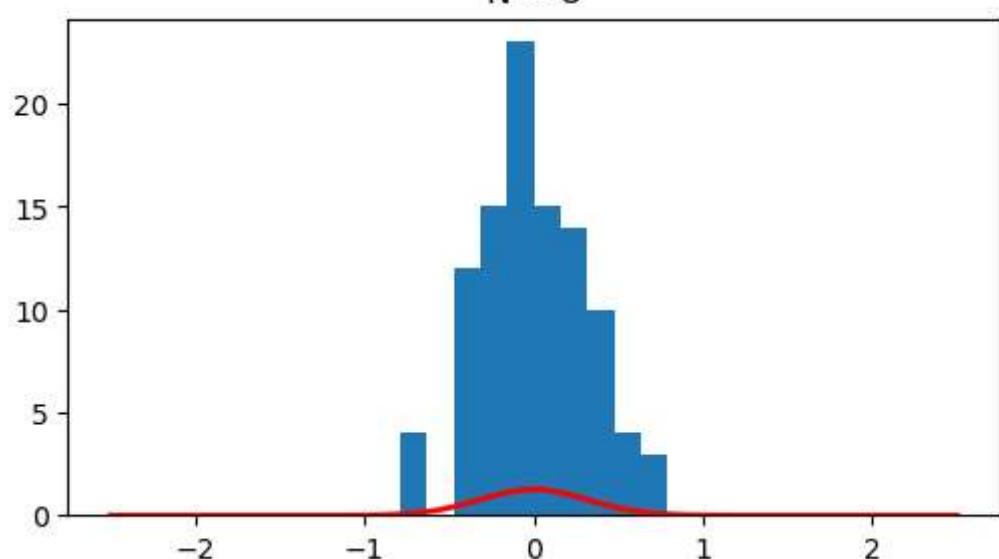
N = 7 Média = 0.004441580551364026 Variância = 0.11276357565626663

N = 7



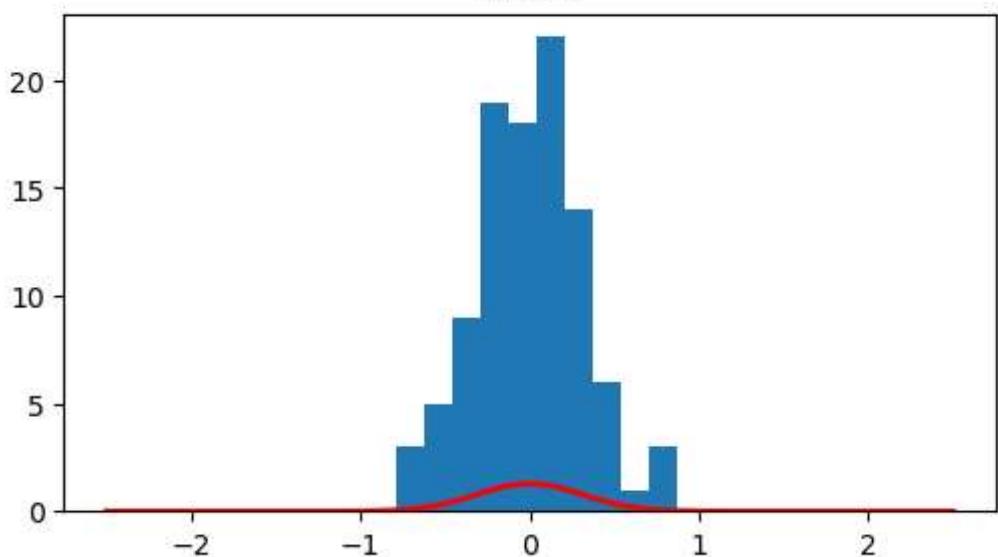
N = 8 Média = -0.001231623587019315 Variância = 0.09881260190892663

N = 8



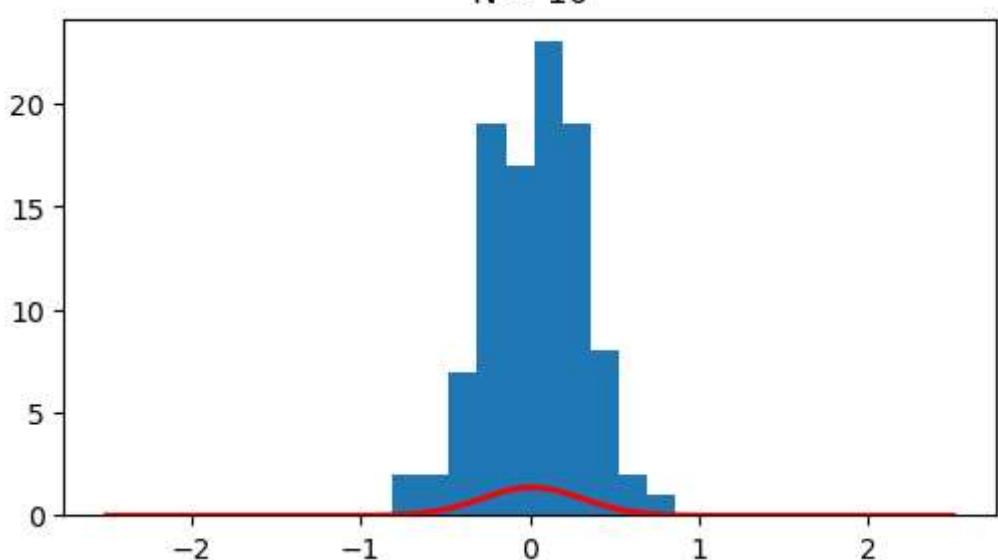
N = 9 Média = -0.0004139405081715564 Variância = 0.09566196691799722

N = 9



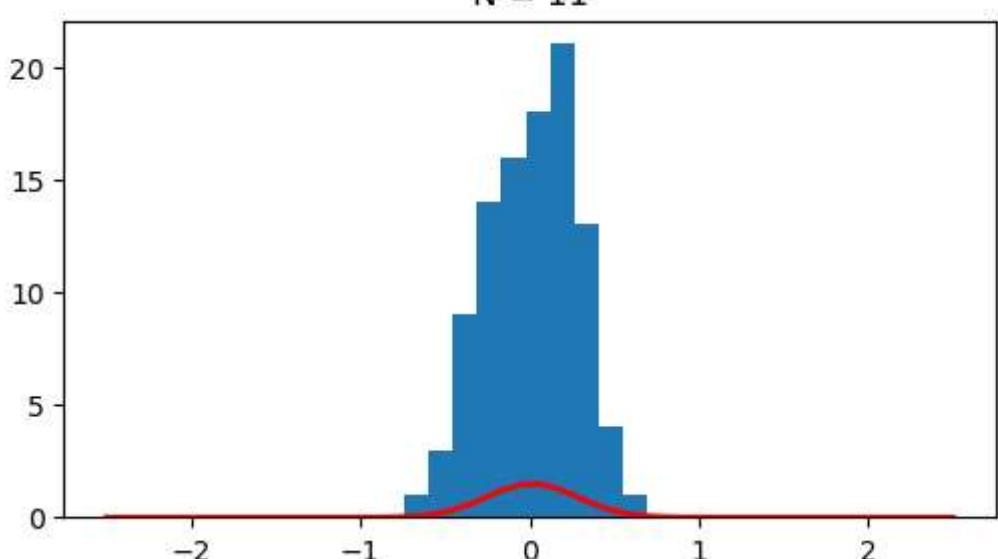
N = 10 Média = 0.014543883072663416 Variância = 0.08438062563795563

N = 10



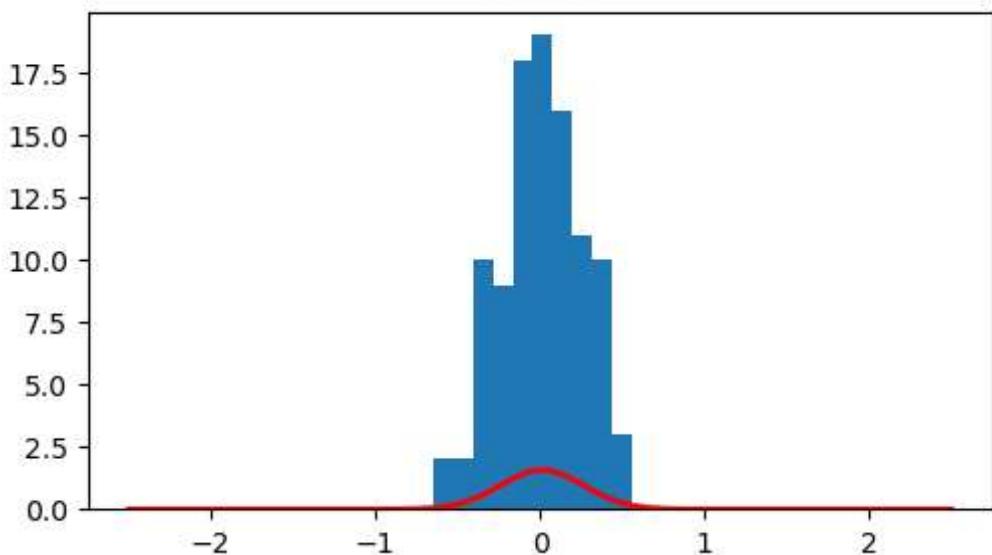
N = 11 Média = 0.013405503534920666 Variância = 0.07110041838221849

N = 11



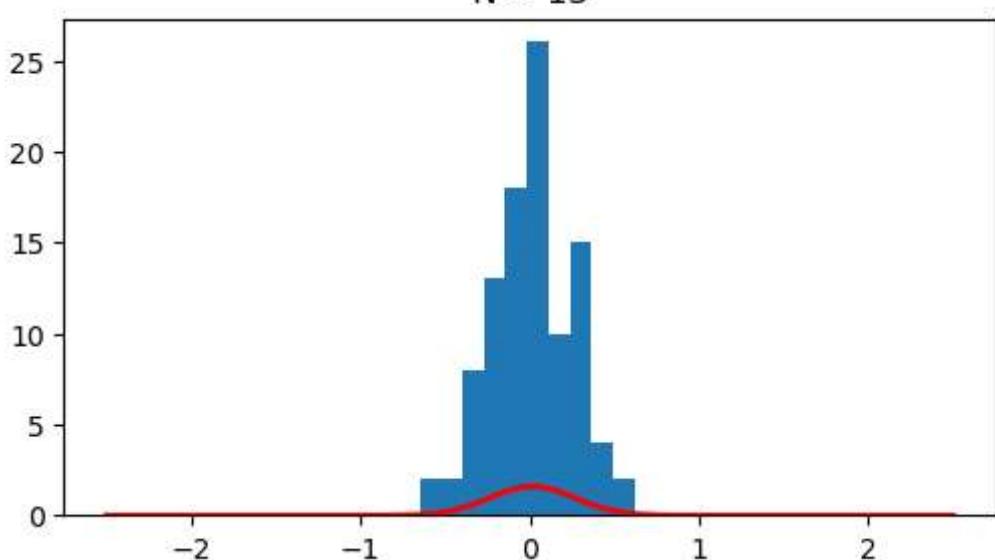
N = 12 Média = 0.012016719426048372 Variância = 0.06332386133165642

N = 12



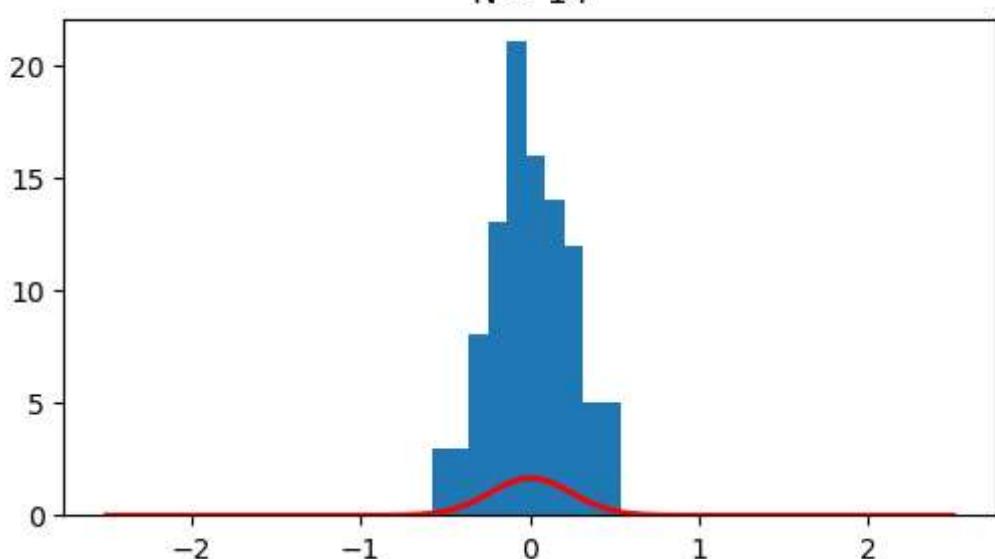
N = 13 Média = 0.015298442449027507 Variância = 0.06160450850196123

N = 13



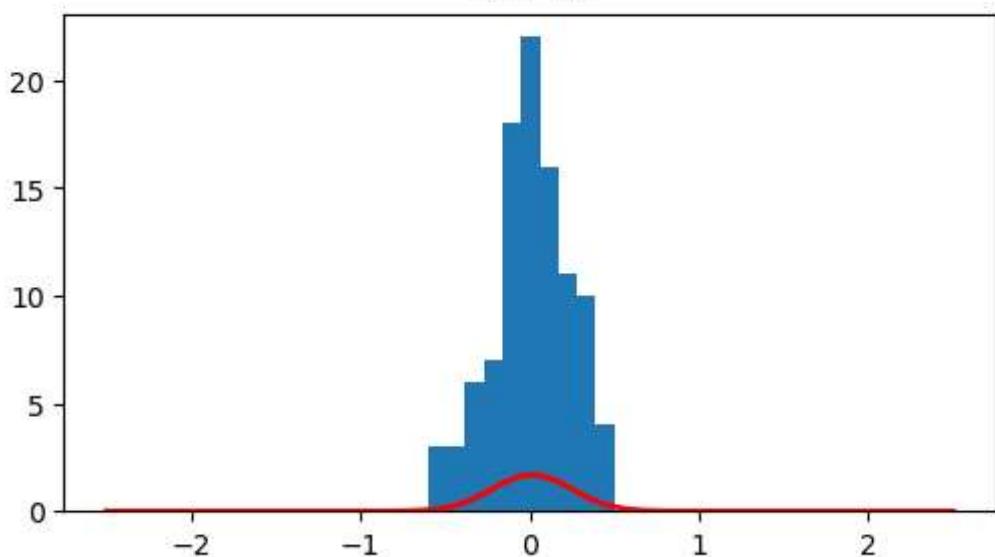
N = 14 Média = 0.007121357060110458 Variância = 0.05676970817807953

N = 14



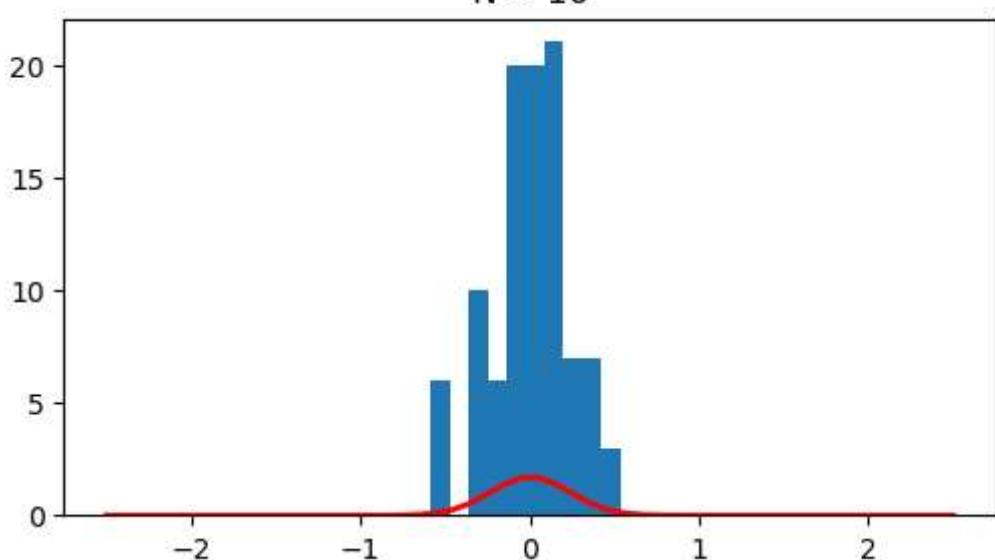
N = 15 Média = 0.014637722141275173 Variância = 0.05434477742552196

N = 15



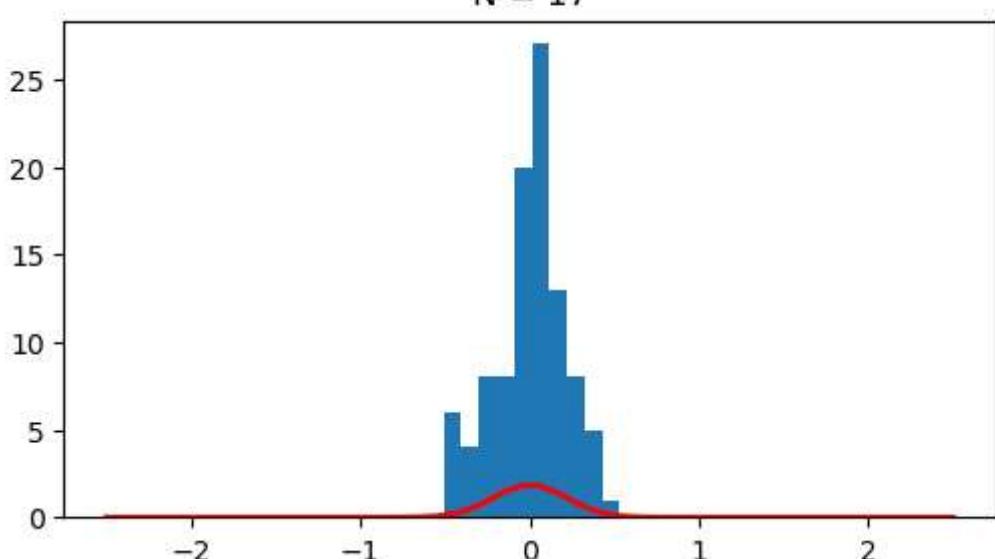
N = 16 Média = 0.004084053439210911 Variância = 0.05453944622273933

N = 16



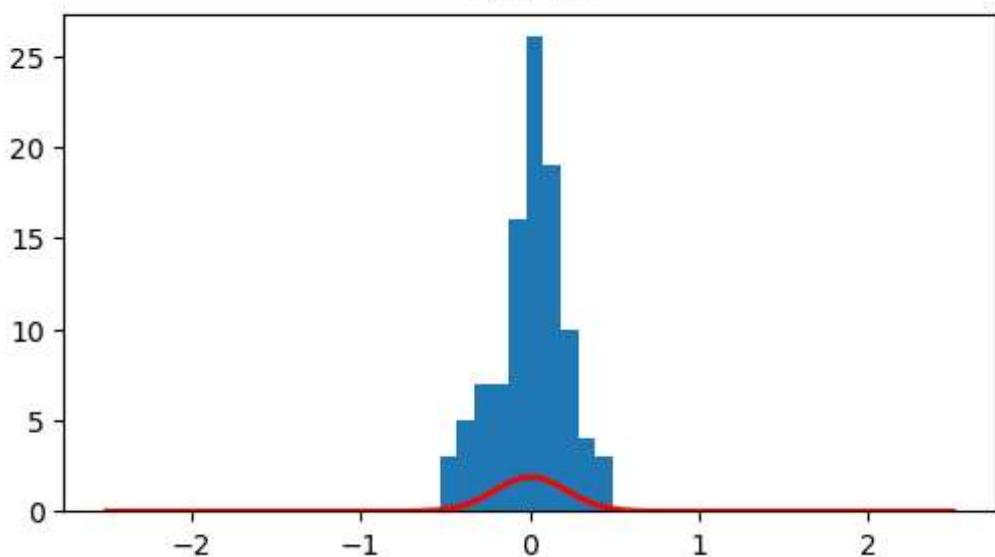
N = 17 Média = 0.0017960181863134416 Variância = 0.045377886987325186

N = 17



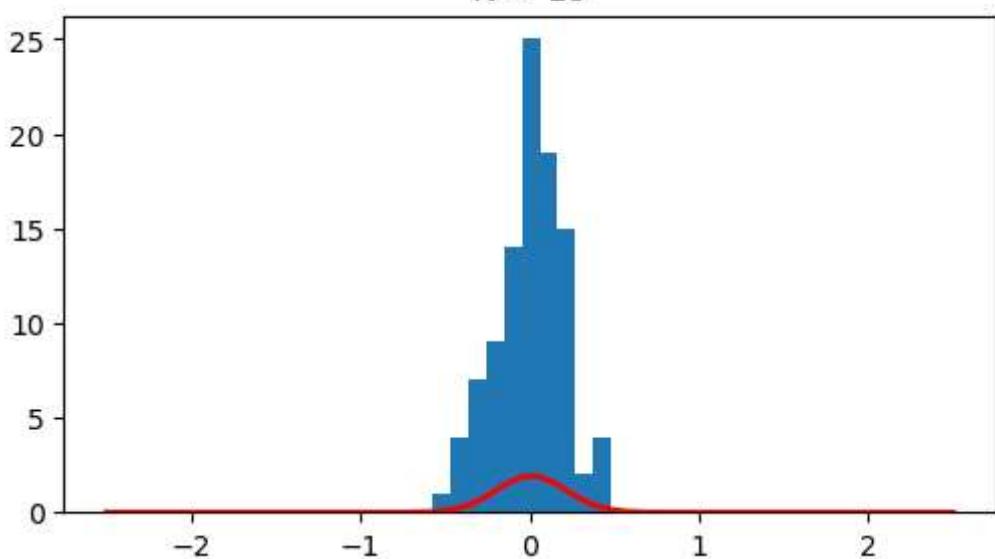
N = 18 Média = 0.005490929777501438 Variância = 0.04356869120392379

N = 18



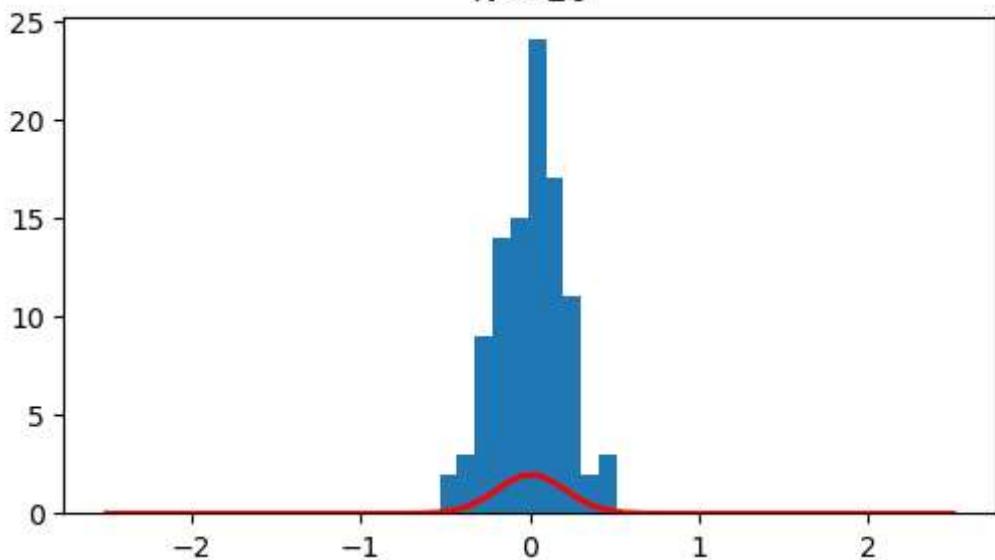
N = 19 Média = 0.008985497811580303 Variância = 0.041603334908003956

N = 19



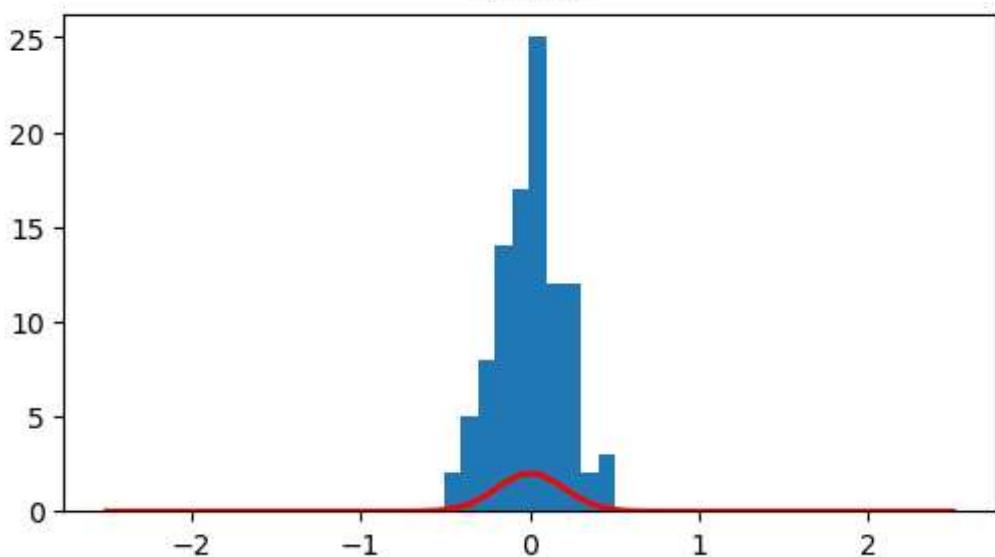
N = 20 Média = 0.007651175557823654 Variância = 0.040173984530188216

N = 20



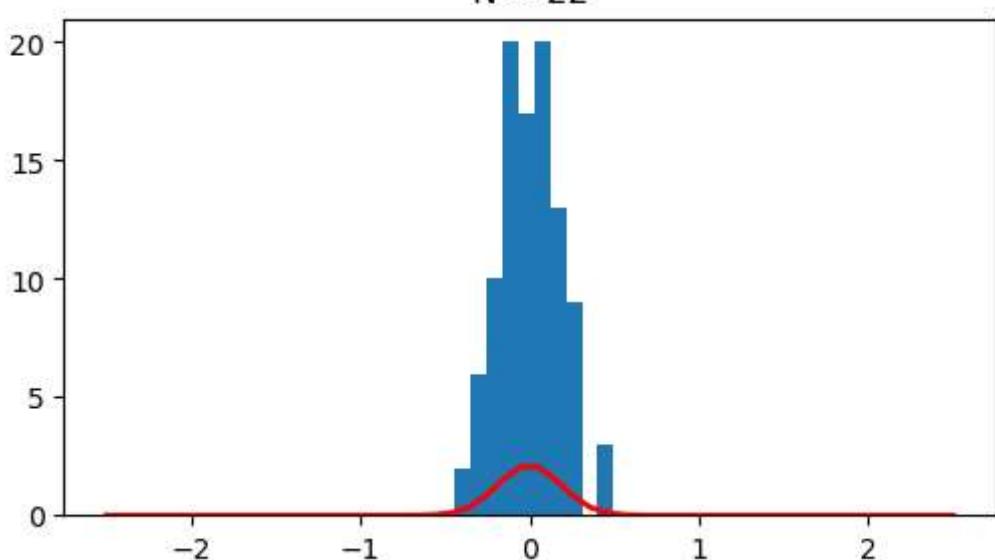
N = 21 Média = 0.003480906582472552 Variância = 0.03861373397673839

N = 21



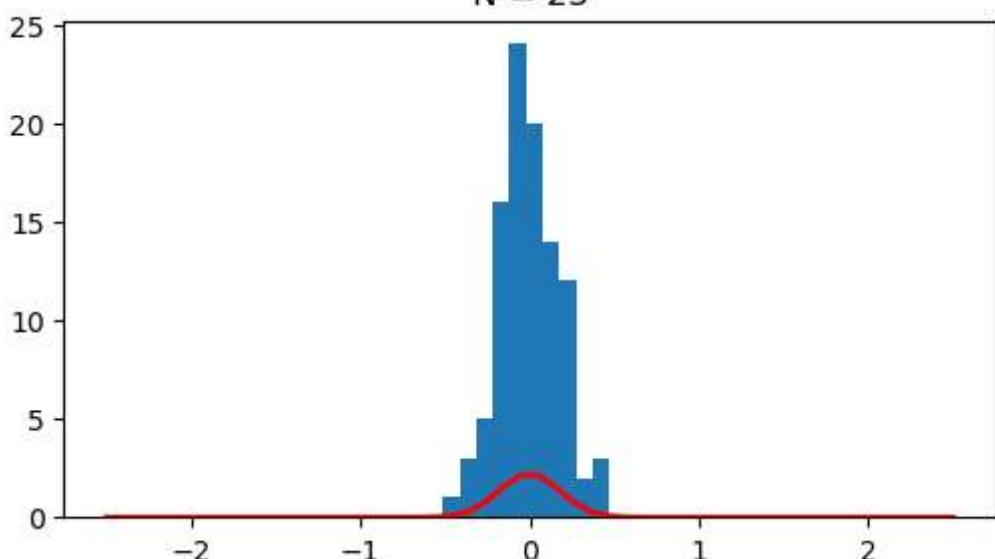
N = 22 Média = -0.001687259628549869 Variância = 0.03510927647937021

N = 22



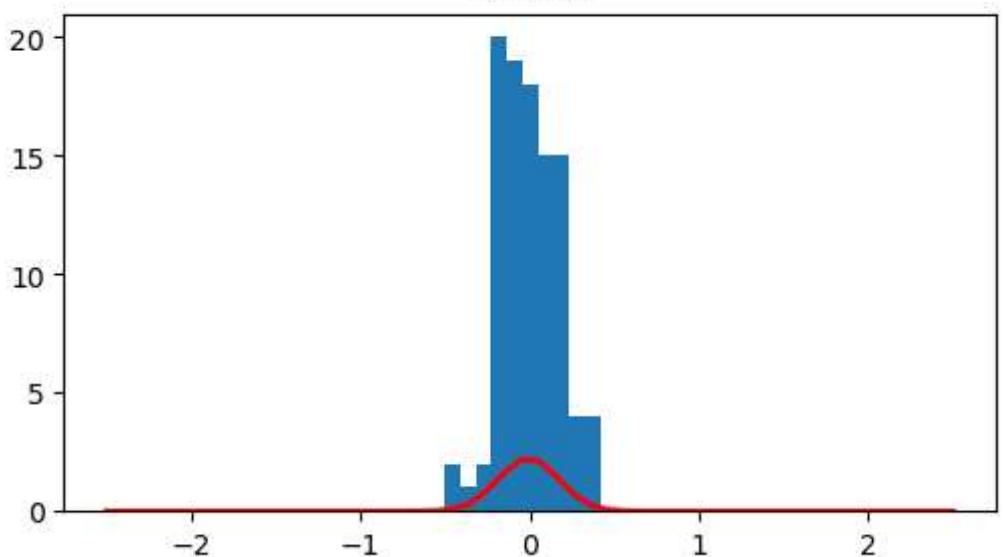
N = 23 Média = -0.002233298348742008 Variância = 0.031982779025825754

N = 23



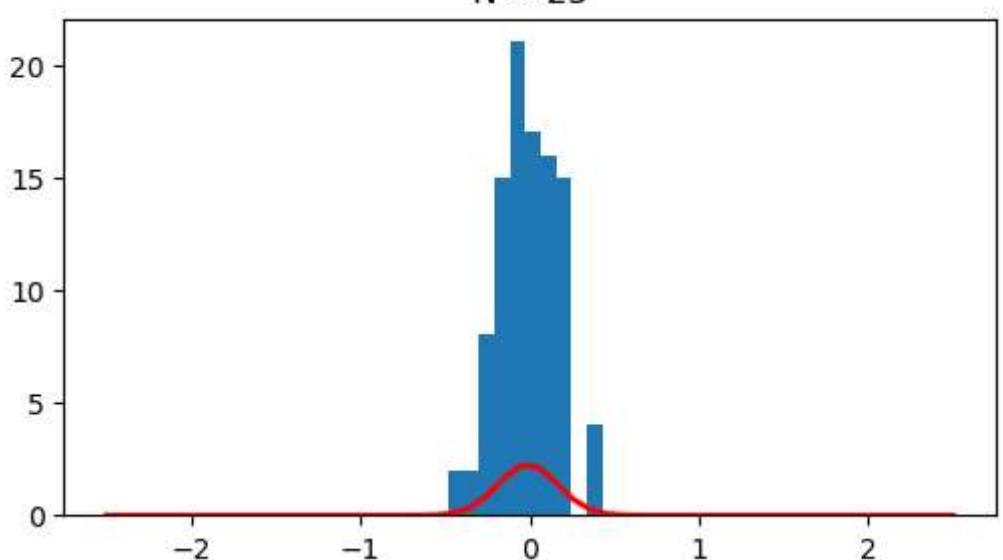
N = 24 Média = -0.007080976630854032 Variância = 0.03131395902805254

N = 24



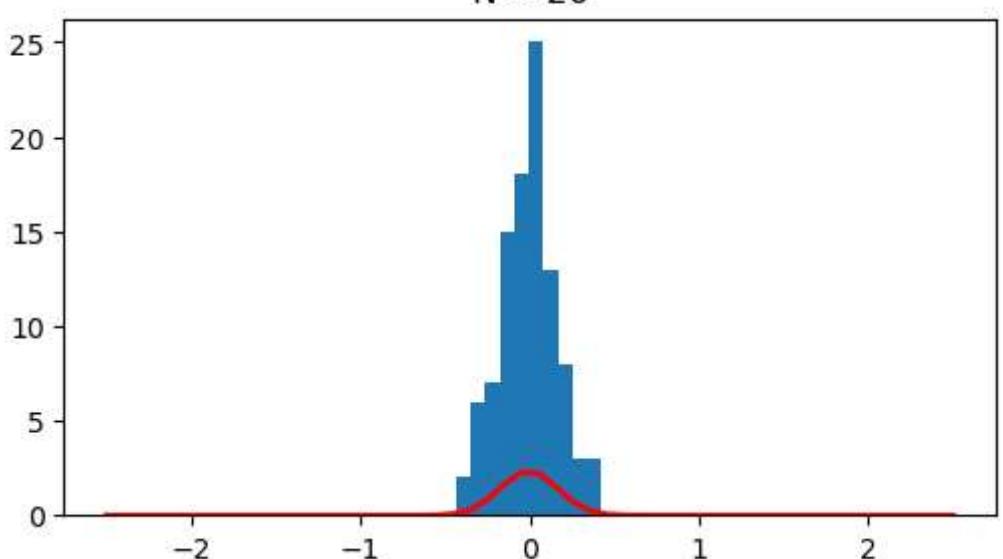
N = 25 Média = -0.010496427558838346 Variância = 0.030772096160737915

N = 25



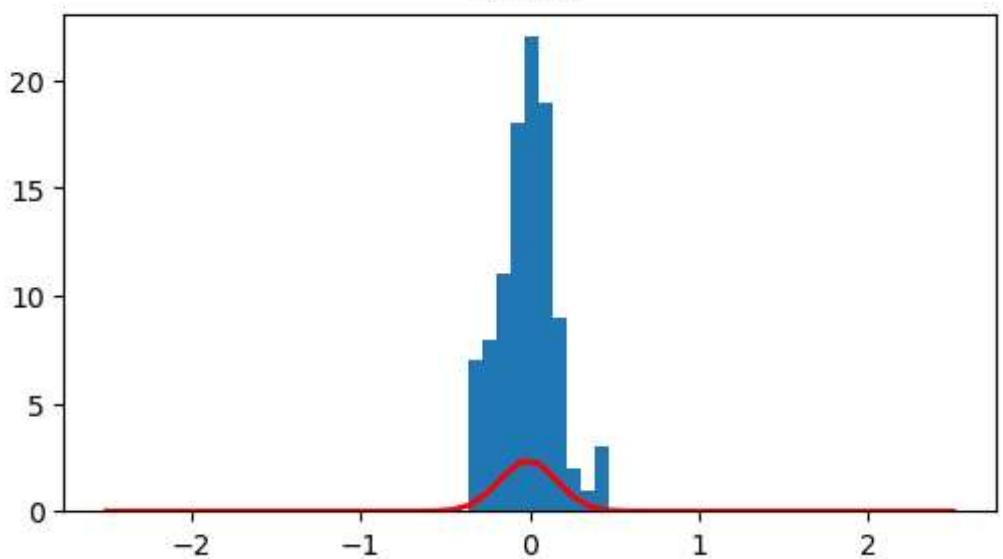
N = 26 Média = -0.006169898253237146 Variância = 0.028684100790818987

N = 26



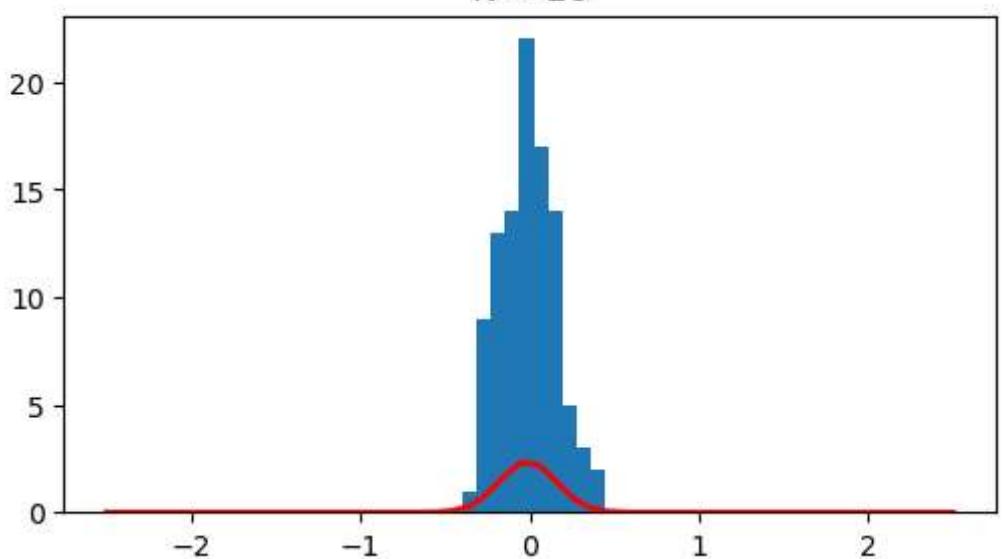
N = 27 Média = -0.009549440159660513 Variância = 0.028079656056623742

N = 27



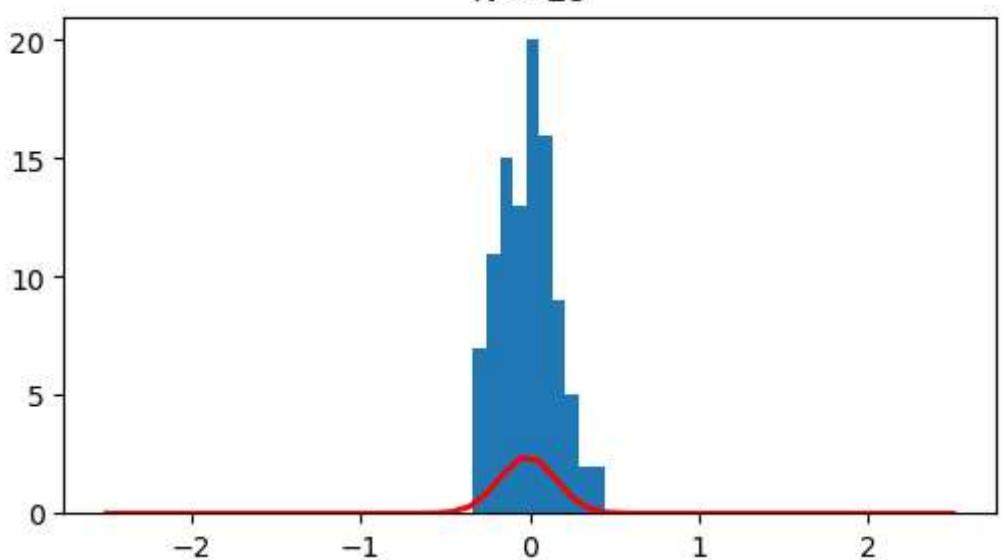
N = 28 Média = -0.01161089106470909 Variância = 0.028073486990157867

N = 28



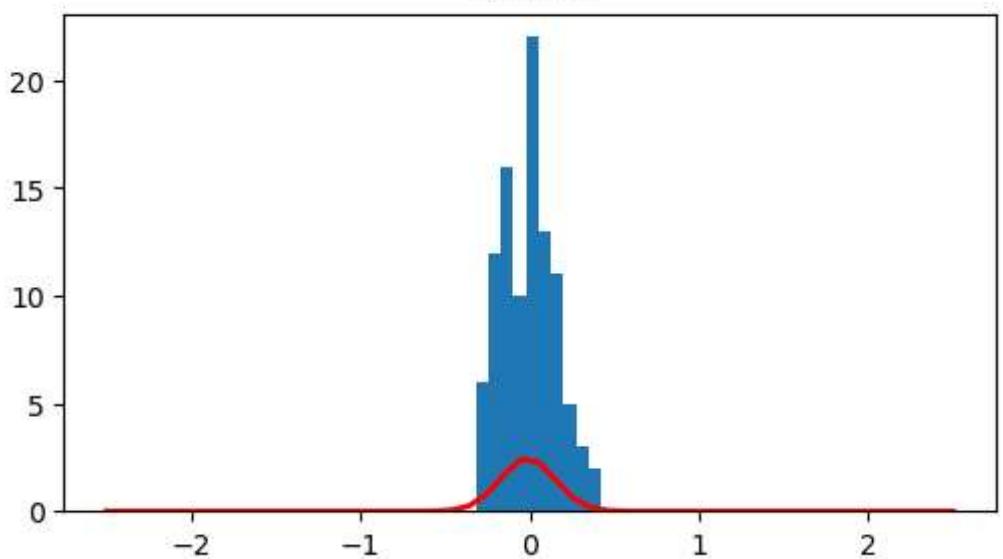
N = 29 Média = -0.013909386685244414 Variância = 0.027346642860497816

N = 29



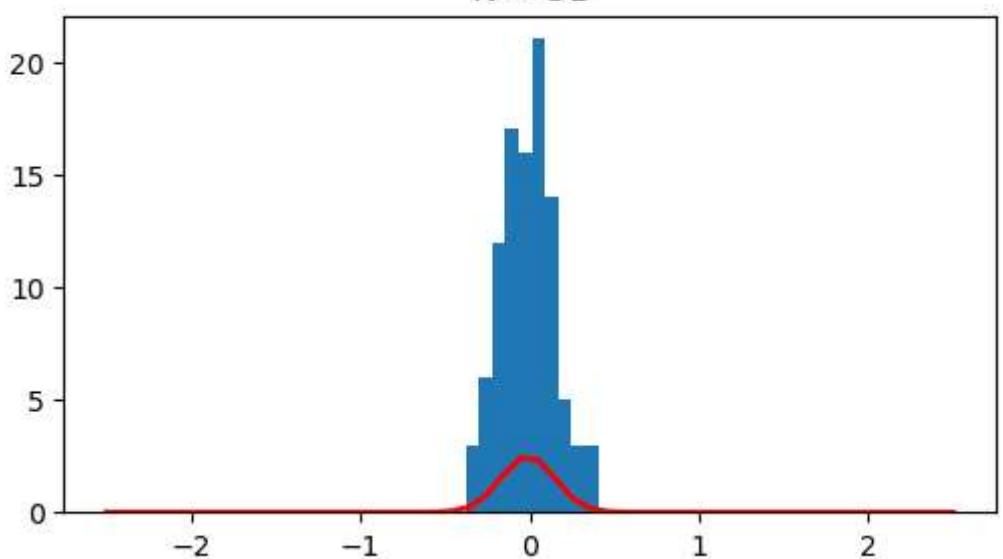
N = 30 Média = -0.011837933938320371 Variância = 0.025914772930245304

N = 30



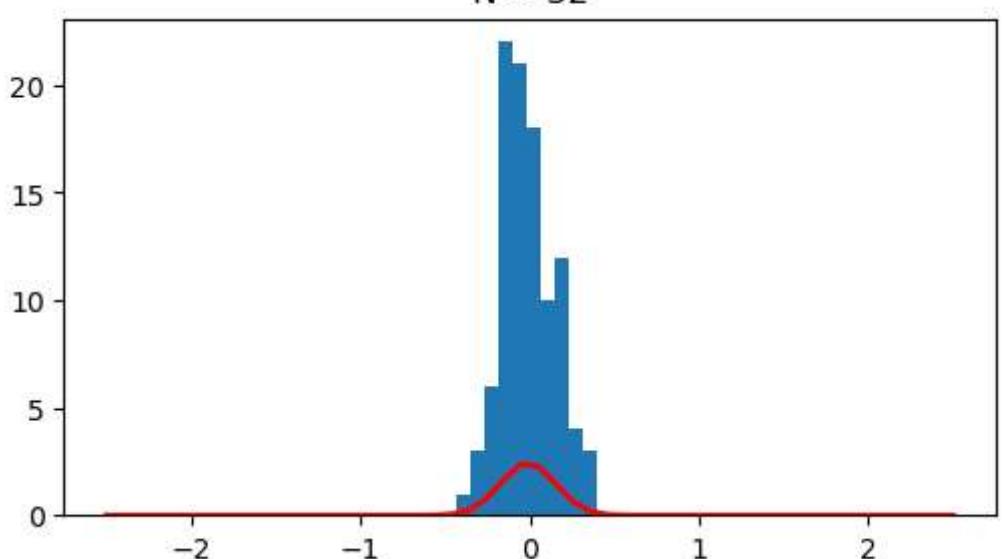
N = 31 Média = -0.011482405377521989 Variância = 0.02541176980117888

N = 31



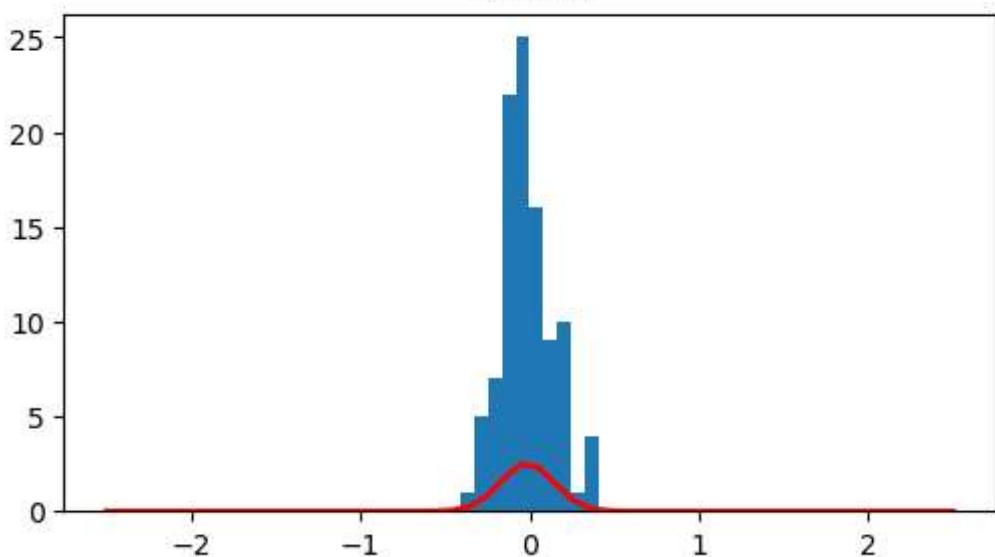
N = 32 Média = -0.01024020295811236 Variância = 0.026290831913401994

N = 32



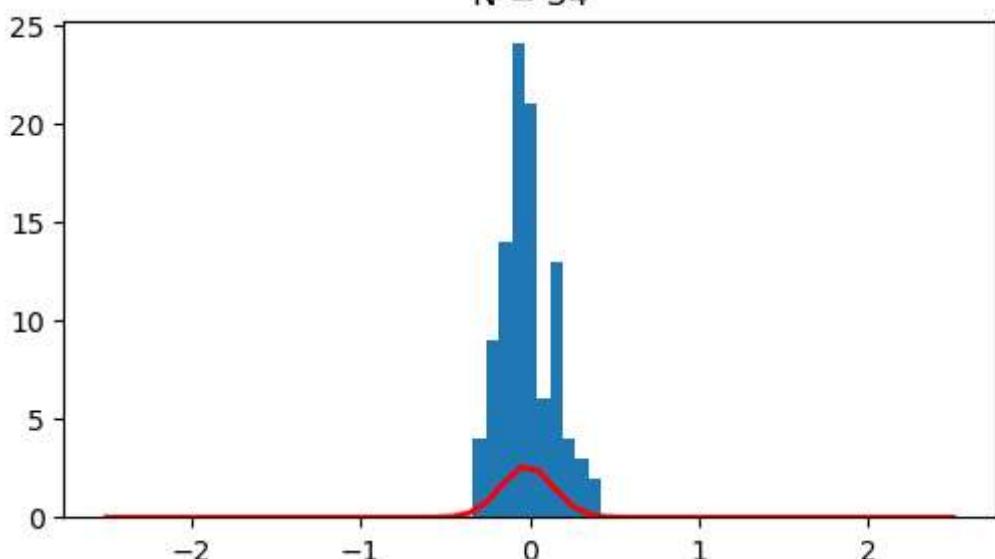
N = 33 Média = -0.01540267948307677 Variância = 0.024778839699806786

N = 33



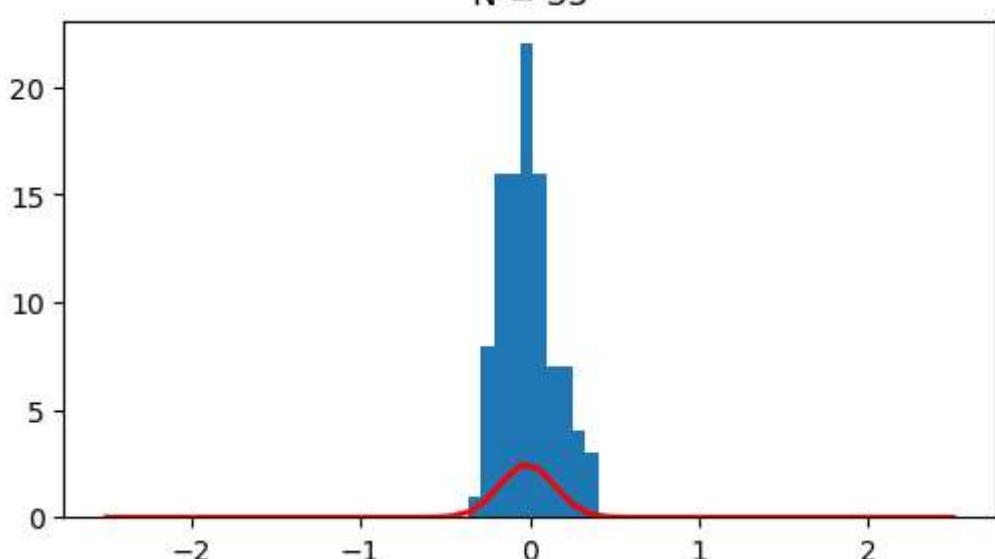
N = 34 Média = -0.015620149758700916 Variância = 0.02341682976438081

N = 34



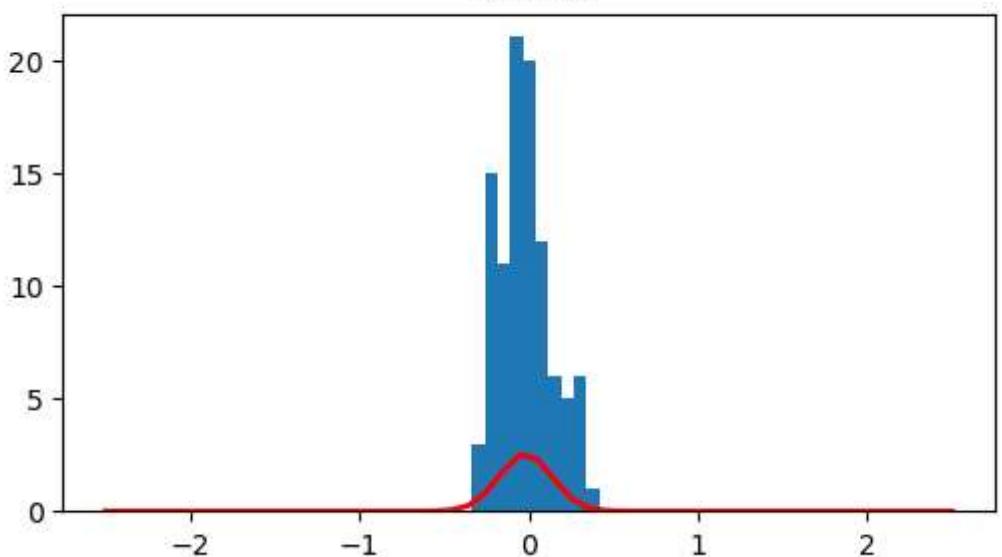
N = 35 Média = -0.016570756627918248 Variância = 0.02555297222317431

N = 35



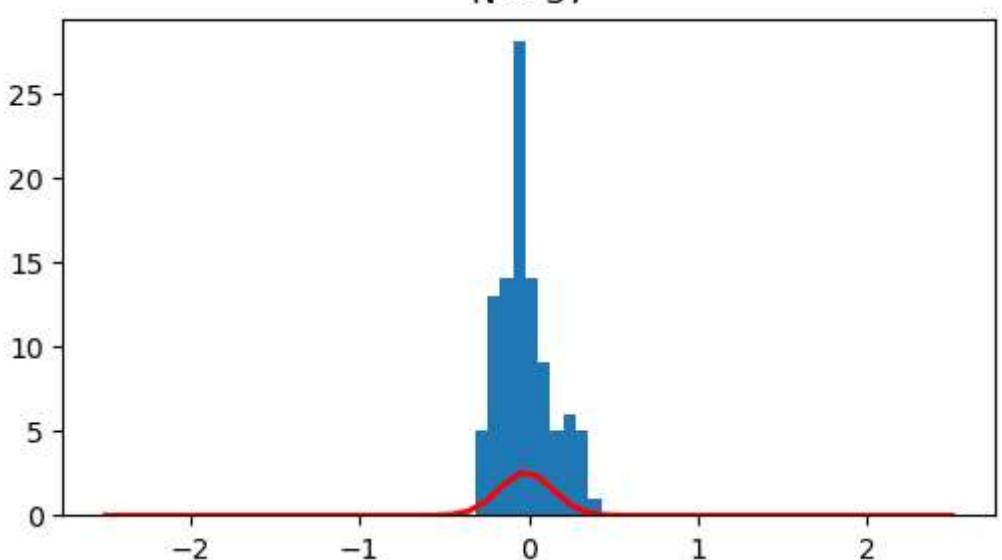
N = 36 Média = -0.01904199455031419 Variância = 0.02443674185362397

N = 36



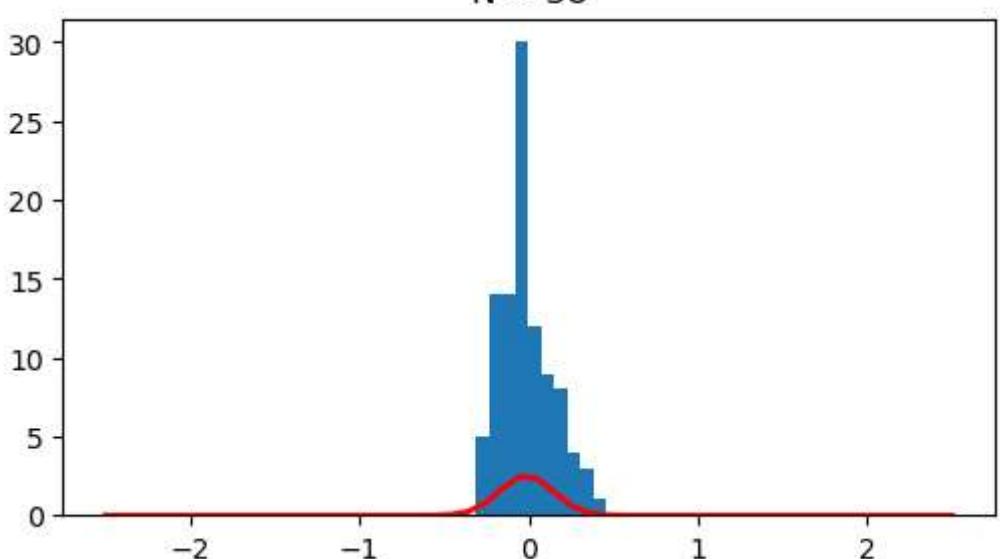
N = 37 Média = -0.01685743213599823 Variância = 0.02415649334597251

N = 37



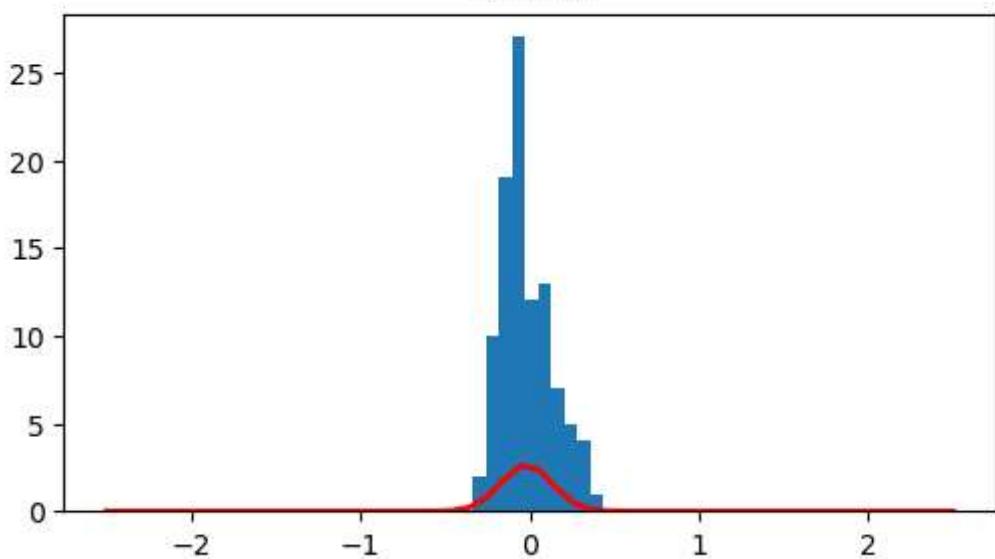
N = 38 Média = -0.014231951166386368 Variância = 0.024739590972108323

N = 38



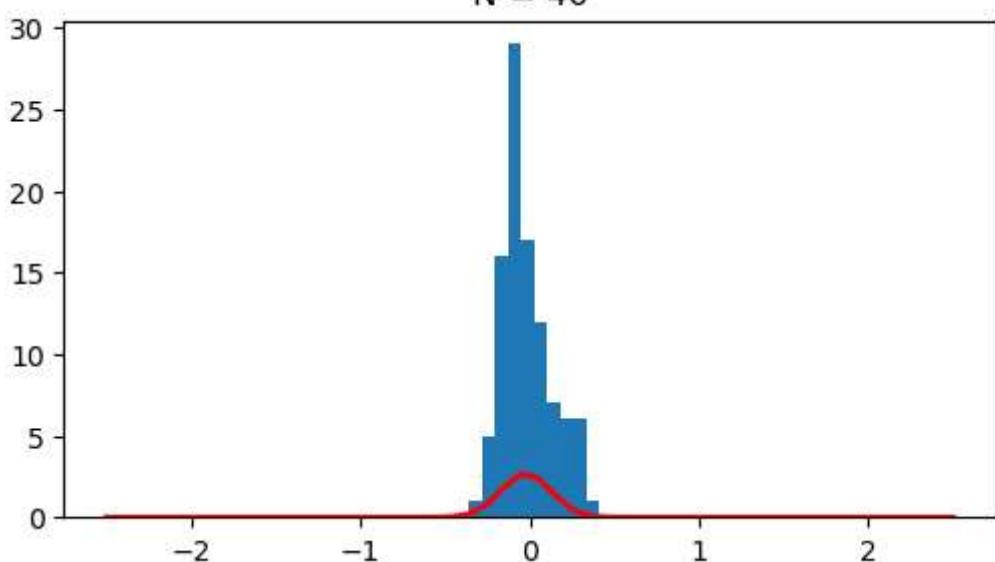
N = 39 Média = -0.019583776758333157 Variância = 0.022461351193862403

N = 39



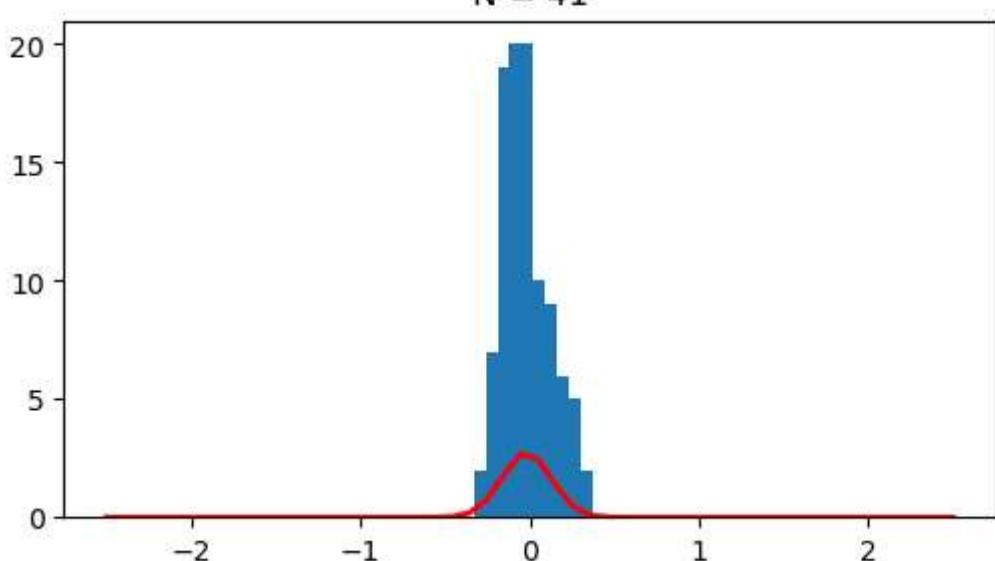
N = 40 Média = -0.022209354667330906 Variância = 0.021540834588612952

N = 40



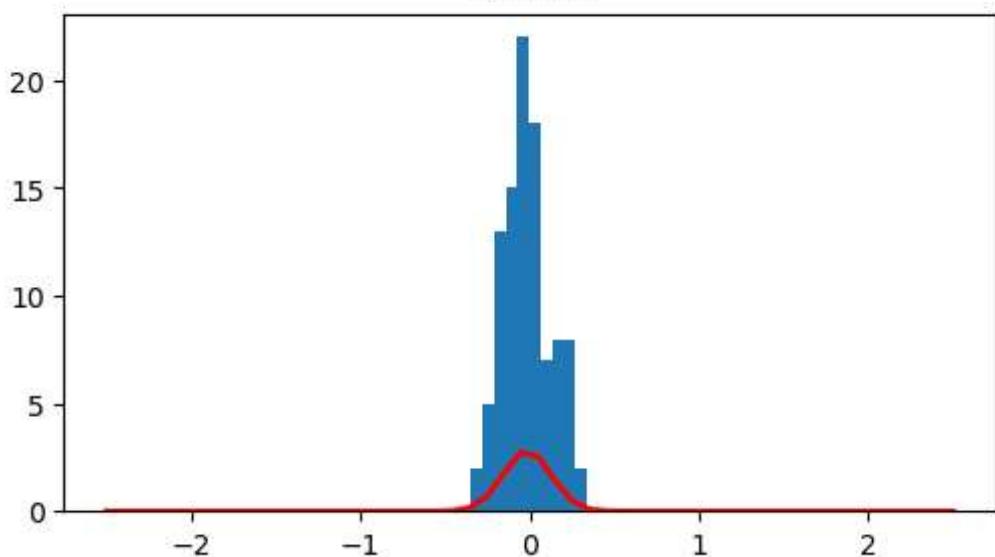
N = 41 Média = -0.0191497800932778 Variância = 0.021162571497881564

N = 41



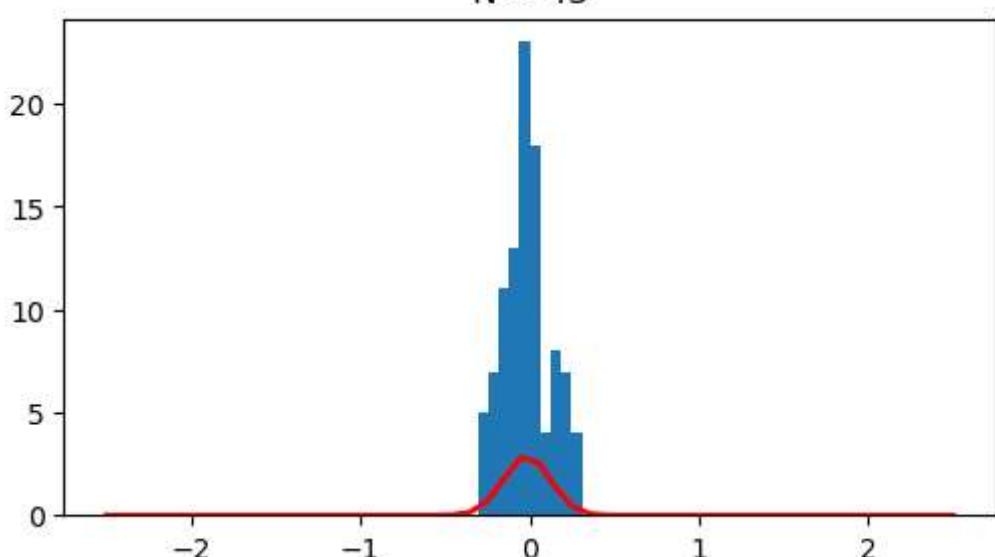
N = 42 Média = -0.01592861351529553 Variância = 0.01995796323271356

N = 42



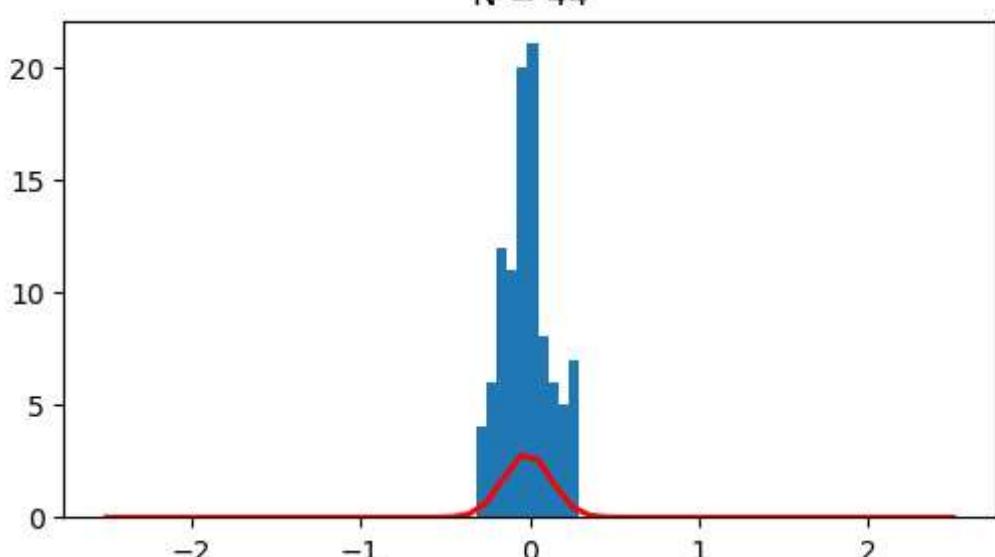
N = 43 Média = -0.016720839836557765 Variância = 0.018880436820269648

N = 43



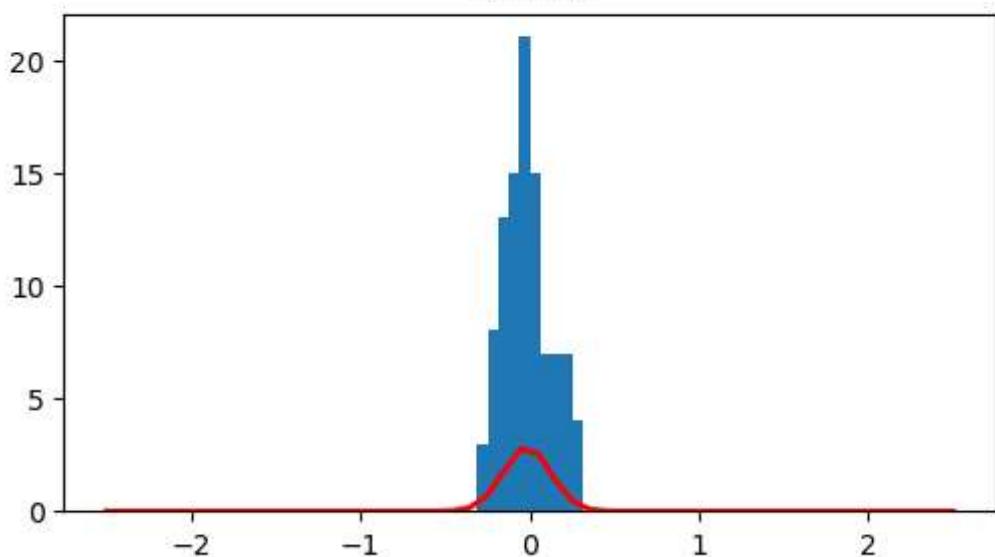
N = 44 Média = -0.015448893396376721 Variância = 0.01969643172616422

N = 44



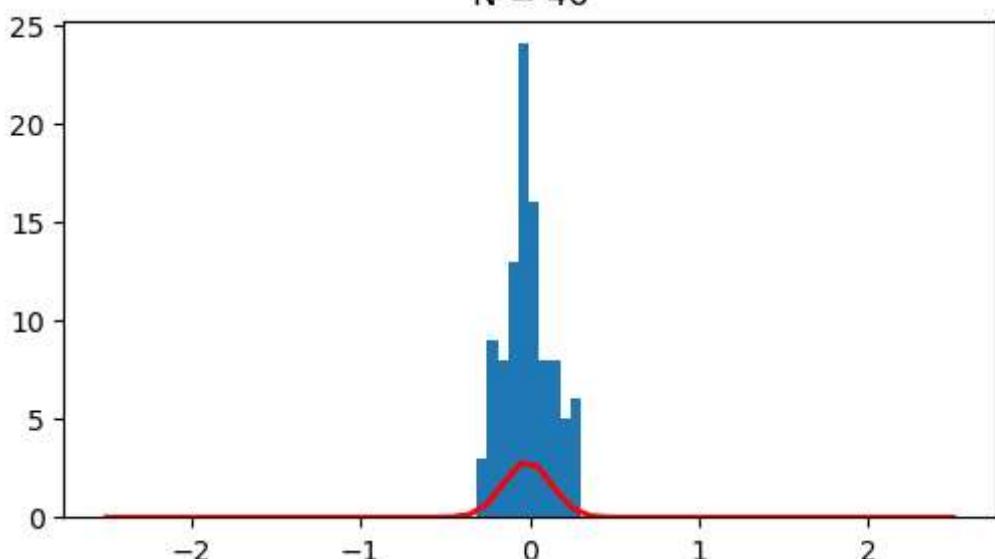
N = 45 Média = -0.01678195787179053 Variância = 0.019513966627920088

N = 45



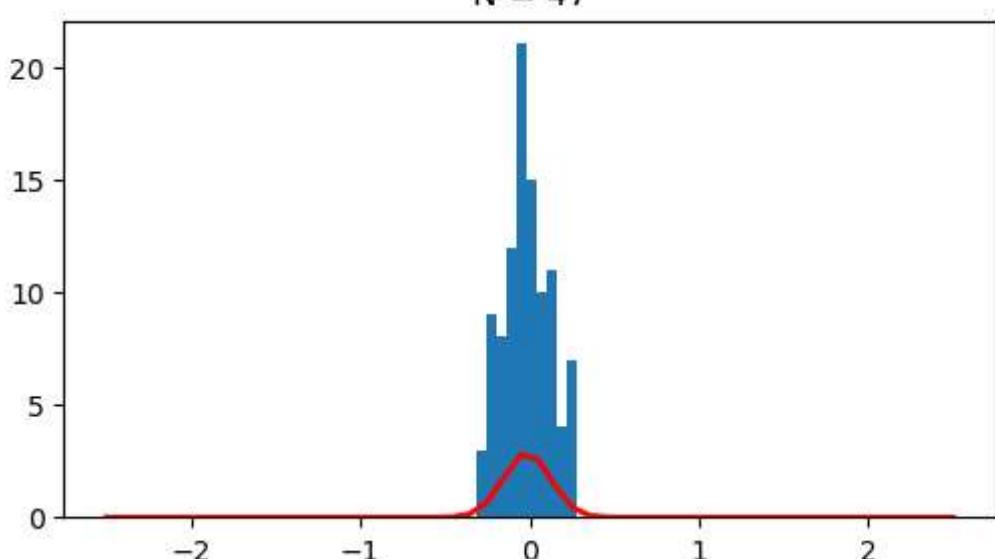
N = 46 Média = -0.014572202844747022 Variância = 0.01946055600720865

N = 46



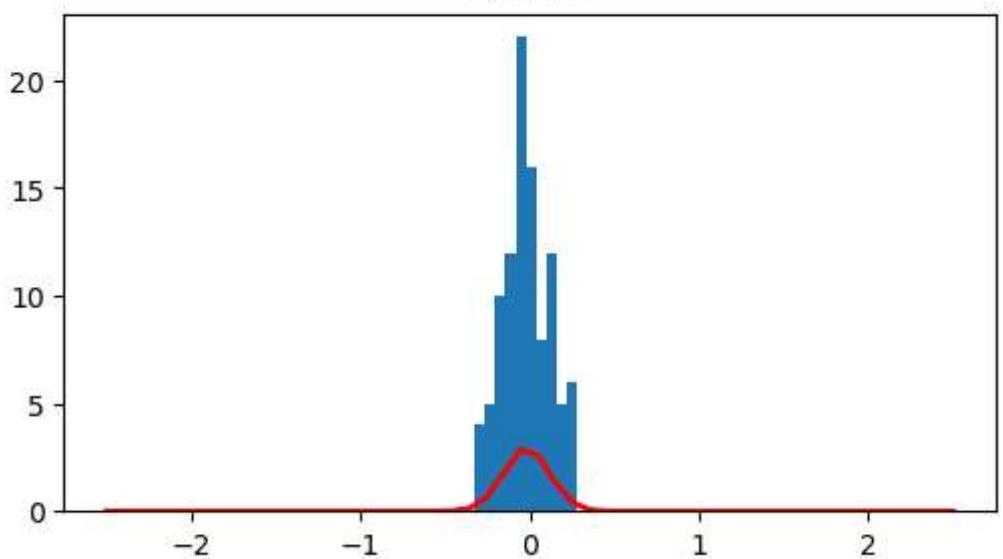
N = 47 Média = -0.01579619747023056 Variância = 0.019180315631431428

N = 47



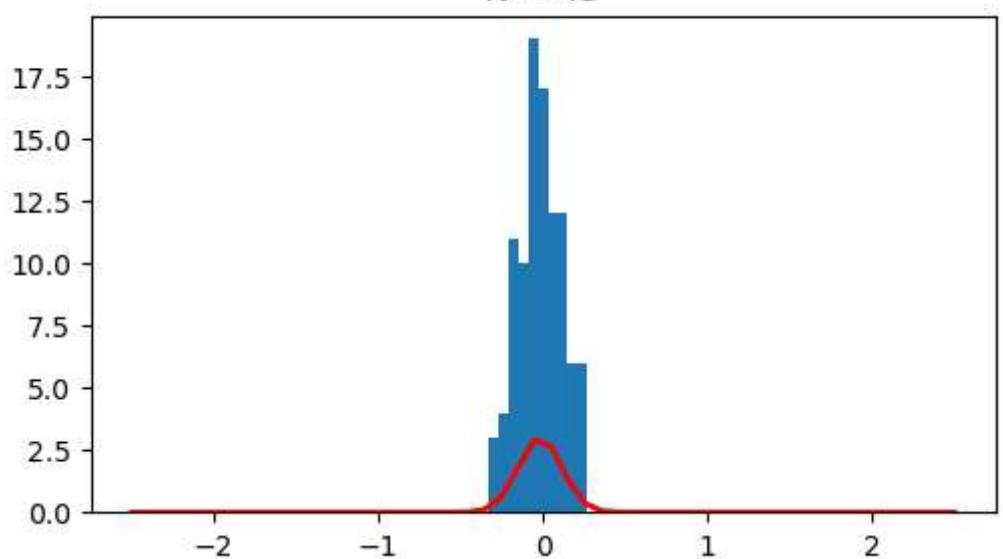
N = 48 Média = -0.018403784038420853 Variância = 0.01836892459408888

N = 48



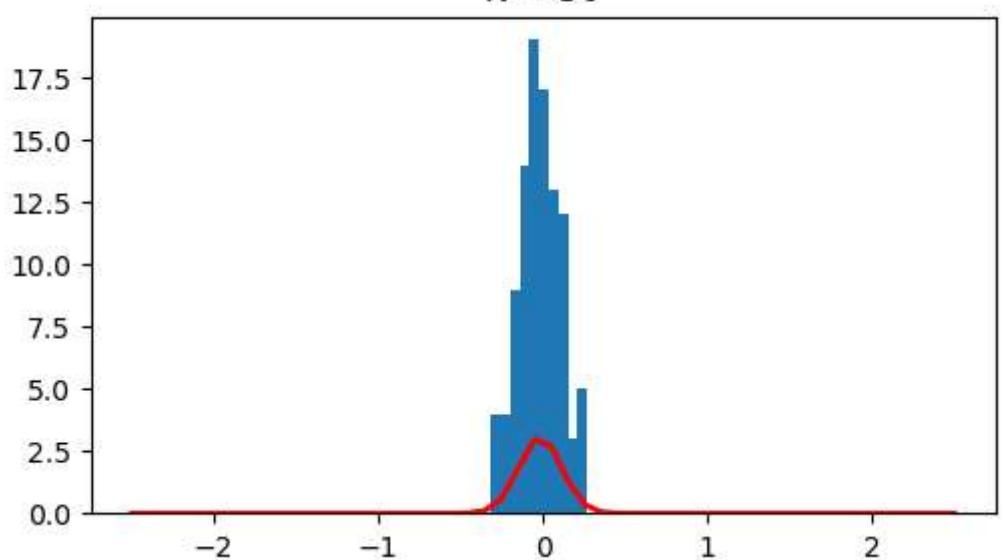
N = 49 Média = -0.017131588646349817 Variância = 0.017507327487736528

N = 49



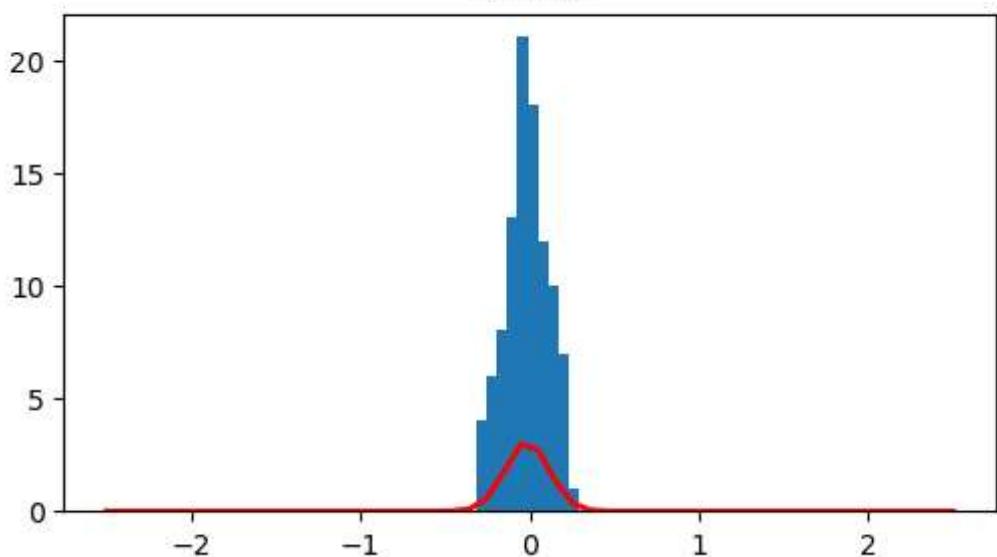
N = 50 Média = -0.016823370520699158 Variância = 0.016799787861730614

N = 50



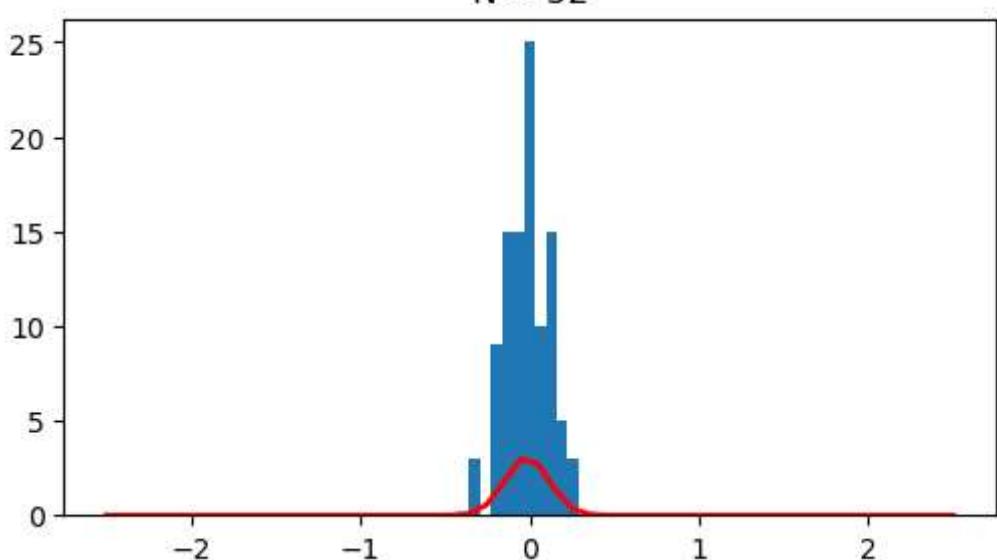
N = 51 Média = -0.015686839918091 Variância = 0.01670129145460211

N = 51



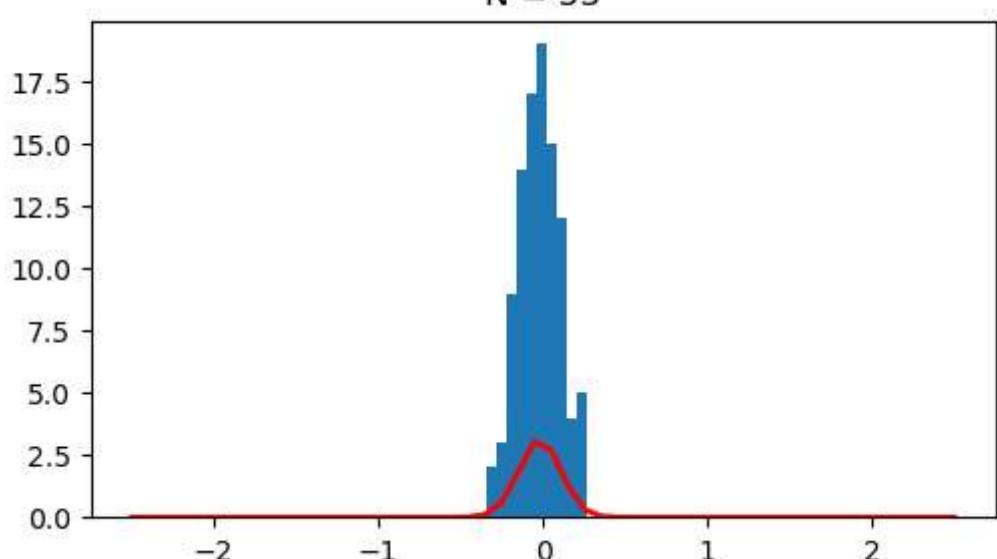
N = 52 Média = -0.016480410562445088 Variância = 0.01669243288426743

N = 52



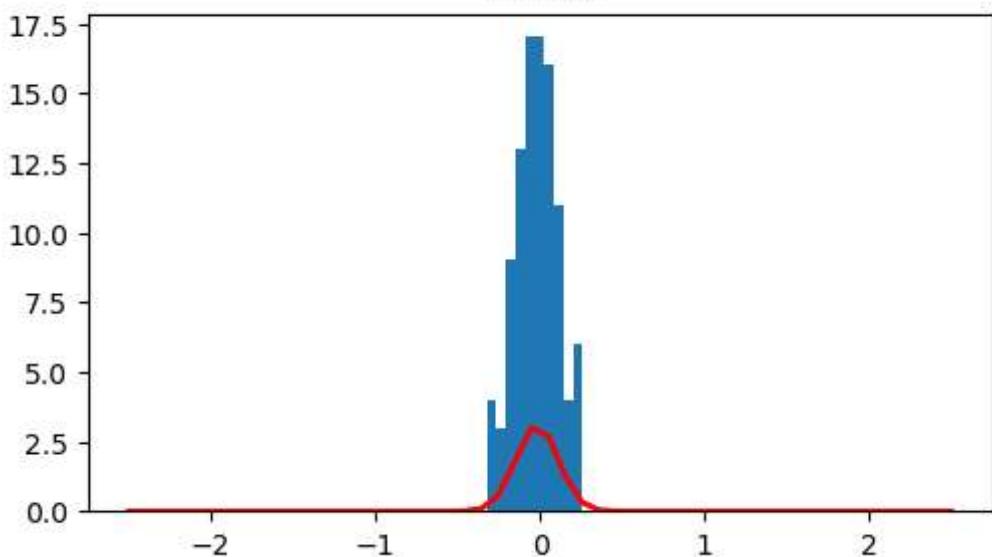
N = 53 Média = -0.019253535438926838 Variância = 0.016264462079831576

N = 53



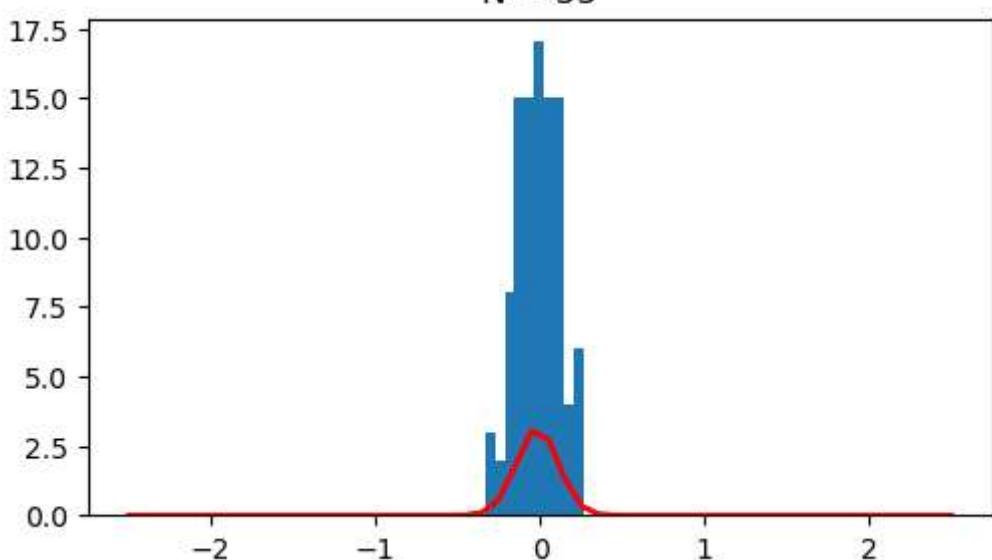
N = 54 Média = -0.017631382513174094 Variância = 0.01643655351506419

N = 54



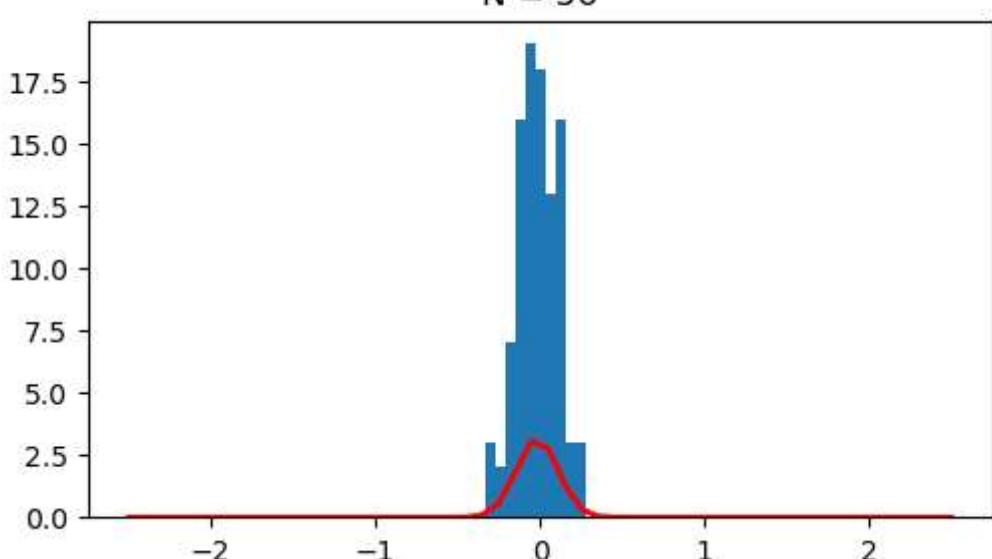
N = 55 Média = -0.015856633637171925 Variância = 0.016117313602274256

N = 55



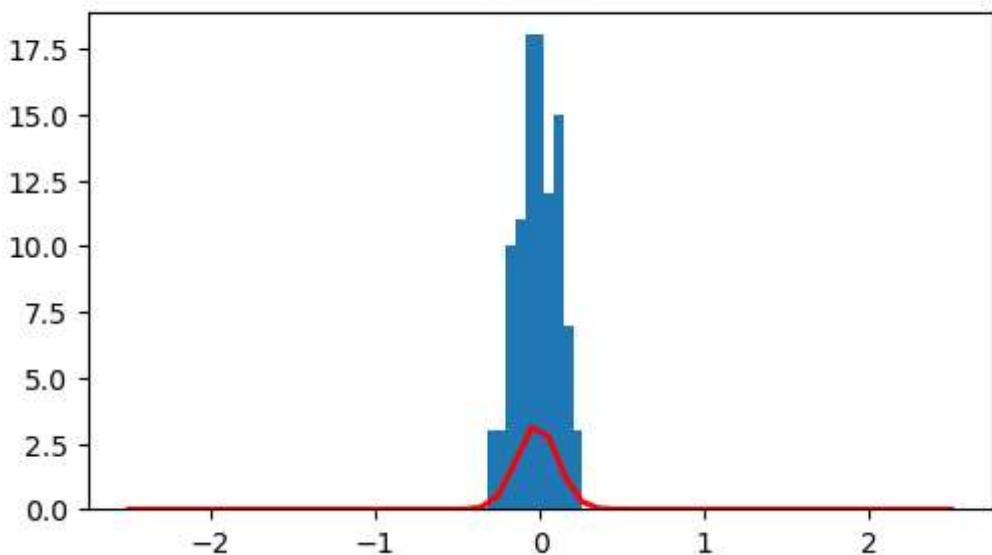
N = 56 Média = -0.016010166154755576 Variância = 0.01573838503066533

N = 56



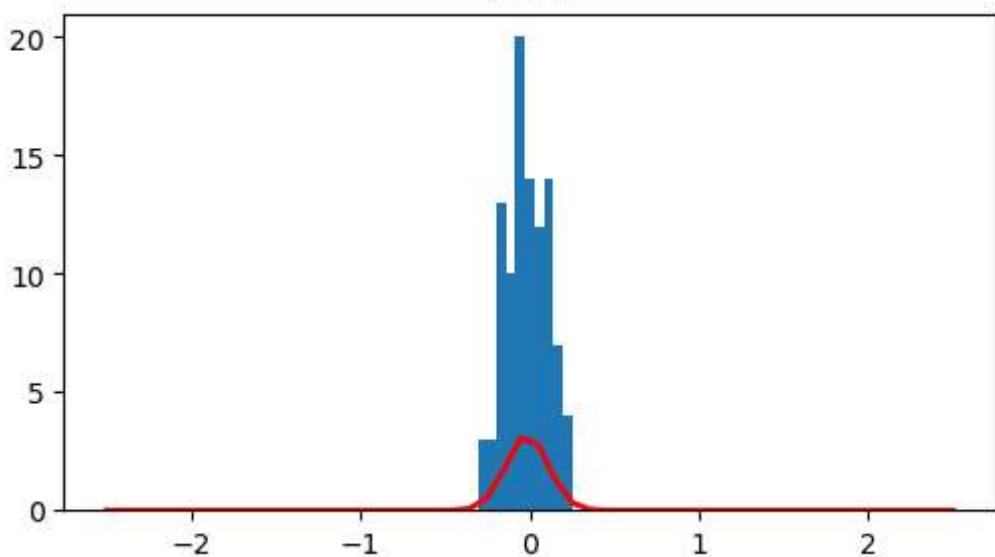
N = 57 Média = -0.017214216193434 Variância = 0.015243903720937514

N = 57



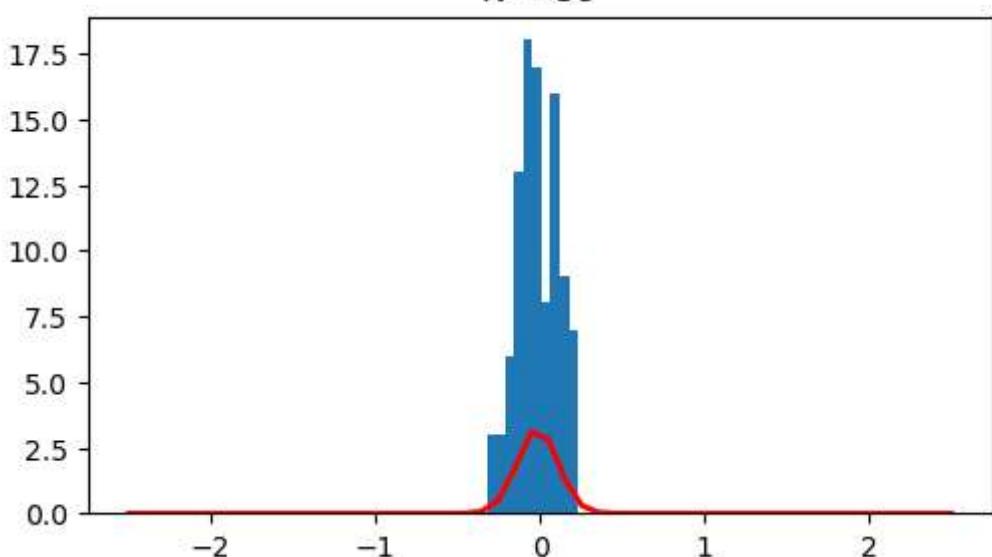
N = 58 Média = -0.015482338524736704 Variância = 0.01553616981138521

N = 58



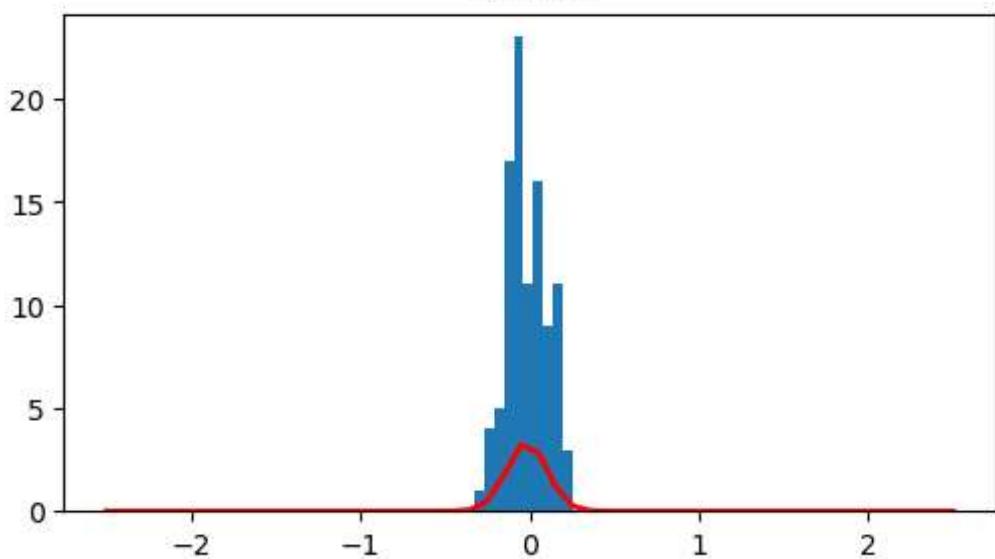
N = 59 Média = -0.014736931712871111 Variância = 0.015115591757572905

N = 59



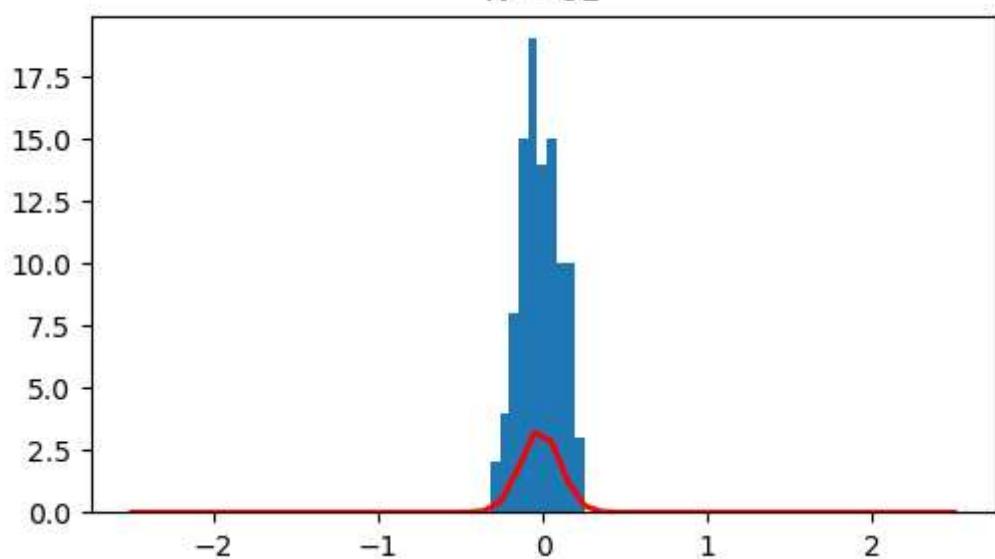
N = 60 Média = -0.017367573341948595 Variância = 0.014181124456954056

N = 60



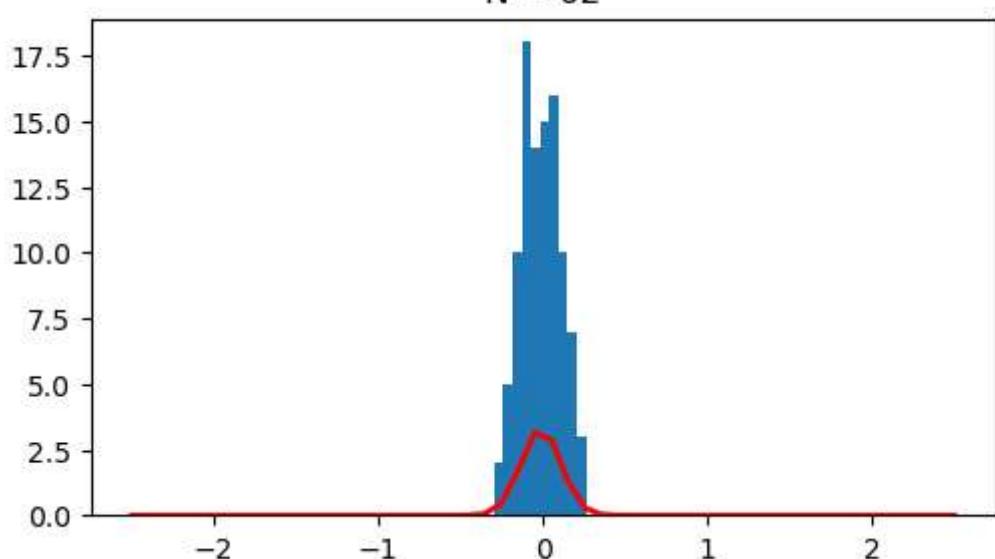
N = 61 Média = -0.016557257155244535 Variância = 0.014321191950741706

N = 61

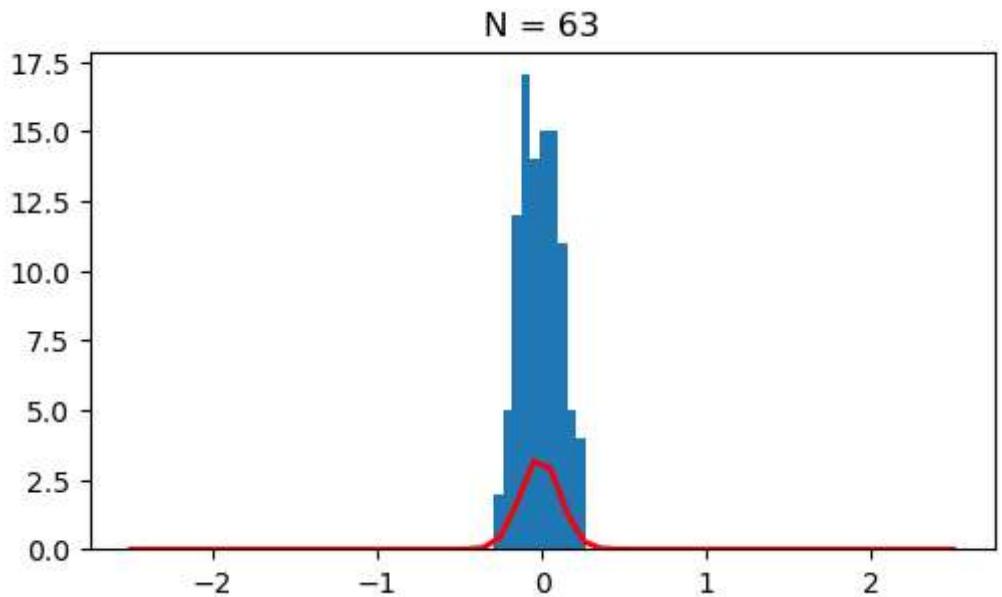


N = 62 Média = -0.012482242915730444 Variância = 0.014550539240286871

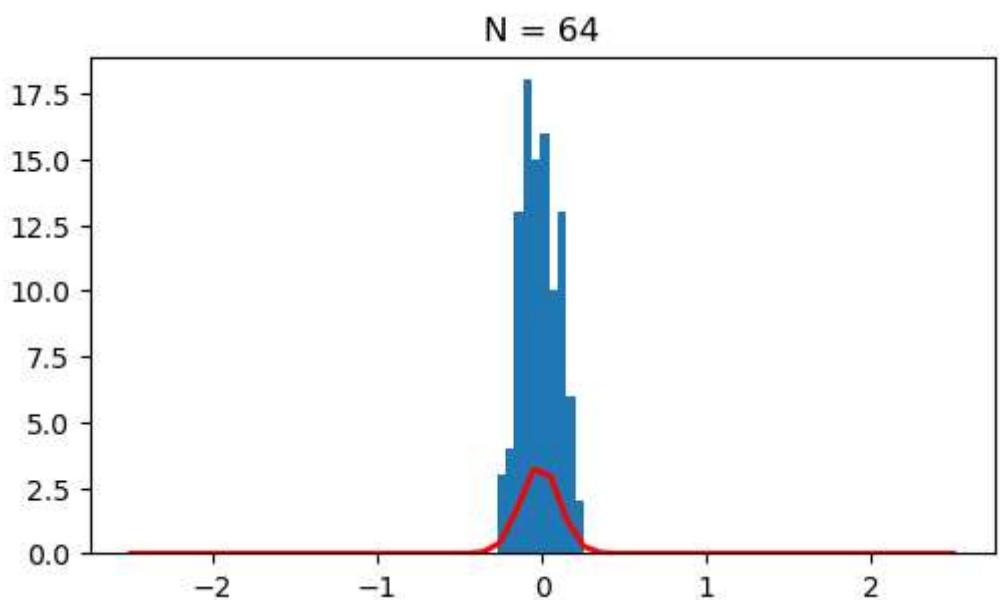
N = 62



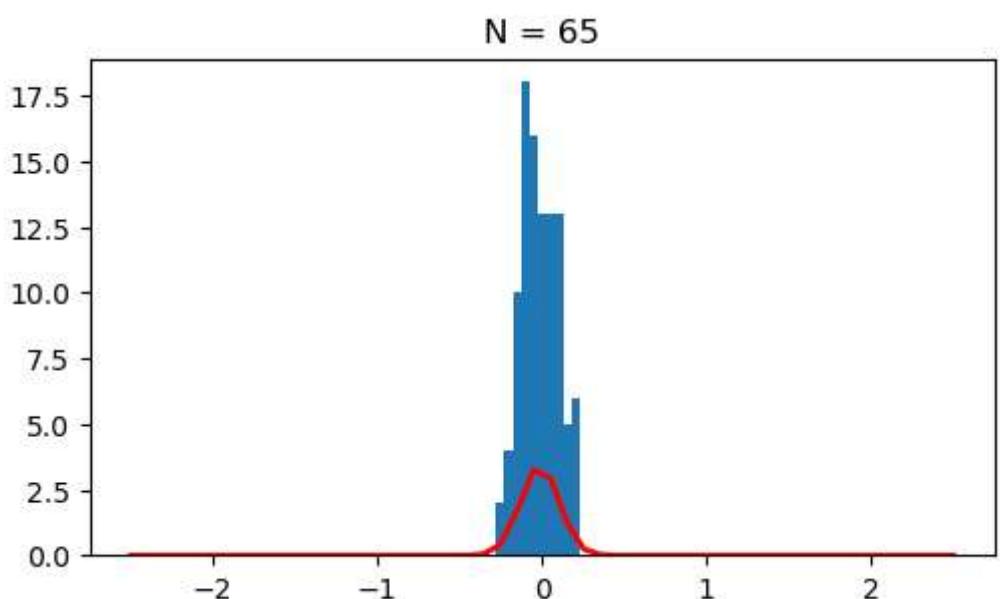
N = 63 Média = -0.011623923218478443 Variância = 0.014413137696011557



N = 64 Média = -0.012464686968077504 Variância = 0.013898552595385912

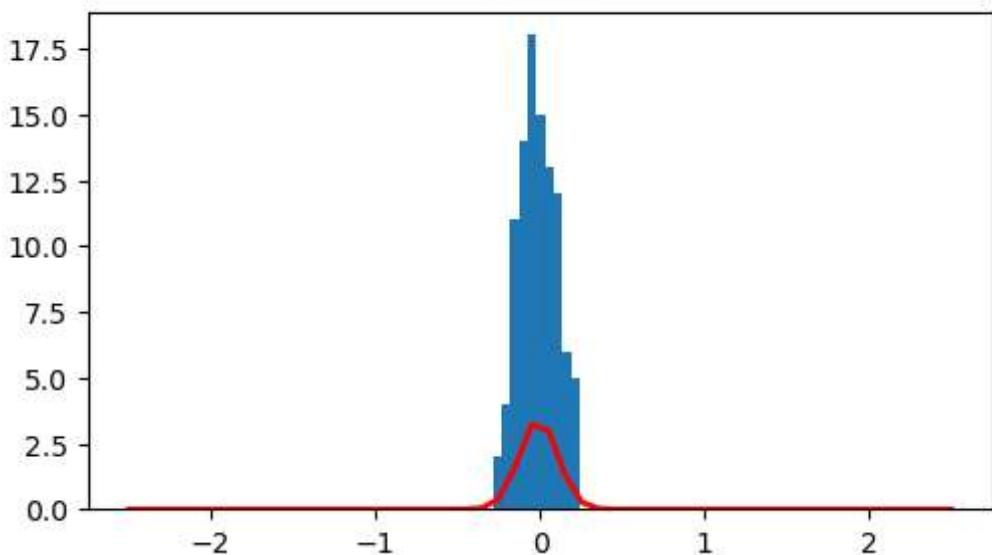


N = 65 Média = -0.013327224948264629 Variância = 0.013553393445432244



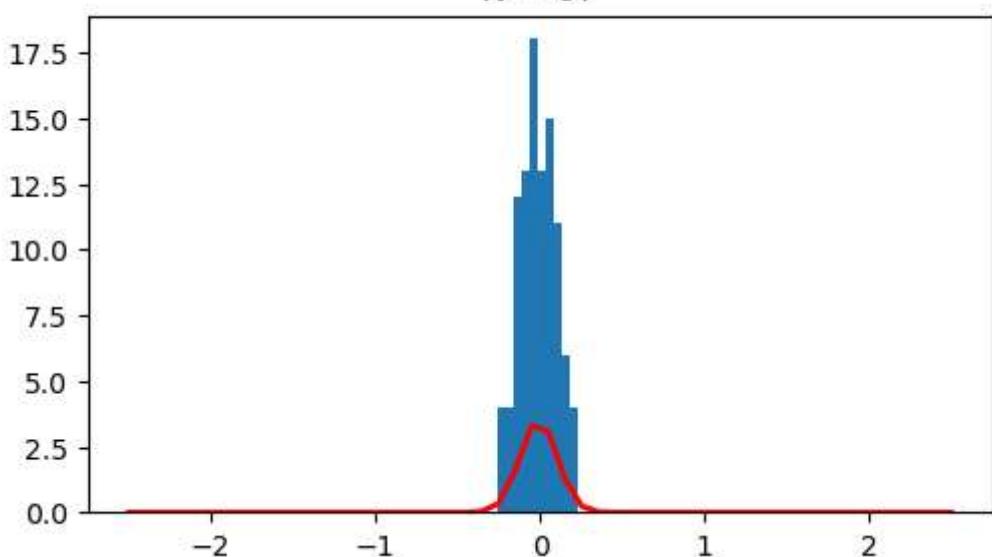
N = 66 Média = -0.009042611121467422 Variância = 0.013551743697265646

N = 66



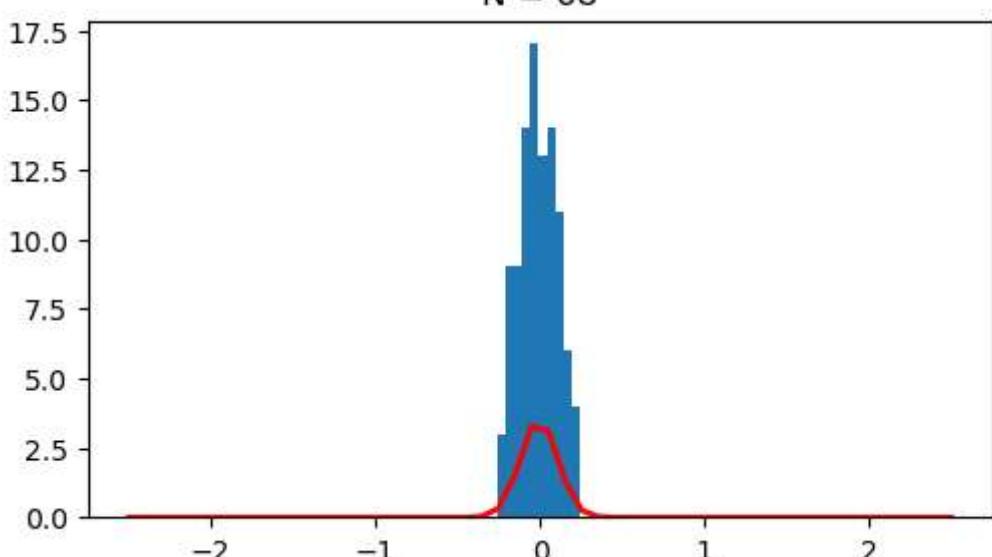
N = 67 Média = -0.009009534172662847 Variância = 0.01269801406429125

N = 67



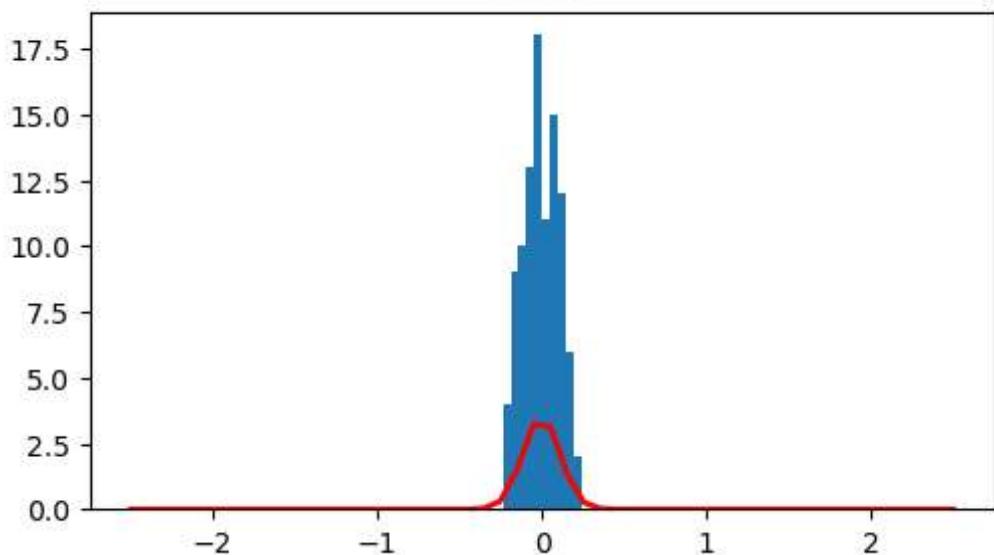
N = 68 Média = -0.006174353856343216 Variância = 0.012769767620772058

N = 68



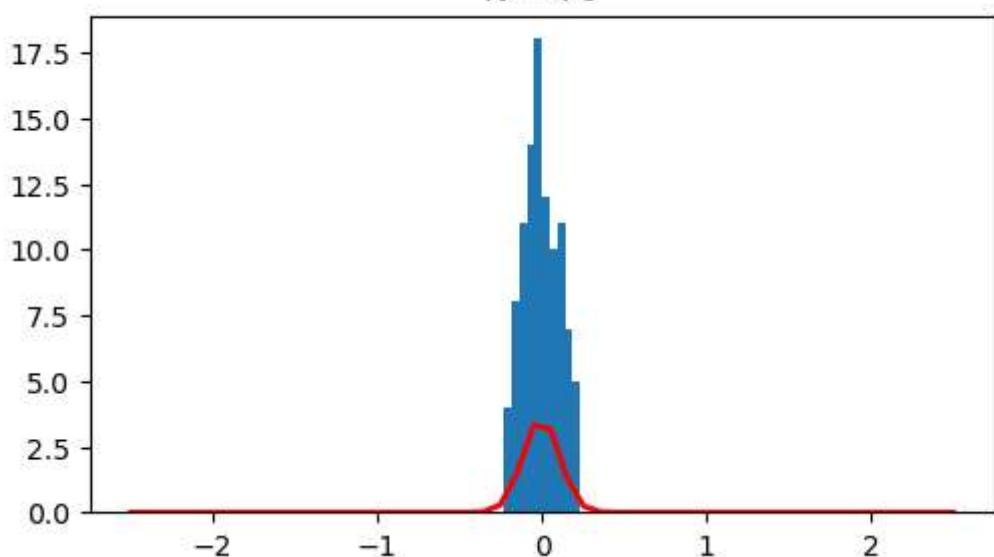
N = 69 Média = -0.004117509513614375 Variância = 0.01279464503570149

N = 69



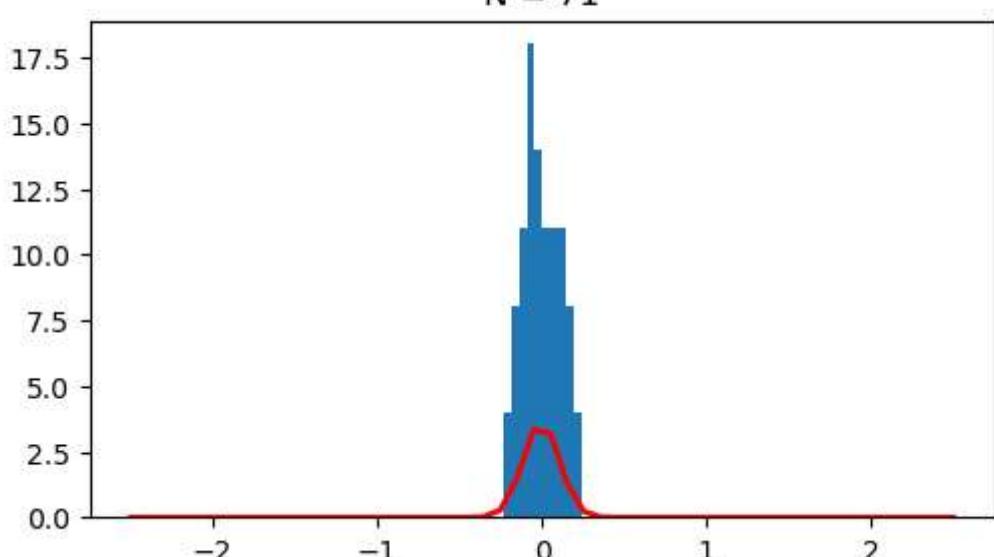
N = 70 Média = -0.0048108482956623535 Variância = 0.012200385058641803

N = 70



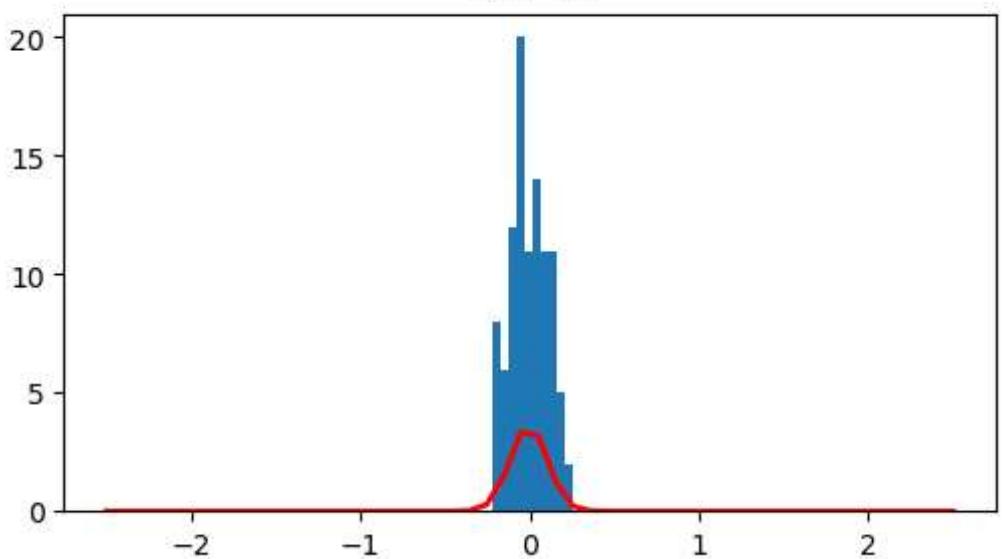
N = 71 Média = -0.004782134116965311 Variância = 0.012042668552262513

N = 71



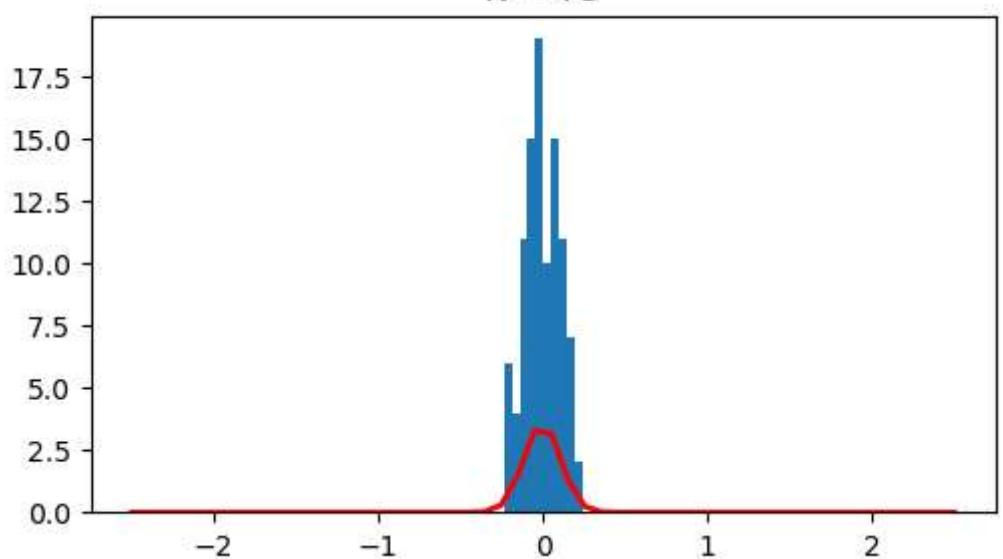
N = 72 Média = -0.006183150812938914 Variância = 0.012057342774551349

N = 72



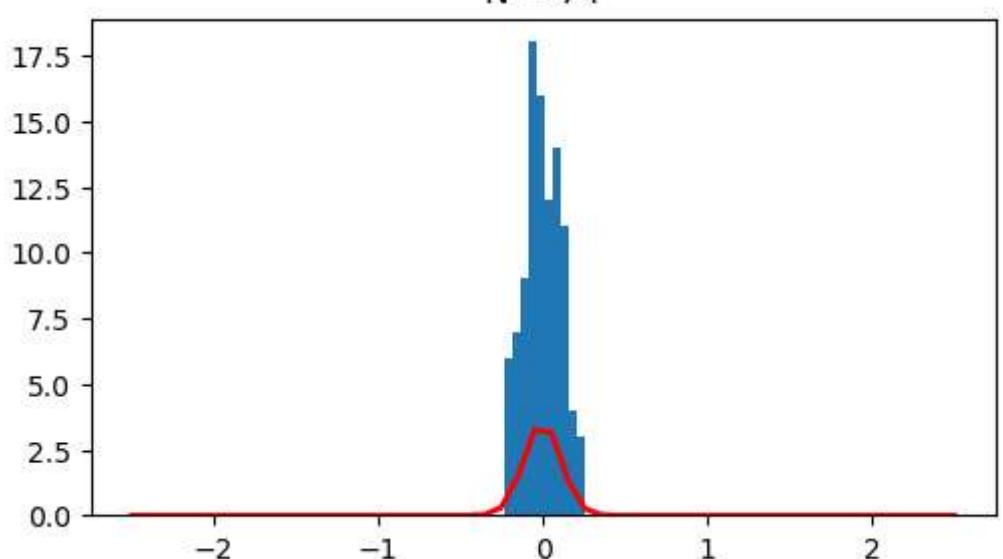
N = 73 Média = -0.005419263691636929 Variância = 0.01241371326235402

N = 73



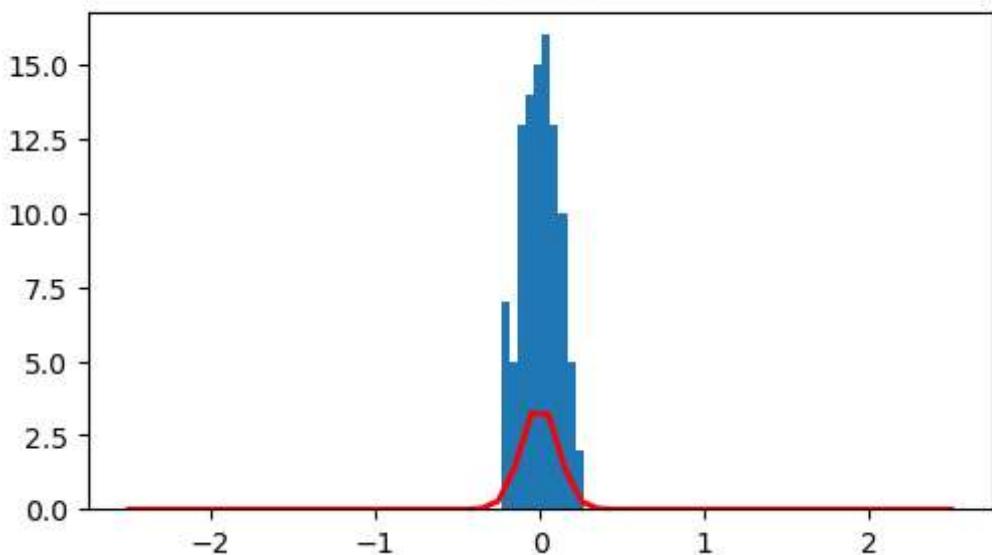
N = 74 Média = -0.003839084568805384 Variância = 0.01262582913809189

N = 74



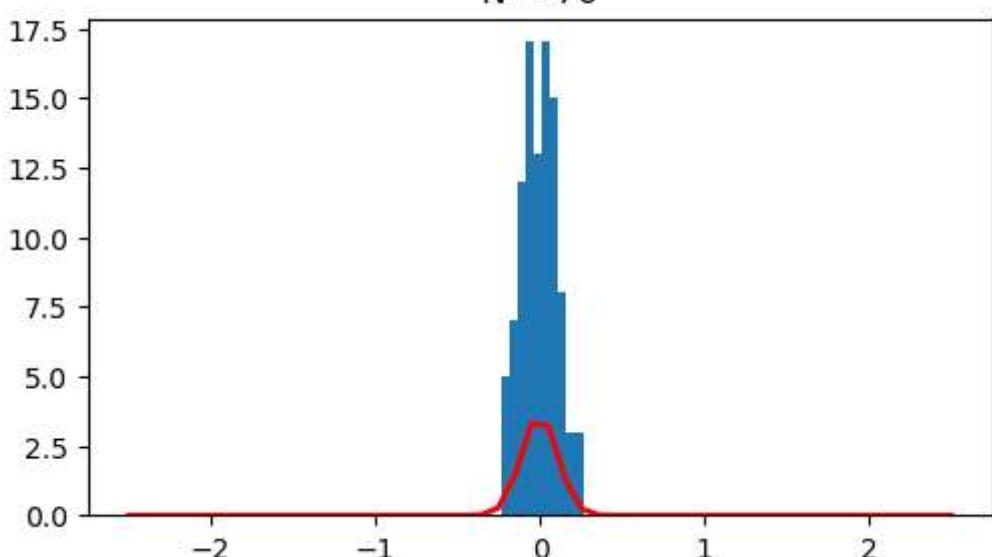
N = 75 Média = -0.002500546082097661 Variância = 0.012389086564220816

N = 75



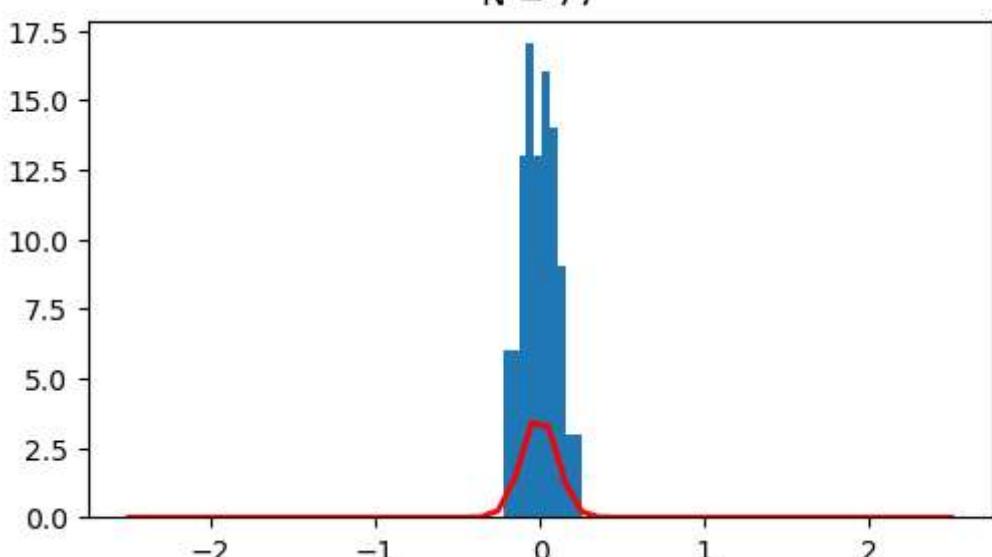
N = 76 Média = -0.003481803779422238 Variância = 0.012068470227143092

N = 76



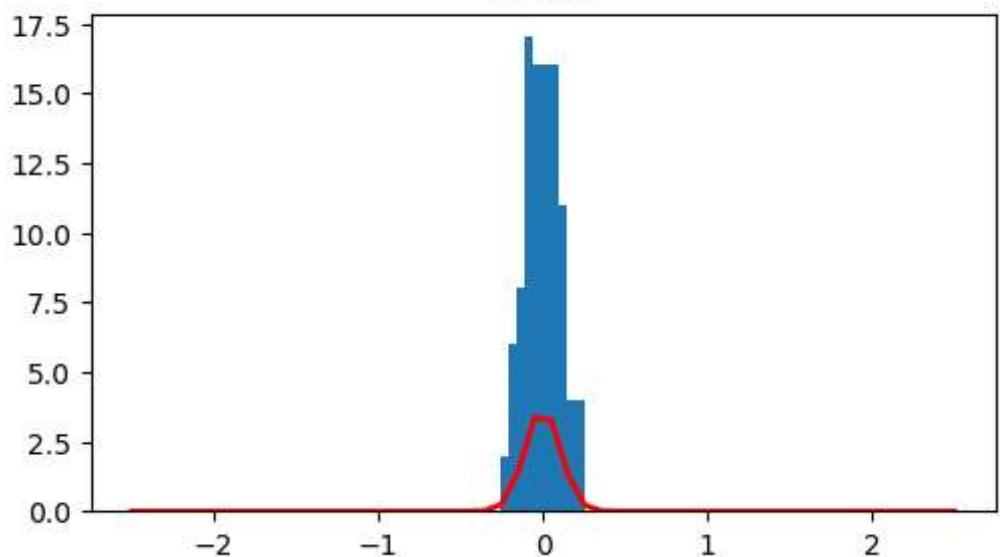
N = 77 Média = -0.00431629307802772 Variância = 0.011416475343319792

N = 77



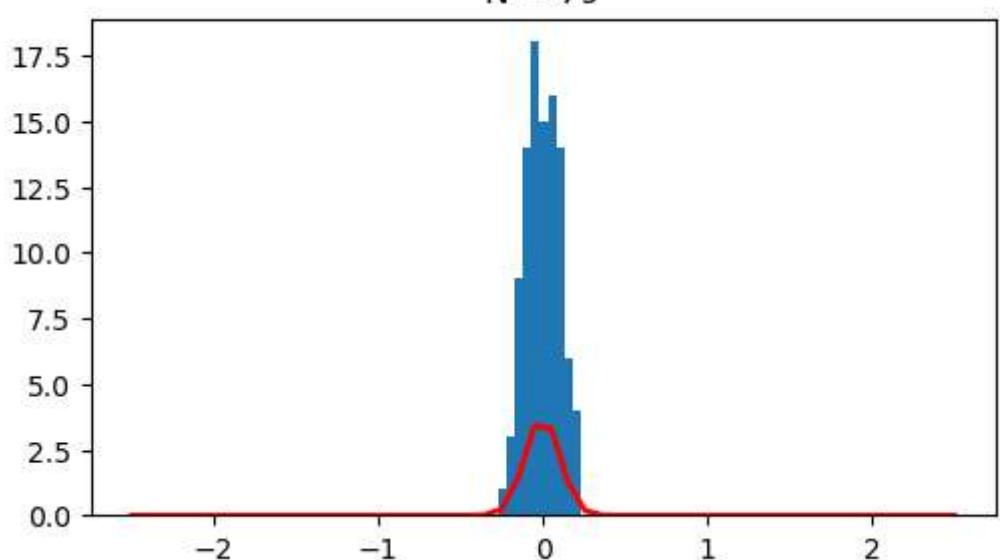
N = 78 Média = -0.002954148977020472 Variância = 0.011599541277488955

N = 78



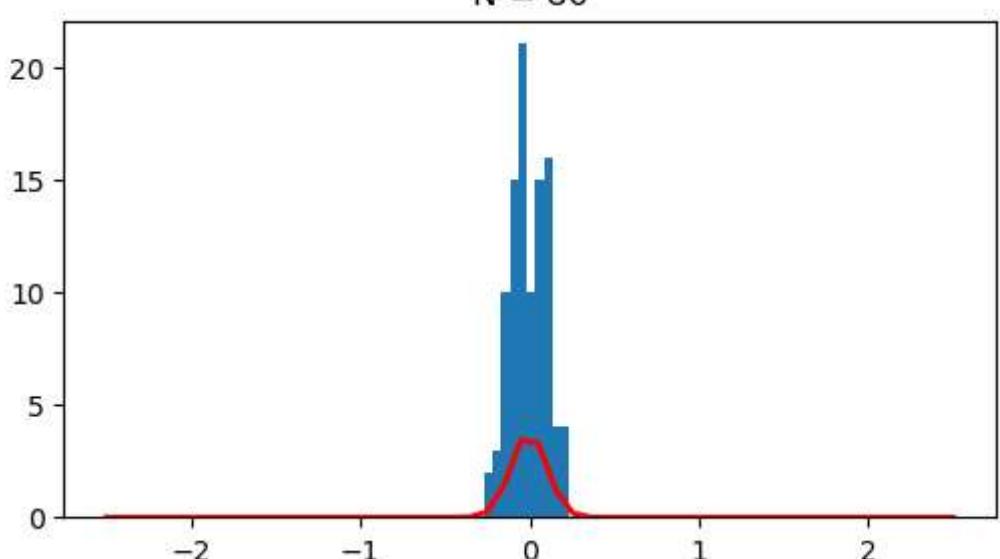
N = 79 Média = -0.003910391074170527 Variância = 0.011155747305061843

N = 79



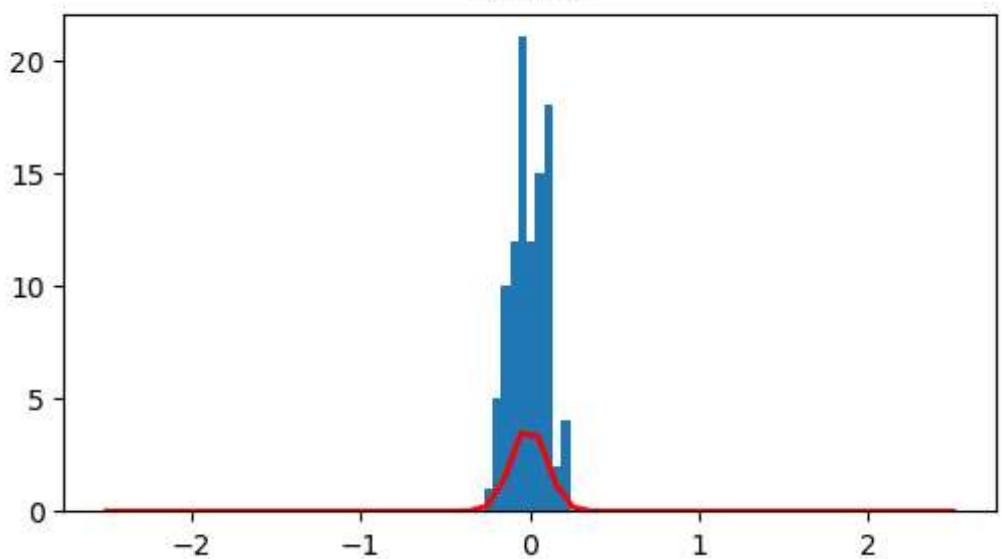
N = 80 Média = -0.004862714243547669 Variância = 0.01113155303066661

N = 80



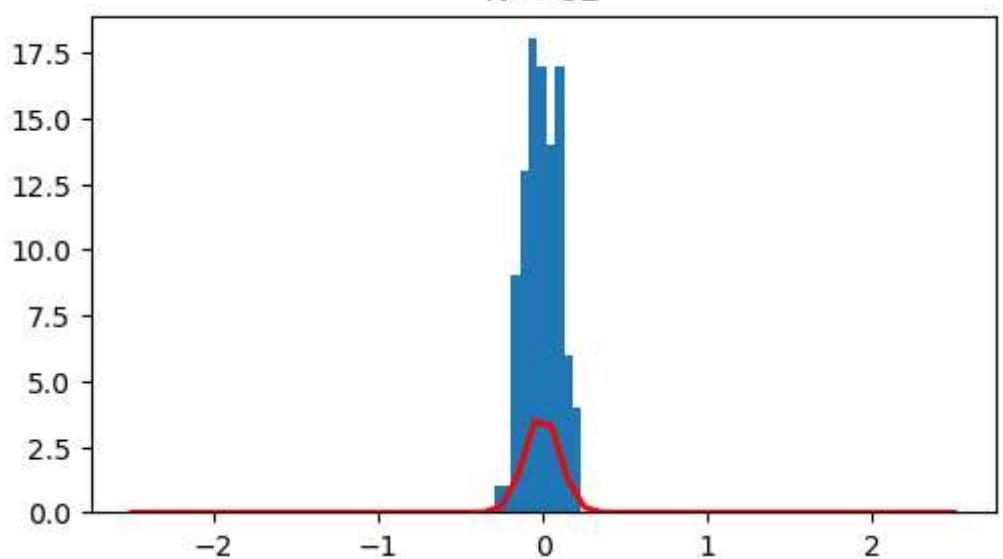
N = 81 Média = -0.004620813981141658 Variância = 0.010959959948178078

N = 81



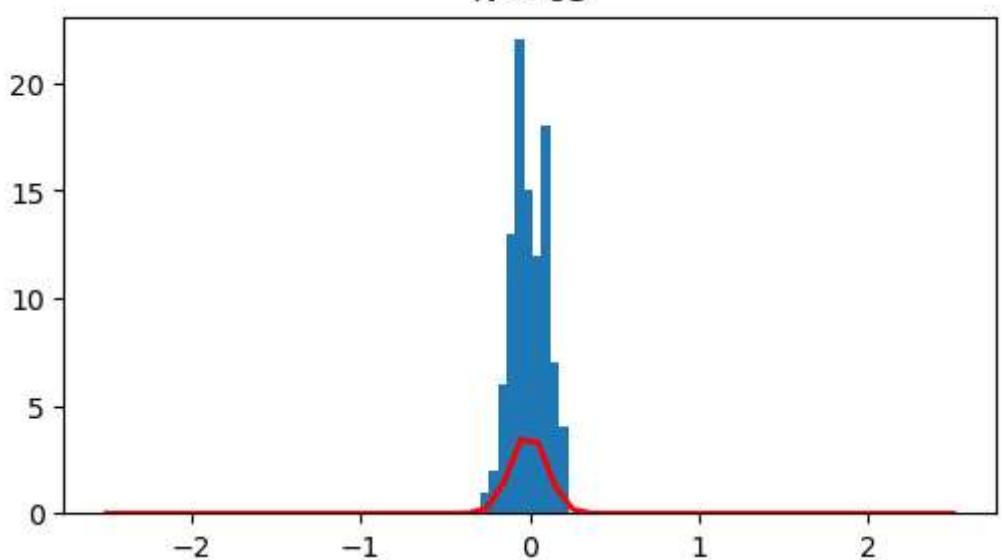
N = 82 Média = -0.004992213017613555 Variância = 0.0110343020627566

N = 82



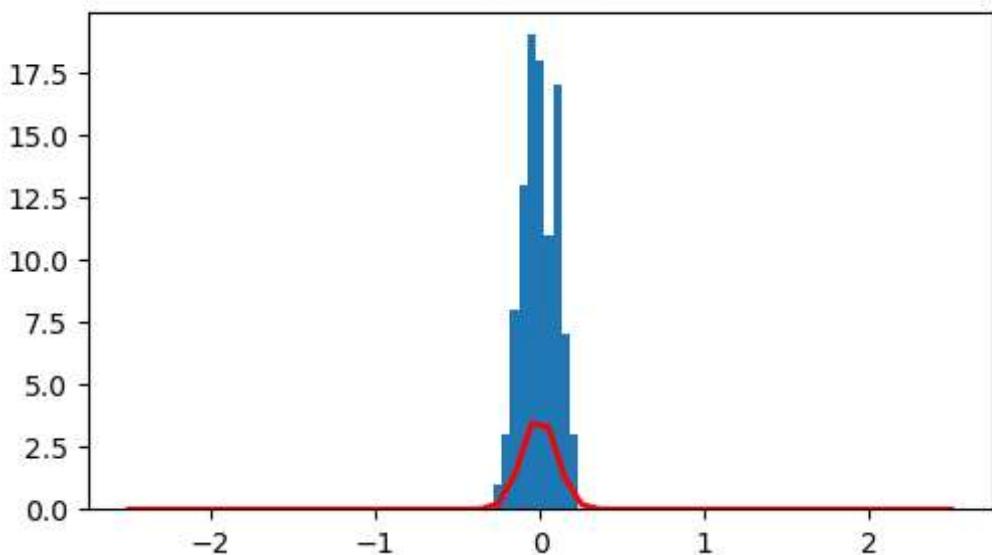
N = 83 Média = -0.005809641844503639 Variância = 0.011190393232764483

N = 83



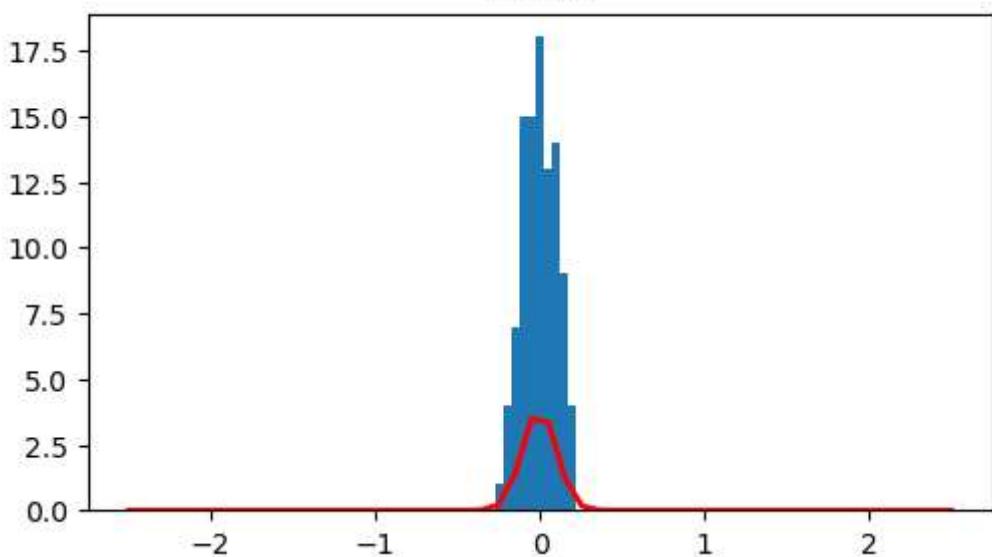
N = 84 Média = -0.004517182540323161 Variância = 0.011080923490317744

N = 84



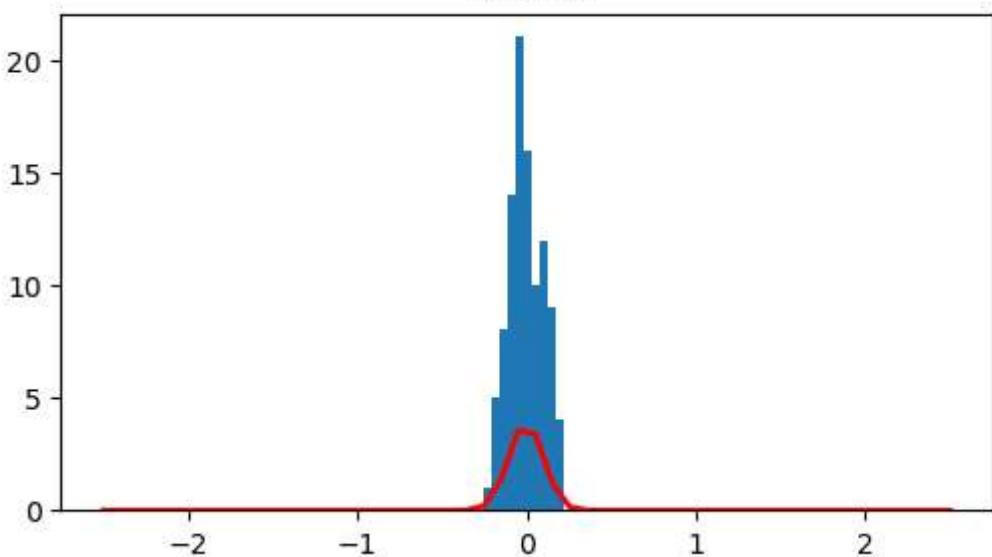
N = 85 Média = -0.0044225686811738 Variância = 0.01065129795549279

N = 85



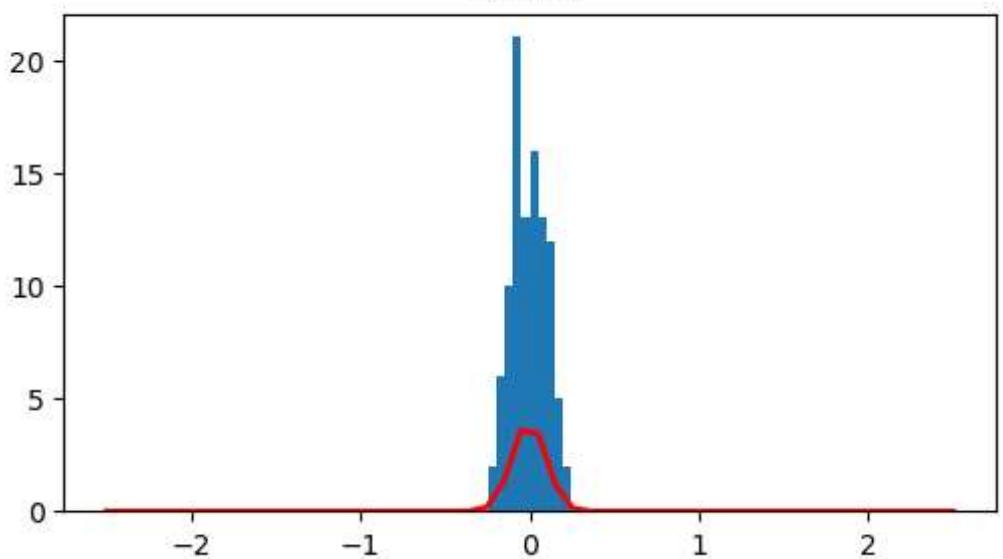
N = 86 Média = -0.0044079152175517085 Variância = 0.010284790357516574

N = 86



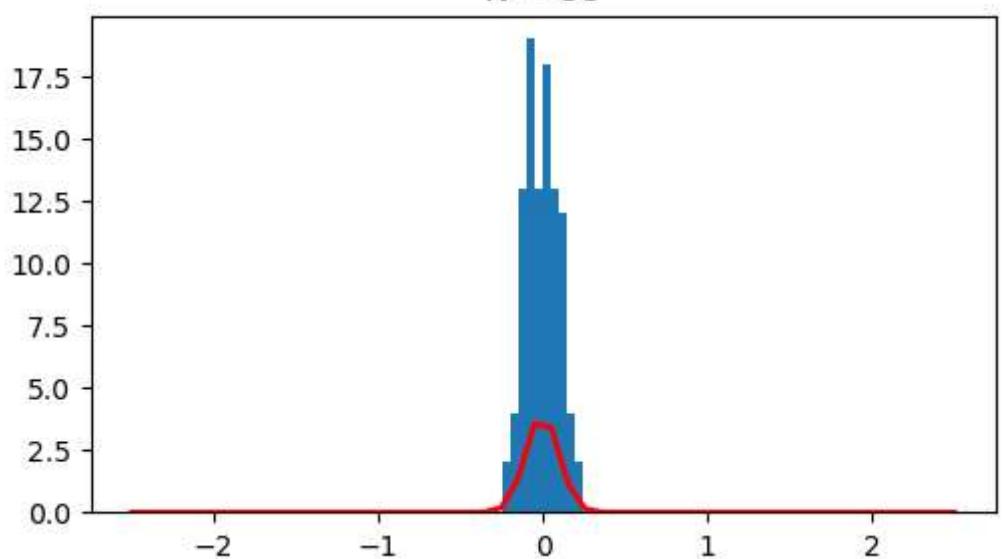
N = 87 Média = -0.00485283963151914 Variância = 0.009941350886610054

N = 87



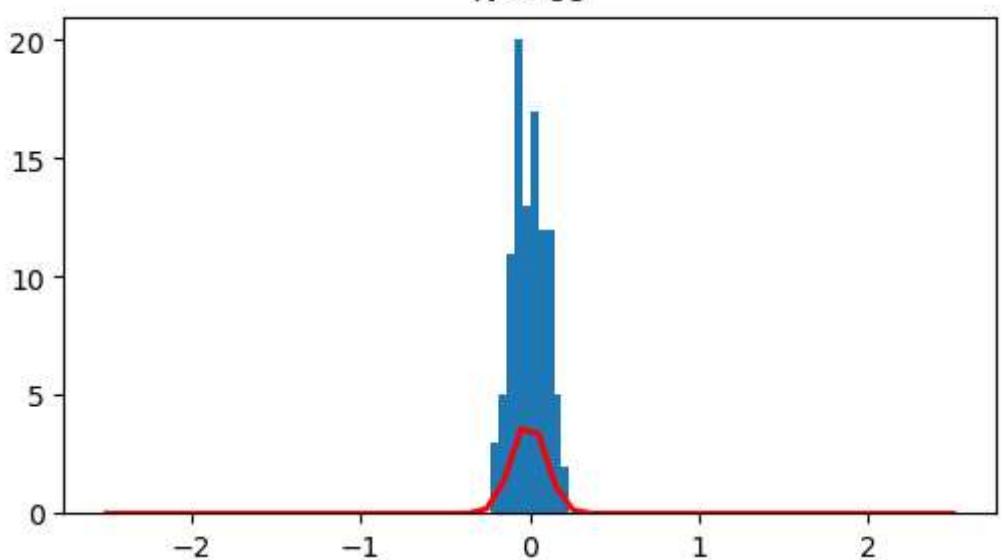
N = 88 Média = -0.004917594216194478 Variância = 0.010078872018460873

N = 88

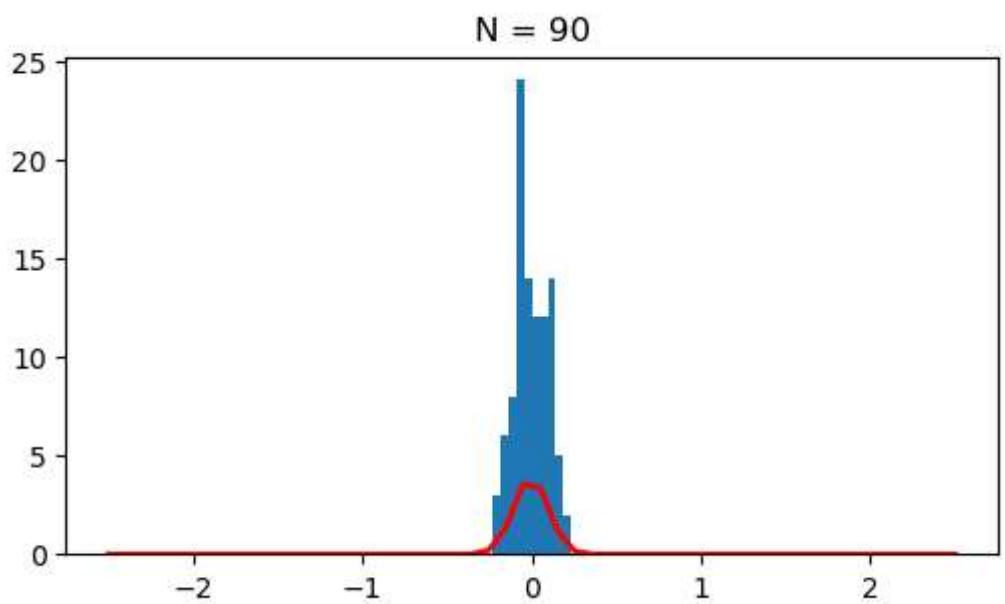


N = 89 Média = -0.005550620019692528 Variância = 0.010229835640390145

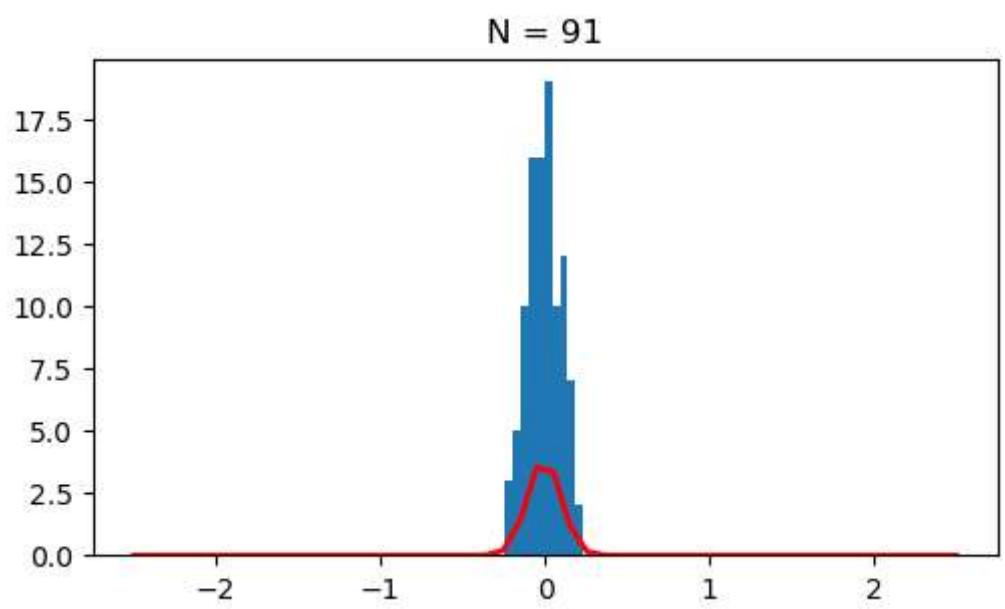
N = 89



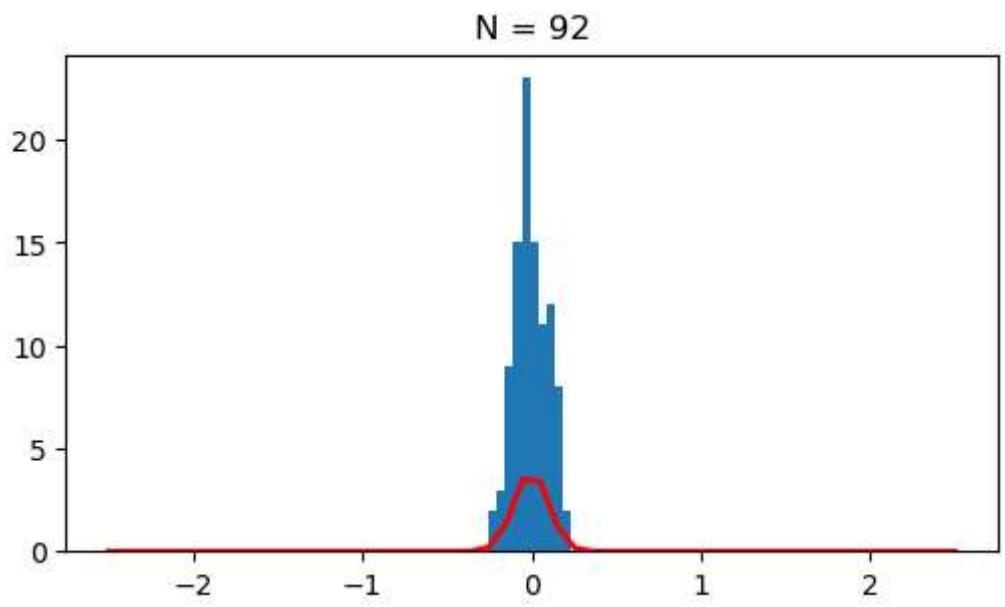
N = 90 Média = -0.004941144667834467 Variância = 0.010372461279214009



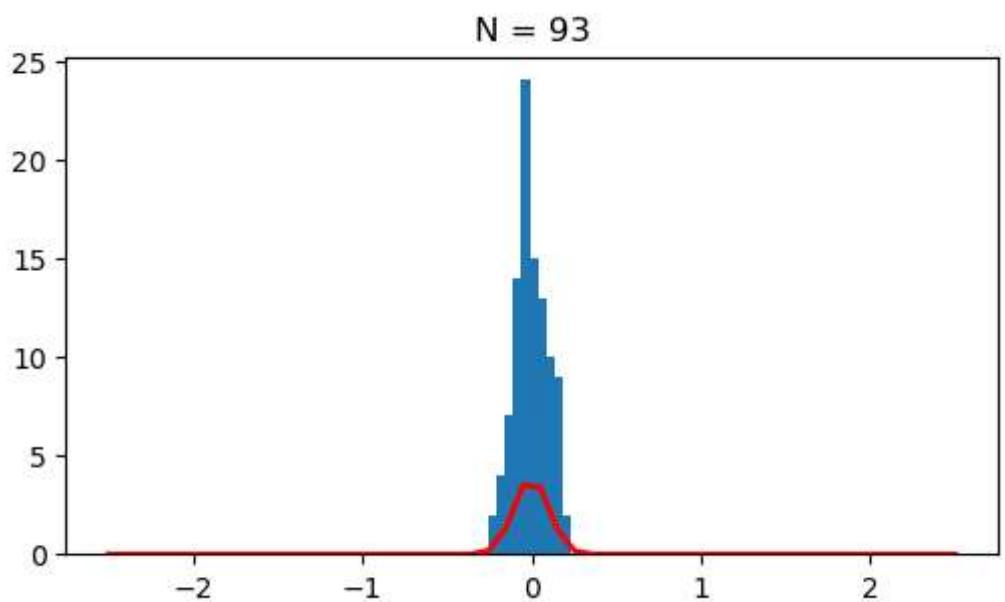
N = 91 Média = -0.0051546024544457565 Variância = 0.01046926605143293



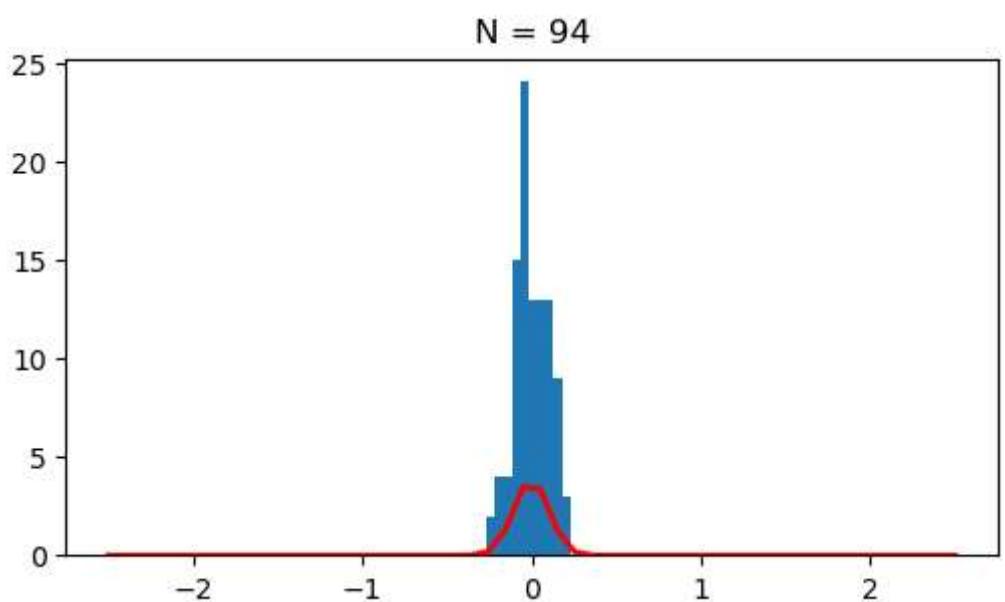
N = 92 Média = -0.0032675064883375122 Variância = 0.010484703066769777



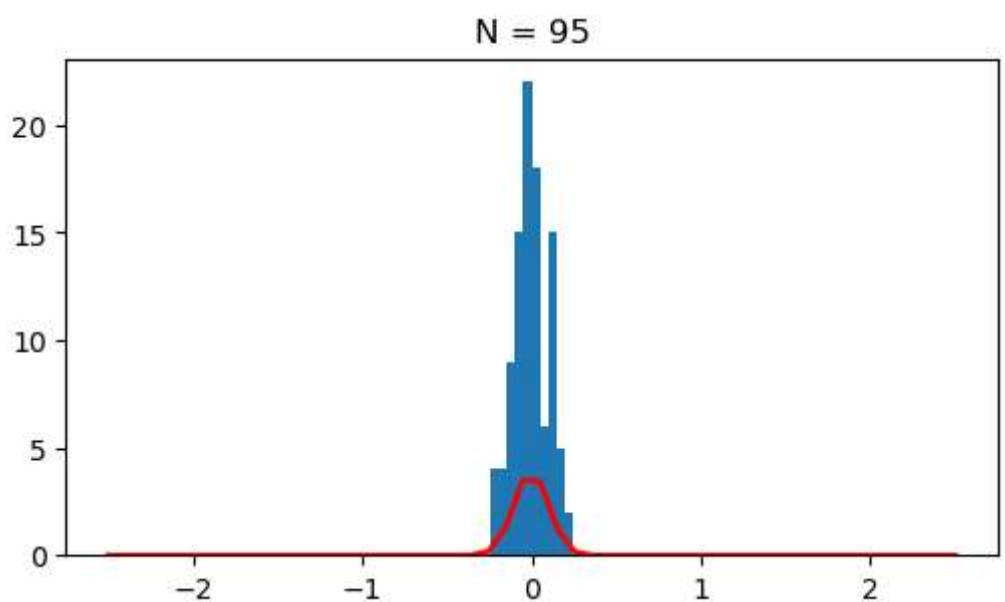
N = 93 Média = -0.0027055777552557254 Variância = 0.010472944064192467



N = 94 Média = -0.003001137114278465 Variância = 0.010697299795352389

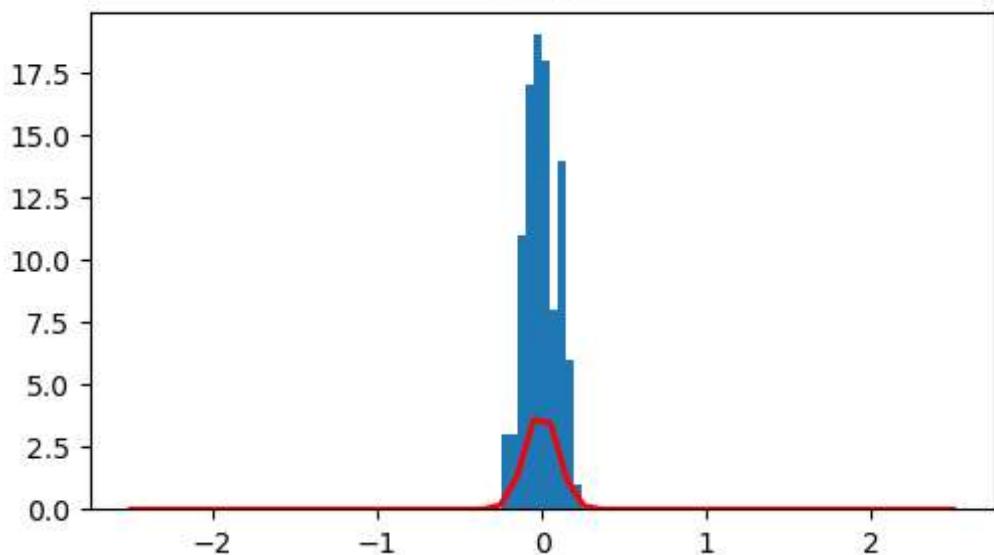


N = 95 Média = -0.002693762581708476 Variância = 0.010314394838408816



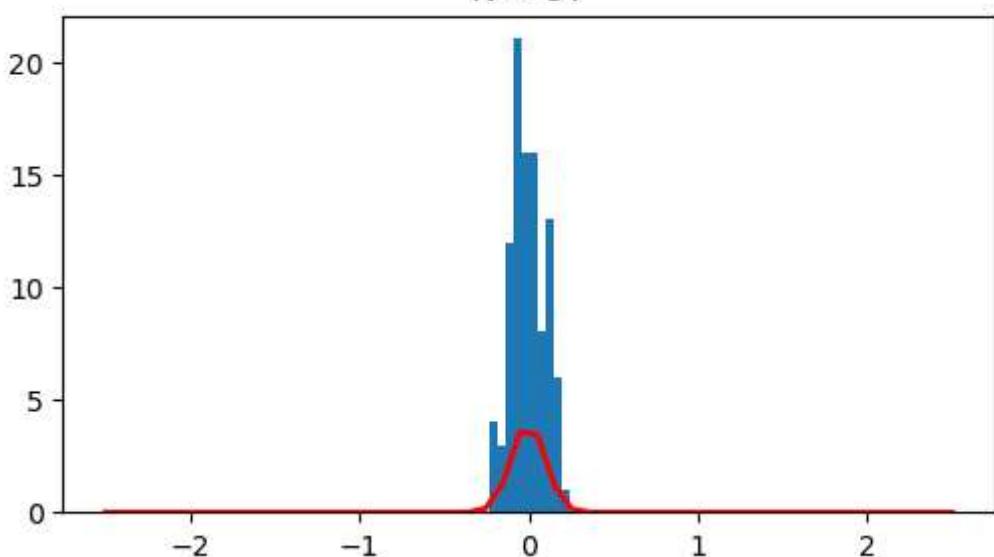
N = 96 Média = -0.003446623871349934 Variância = 0.009807776787830144

N = 96



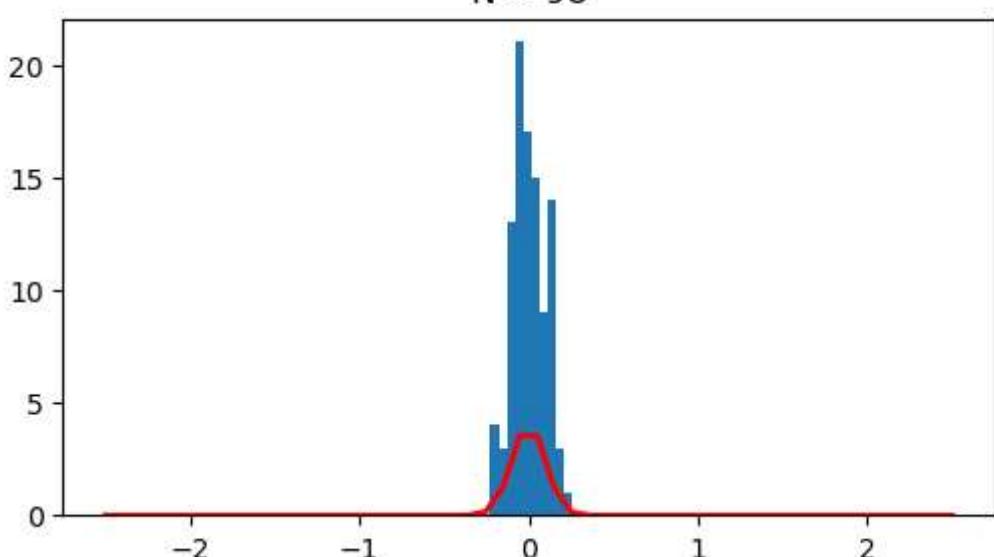
N = 97 Média = -0.003291924527117676 Variância = 0.00994151232673902

N = 97



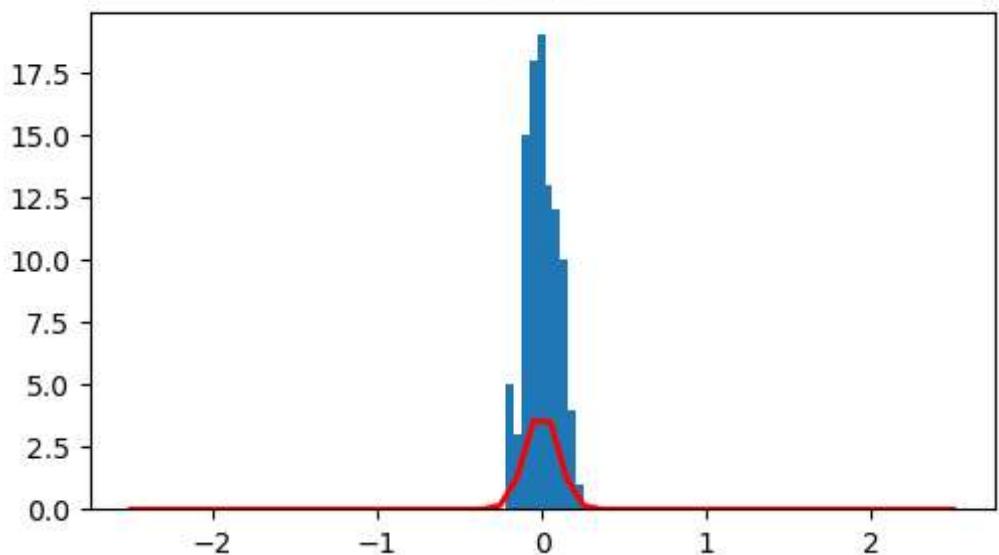
N = 98 Média = -0.0012998415056691664 Variância = 0.009778680778192451

N = 98



N = 99 Média = -0.001512752929063563 Variância = 0.00984989453631994

N = 99

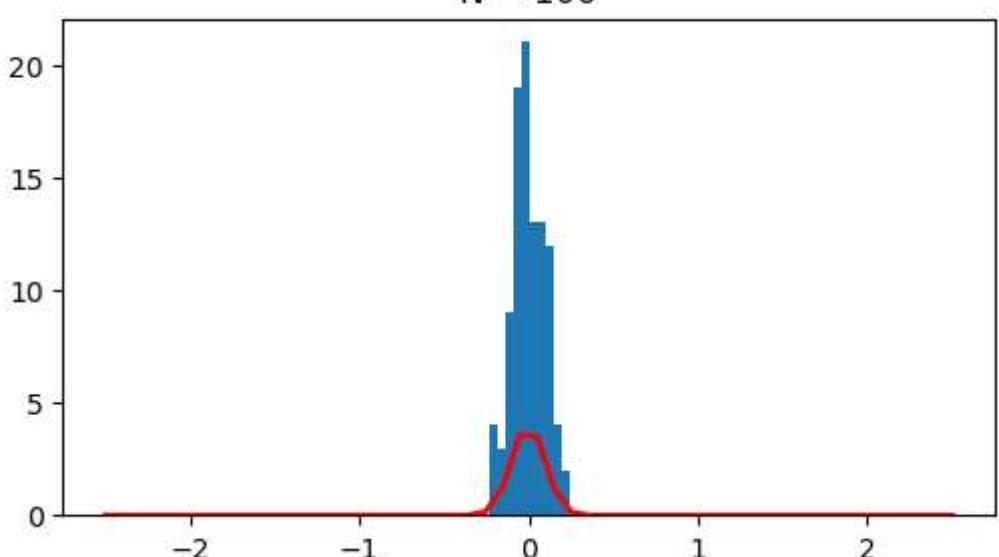


N = 100

Média = -0.0034035168149945073

Variância = 0.009702284671738712

N = 100

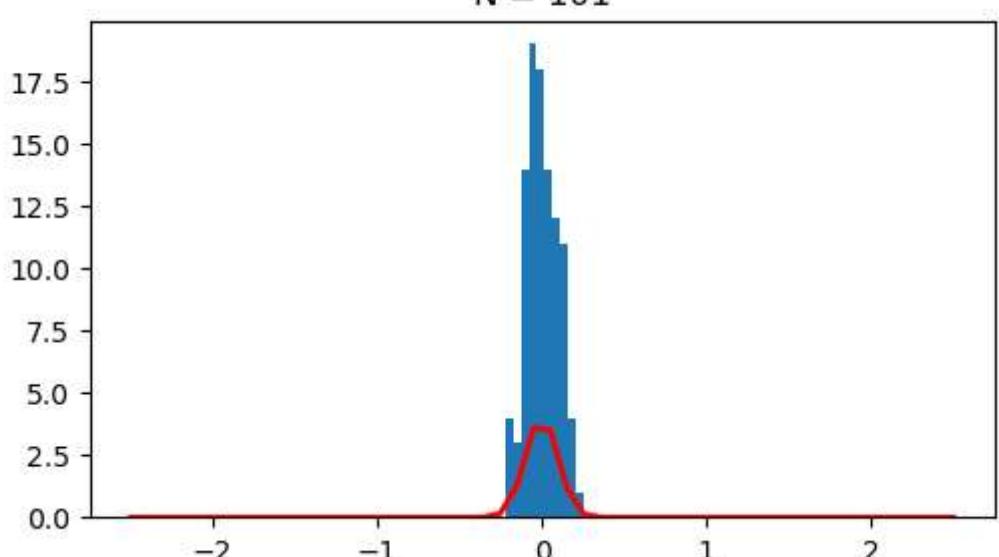


N = 101

Média = -0.002624922706813136

Variância = 0.009643385599963613

N = 101

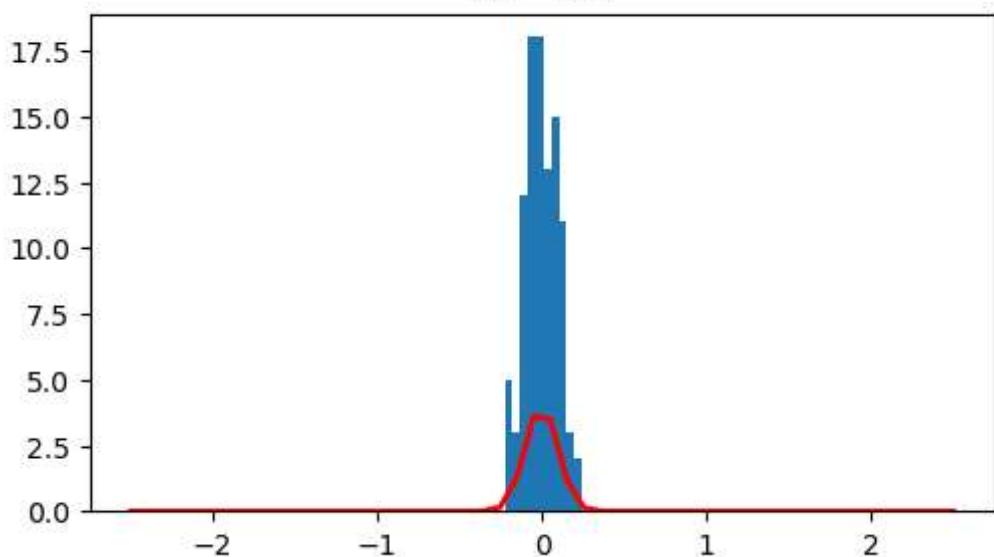


N = 102

Média = -0.0030041046220988586

Variância = 0.009685759578814748

N = 102

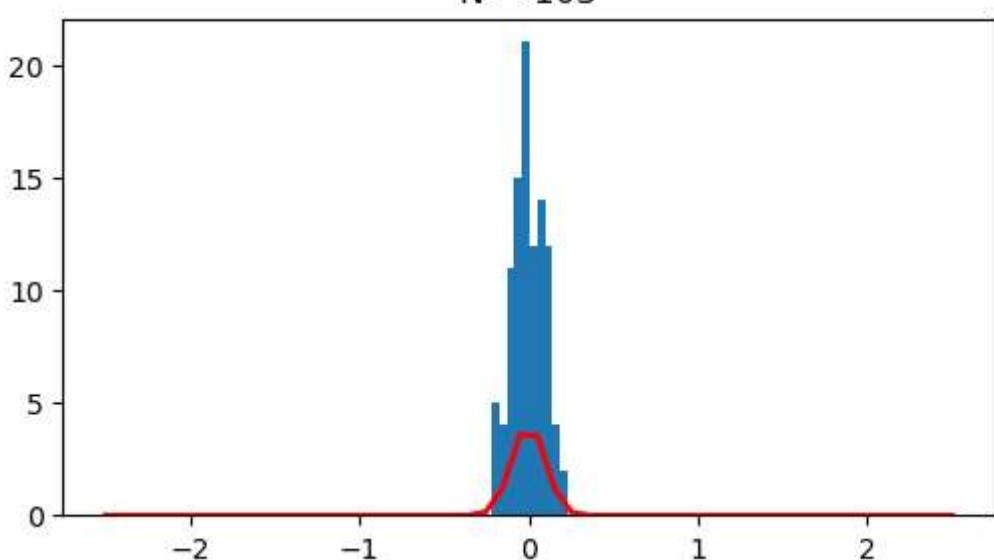


N = 103

Média = -0.0016438409430076862

Variância = 0.0095894052207546

N = 103

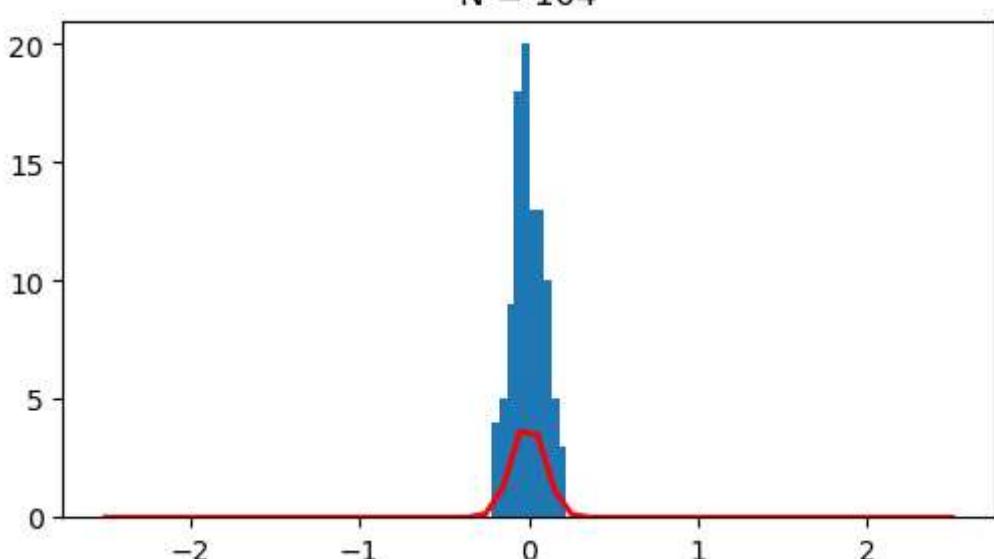


N = 104

Média = -0.00331544271298154

Variância = 0.00948751456016199

N = 104

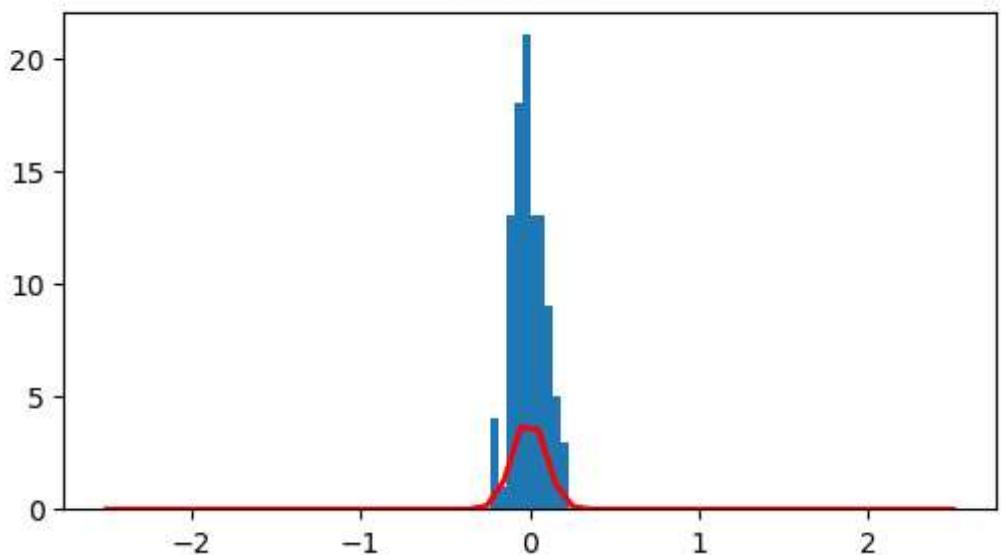


N = 105

Média = -0.0035640054059398957

Variância = 0.009387482820568217

N = 105

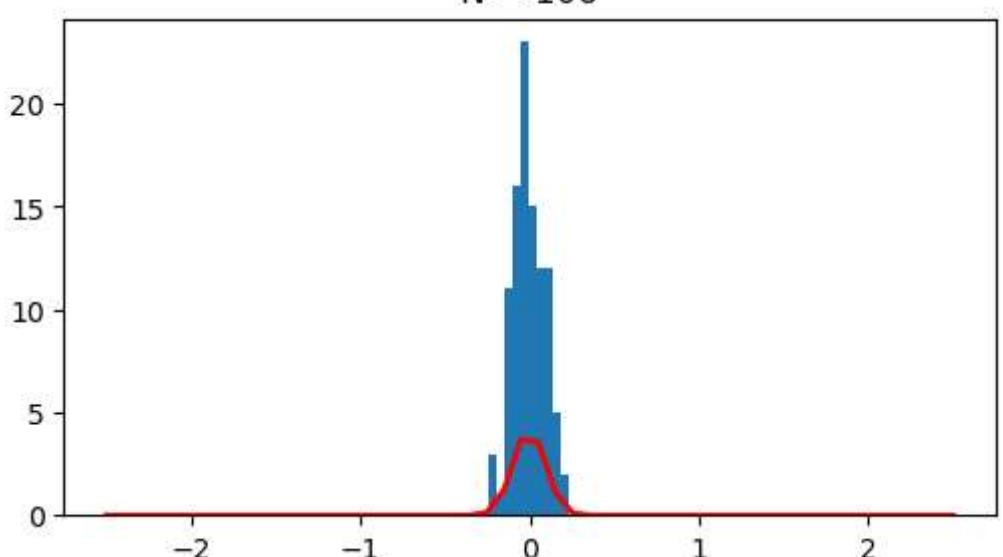


N = 106

Média = -0.0034546084454994117

Variância = 0.009118698250805808

N = 106

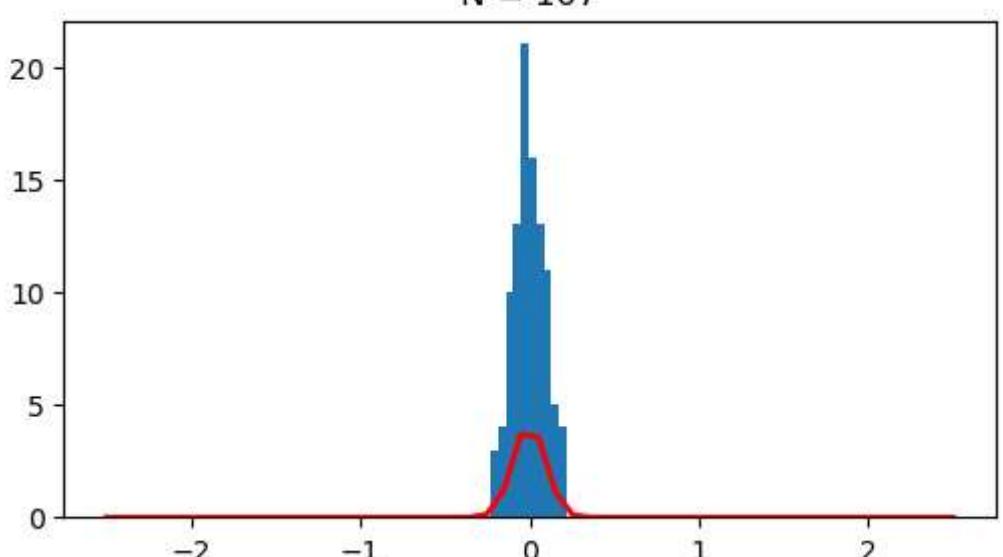


N = 107

Média = -0.003025064068887192

Variância = 0.009118273952011254

N = 107

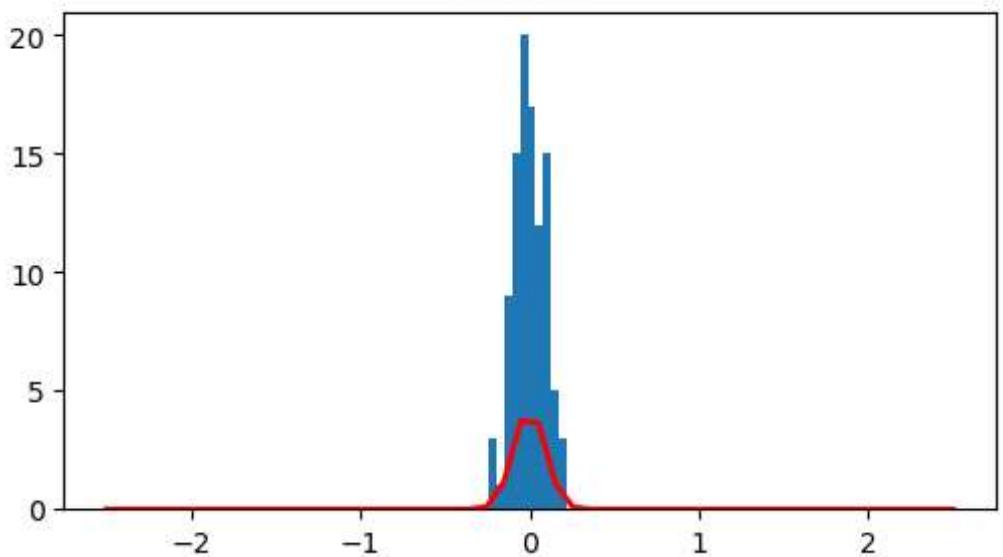


N = 108

Média = -0.002175807996038531

Variância = 0.008659944977606875

N = 108

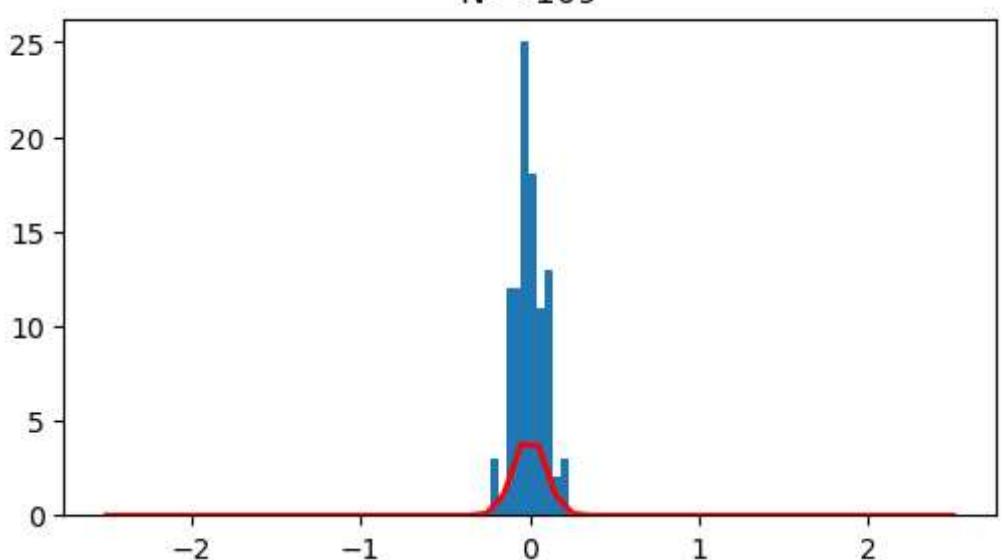


N = 109

Média = -0.0014151545143532521

Variância = 0.008516868016904535

N = 109

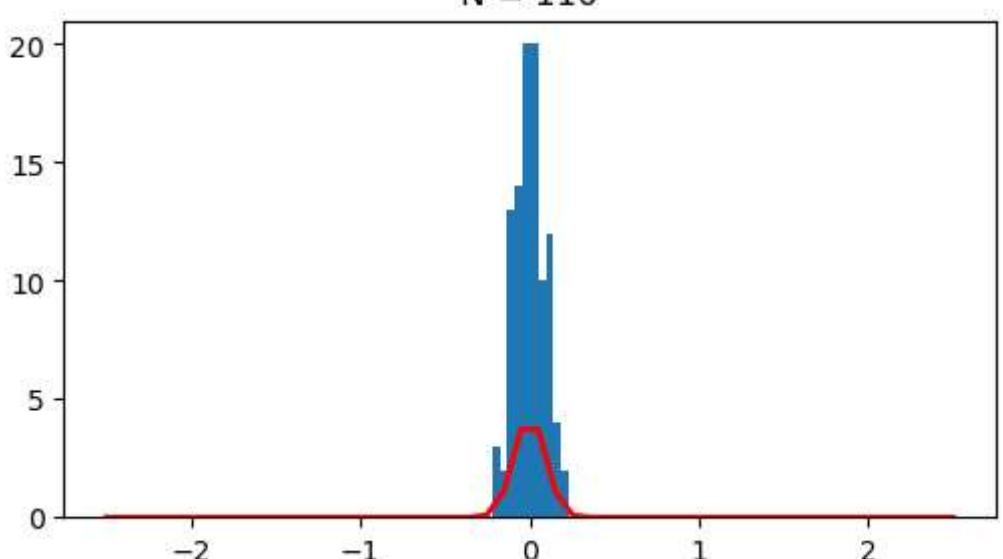


N = 110

Média = -0.0006300398311547777

Variância = 0.008448657521090358

N = 110

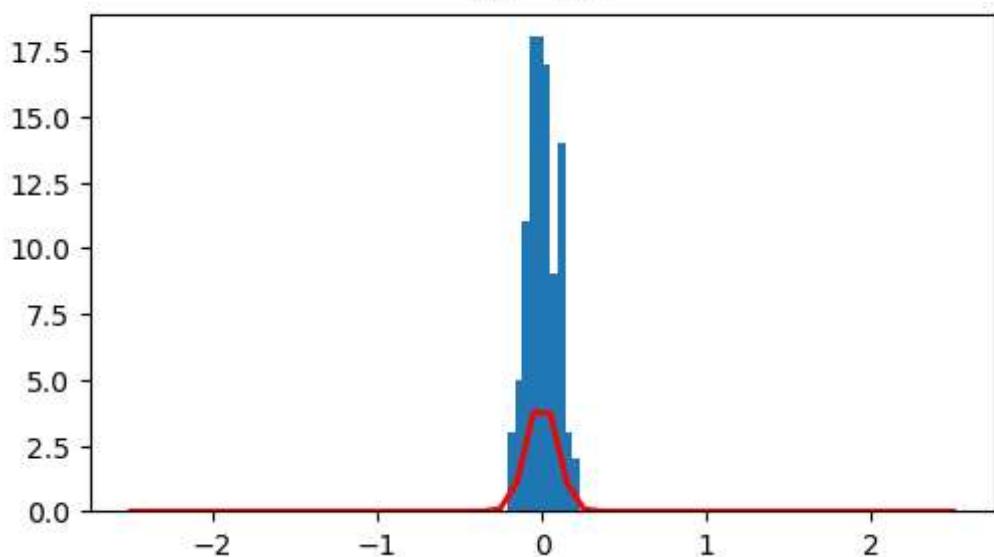


N = 111

Média = -0.0011689646483161056

Variância = 0.008303271237826195

N = 111

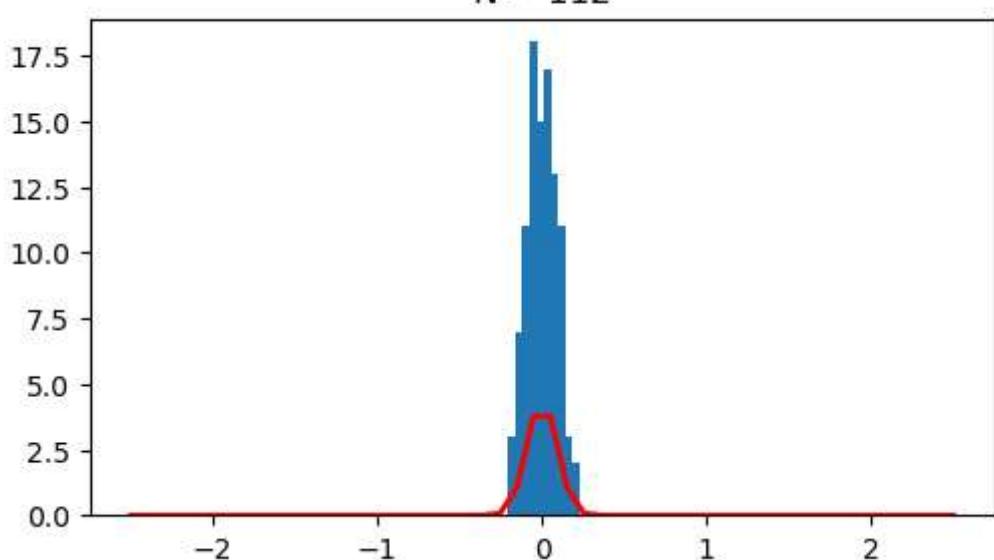


N = 112

Média = -0.00016648324063263622

Variância = 0.00811617694759323

N = 112

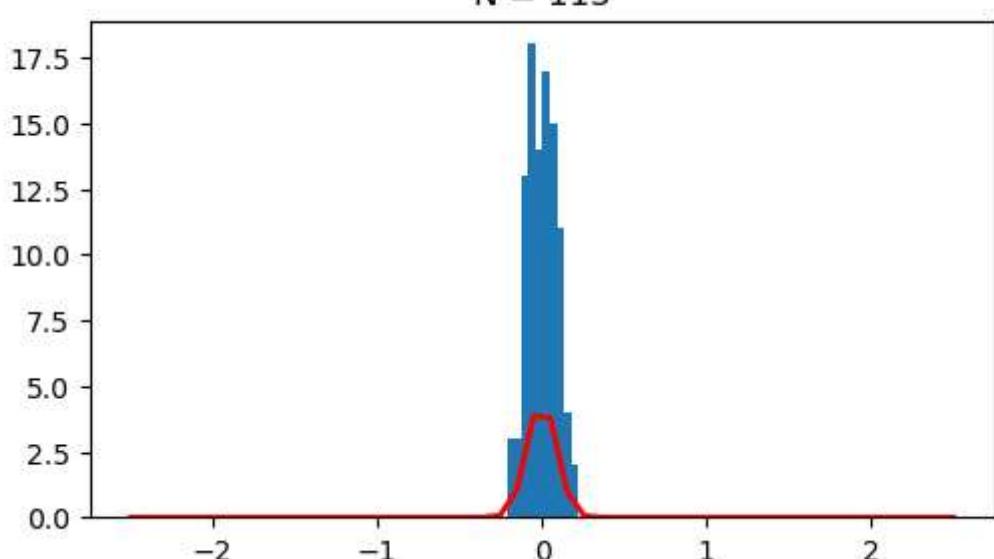


N = 113

Média = -0.0014409576545242329

Variância = 0.007825002749630543

N = 113

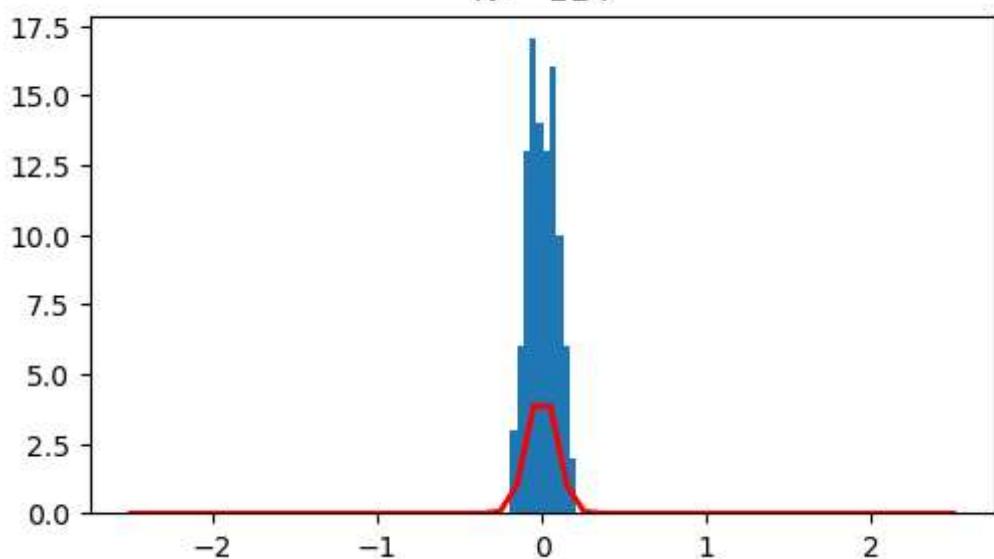


N = 114

Média = -0.0004119652494427616

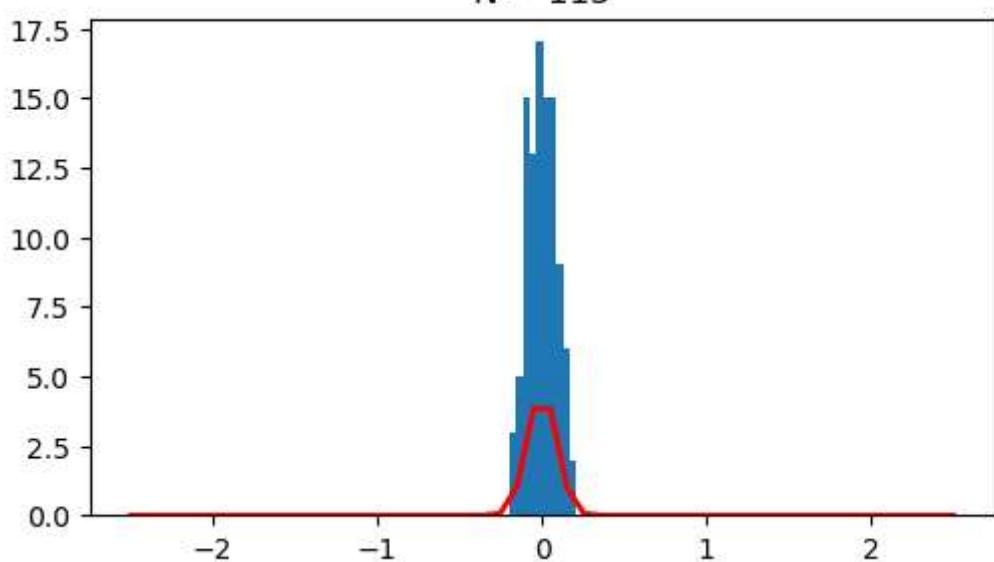
Variância = 0.007657992512432312

N = 114



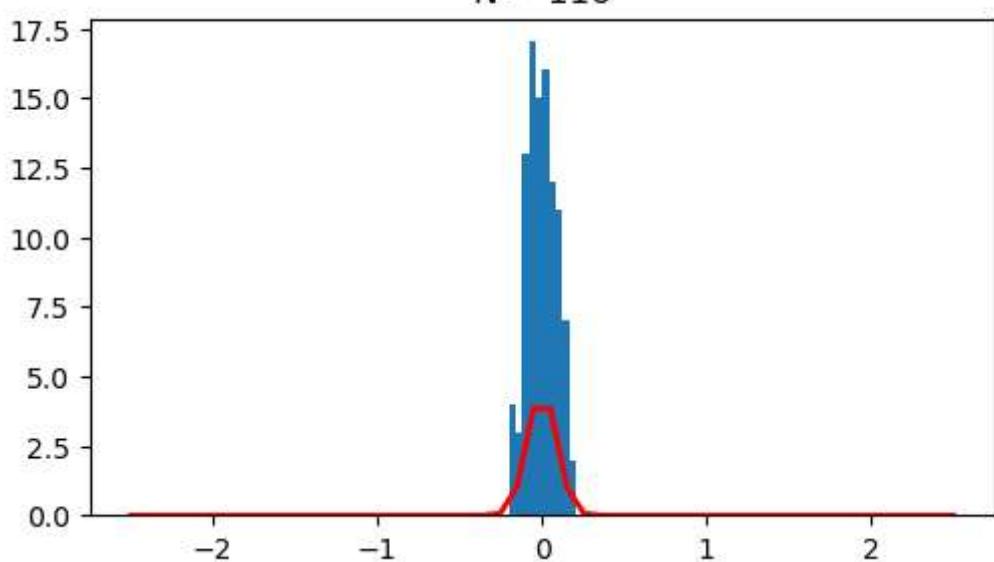
N = 115 Média = -0.0005283825812211555 Variância = 0.00773596893953117

N = 115



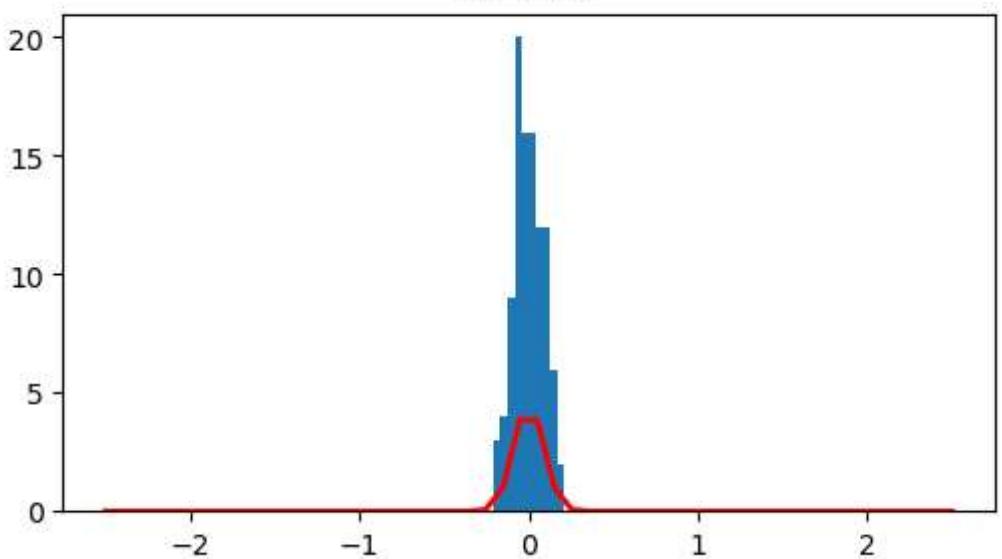
N = 116 Média = -0.0003092781411522524 Variância = 0.007727249587174844

N = 116



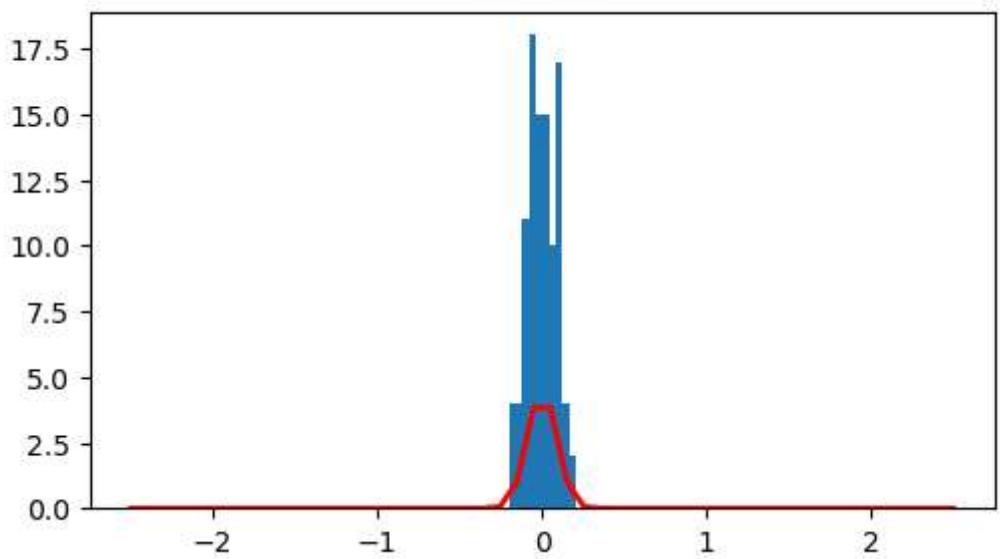
N = 117 Média = -0.00012576147372626037 Variância = 0.00764059904108768

N = 117



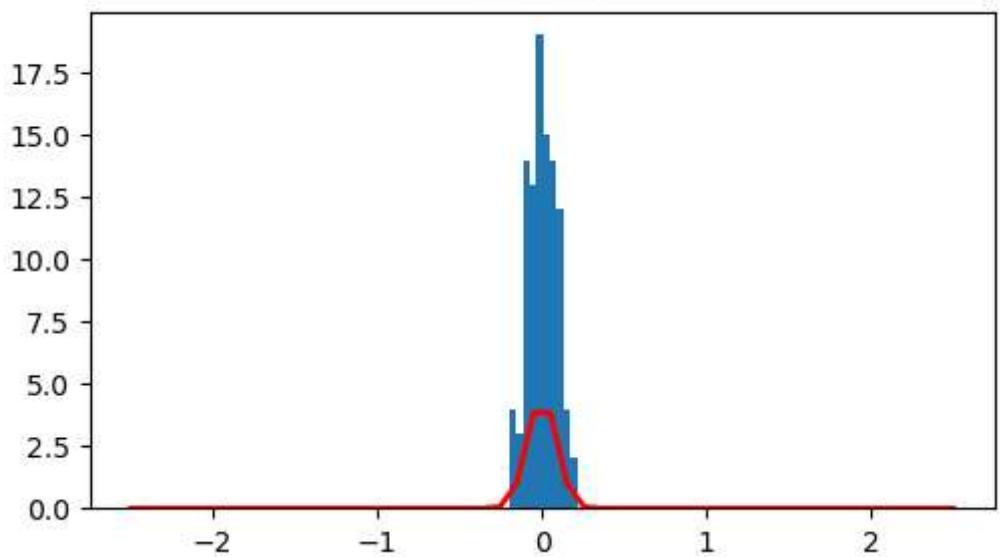
N = 118 Média = -0.00029601162864037163 Variância = 0.007715038057823666
4

N = 118



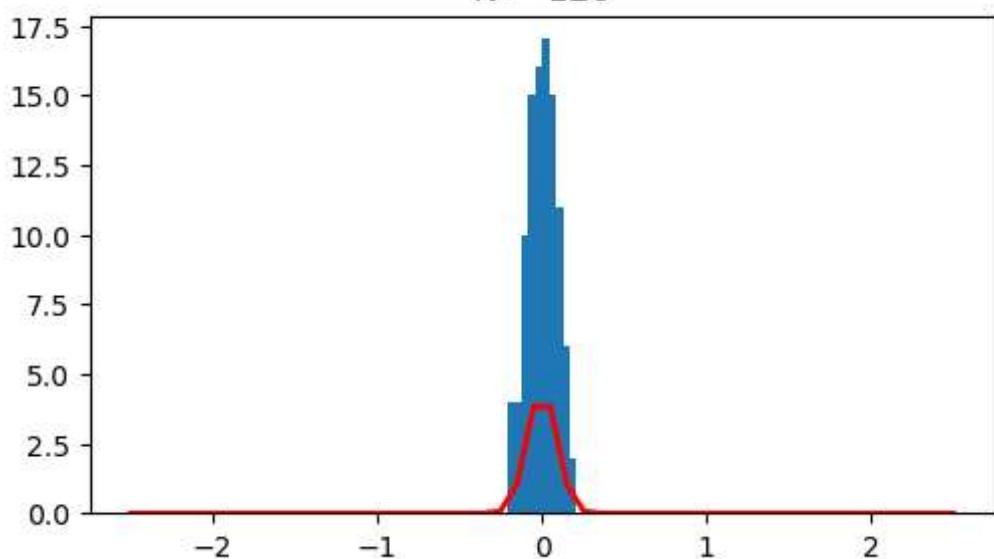
N = 119 Média = -0.0005971377316885857 Variância = 0.007683999952311464

N = 119



N = 120 Média = -0.0002524880151169498 Variância = 0.007776762484935934

N = 120

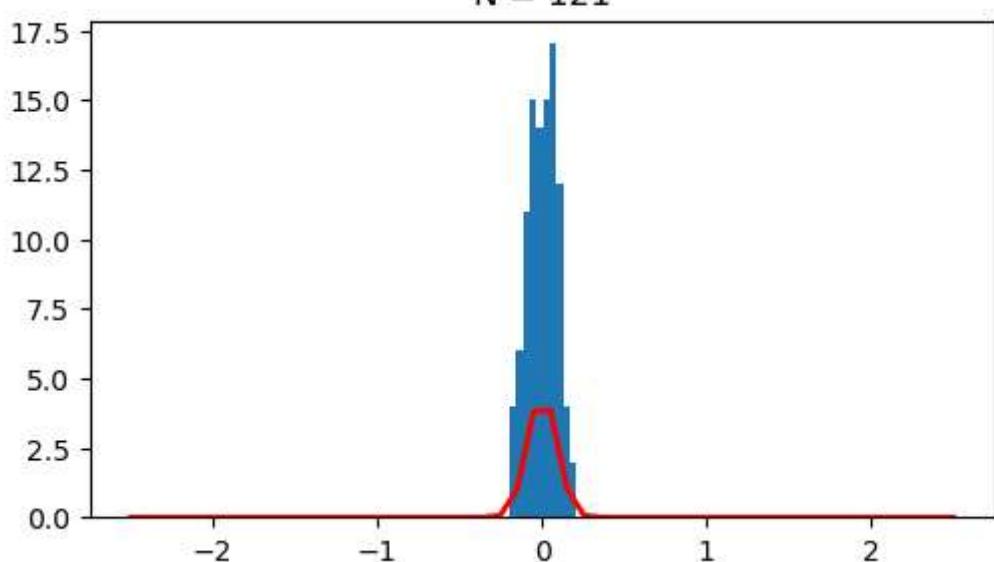


N = 121

Média = 0.0009592169884353697

Variância = 0.007764921987560353

N = 121

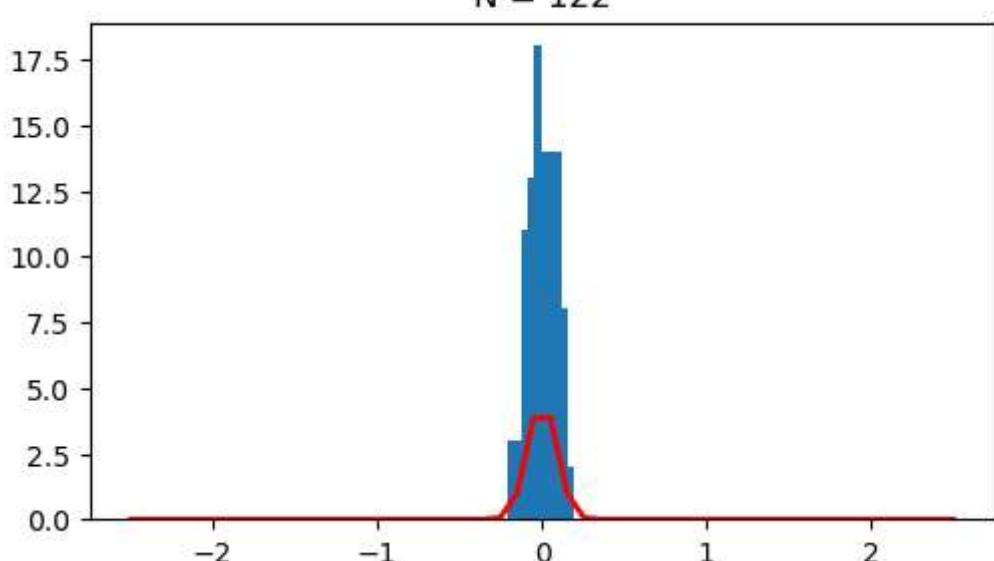


N = 122

Média = 0.0005397865959211398

Variância = 0.007560882390883206

N = 122

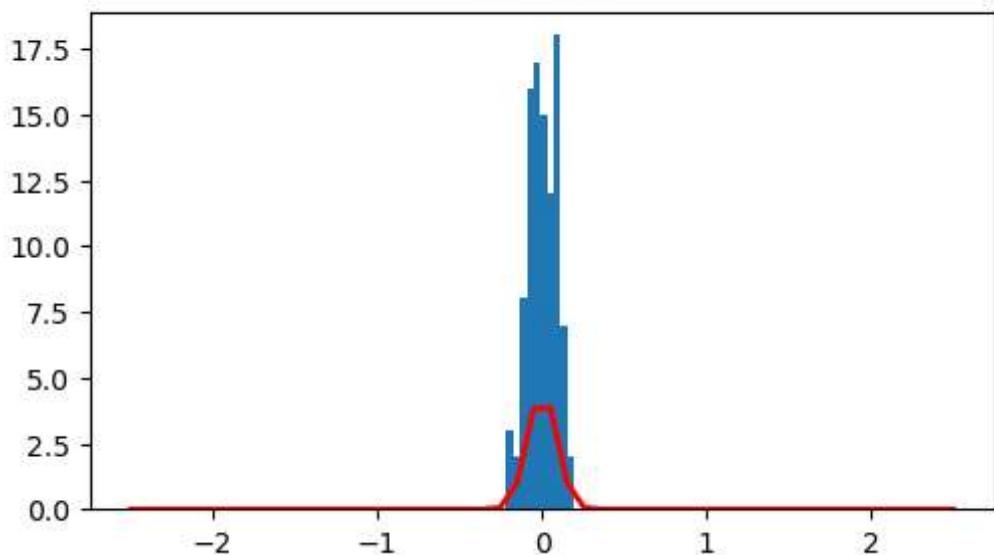


N = 123

Média = 0.001064206542441322

Variância = 0.00768621677900257

N = 123

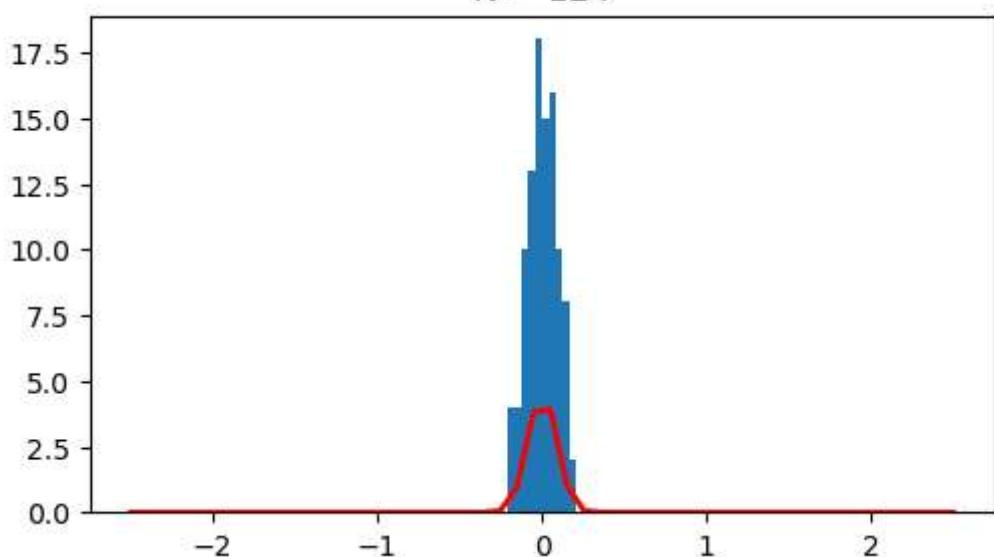


N = 124

Média = 0.001542169714048225

Variância = 0.0075498386488260984

N = 124

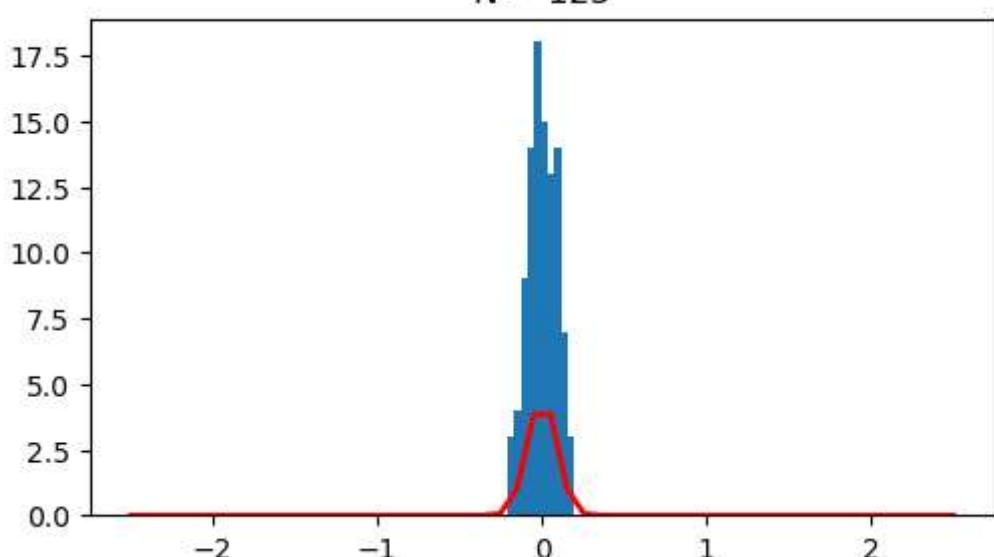


N = 125

Média = 0.000519494421524551

Variância = 0.007666193159731166

N = 125

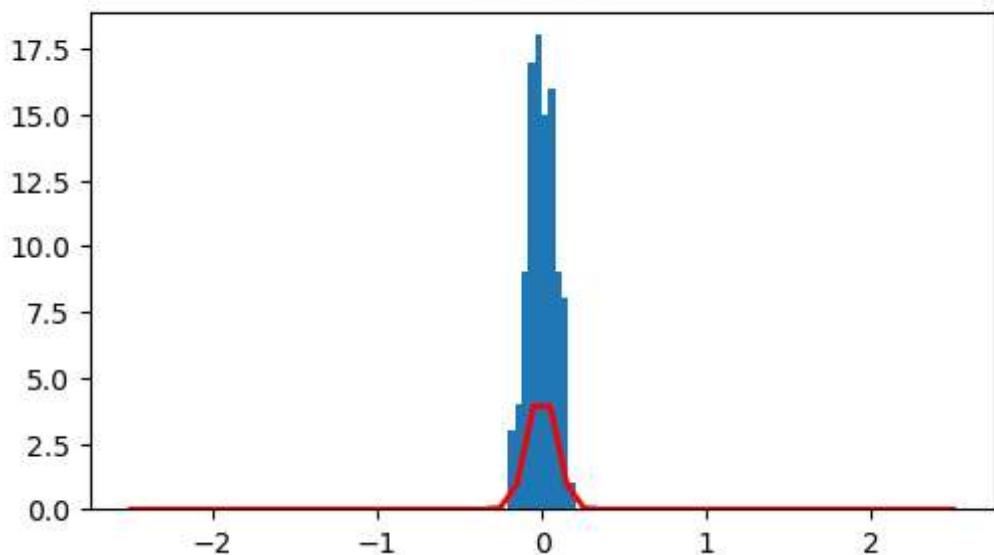


N = 126

Média = -0.00041743741674204945

Variância = 0.007273973783765151

N = 126

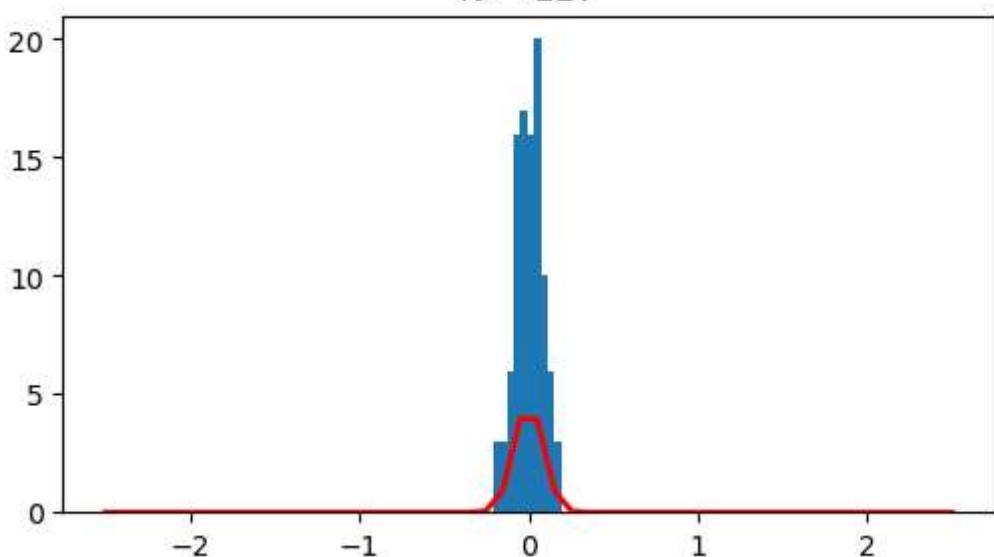


N = 127

Média = -0.0007660358057192343

Variância = 0.00707910144271019

N = 127

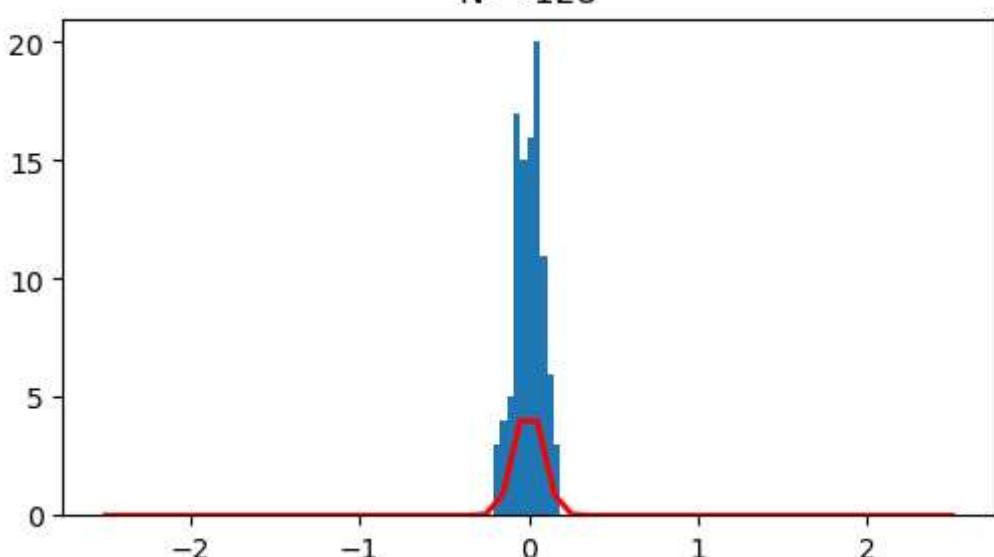


N = 128

Média = -0.00022410736958789485

Variância = 0.006821415014466875

N = 128

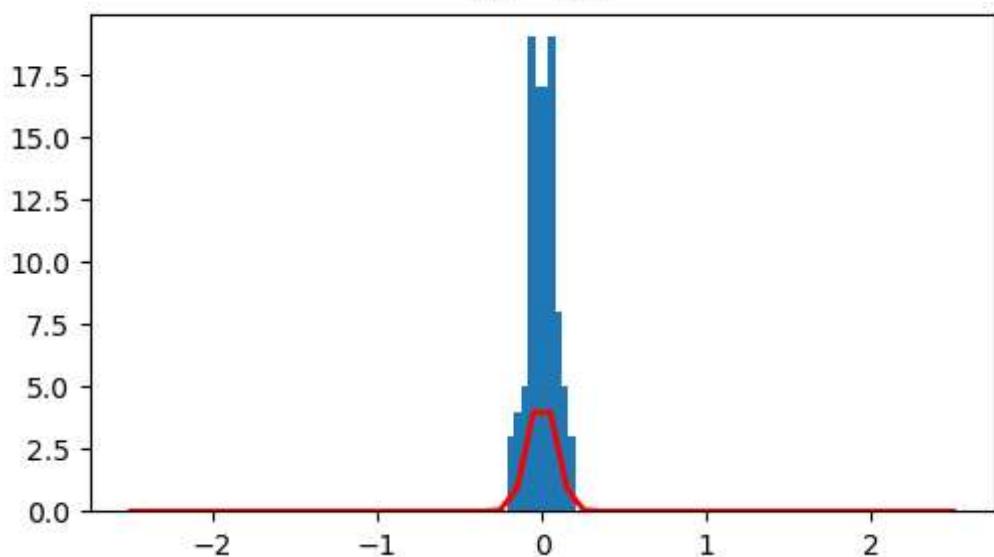


N = 129

Média = -0.0003624807944565886

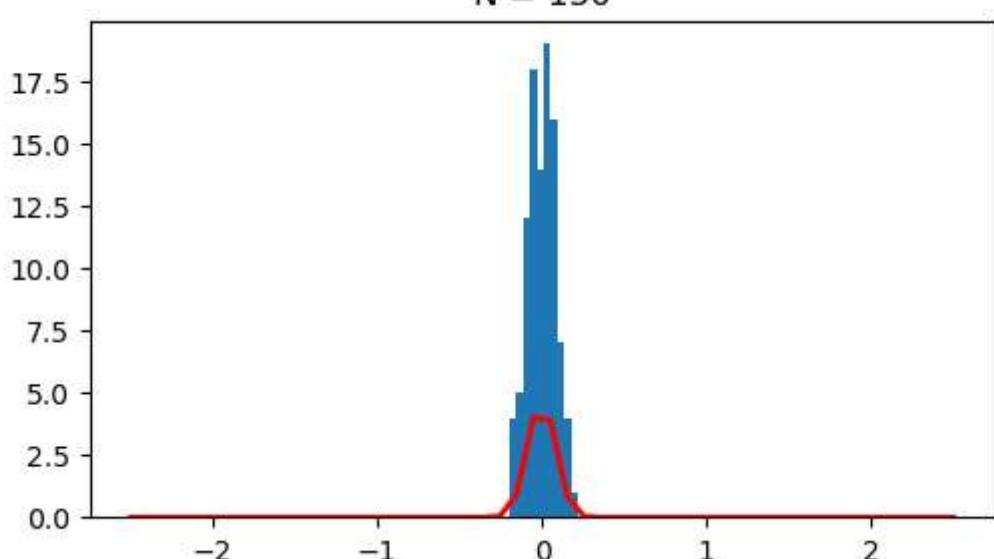
Variância = 0.006975785781568567

N = 129



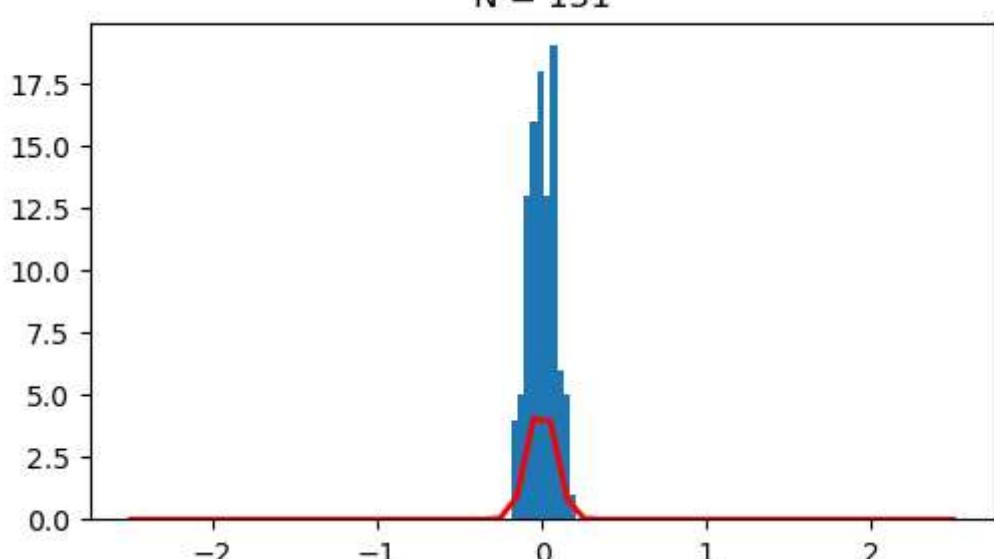
N = 130 Média = -0.002285213662971958 Variância = 0.007006062330855818

N = 130



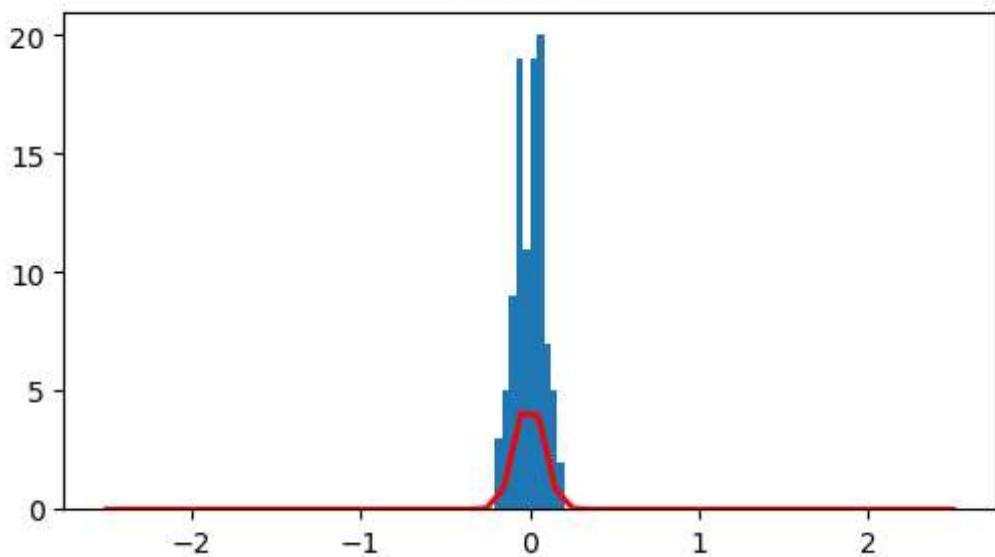
N = 131 Média = -0.001981632849938458 Variância = 0.006809872983292169

N = 131



N = 132 Média = -0.0014874870169791013 Variância = 0.00683160661895044

N = 132

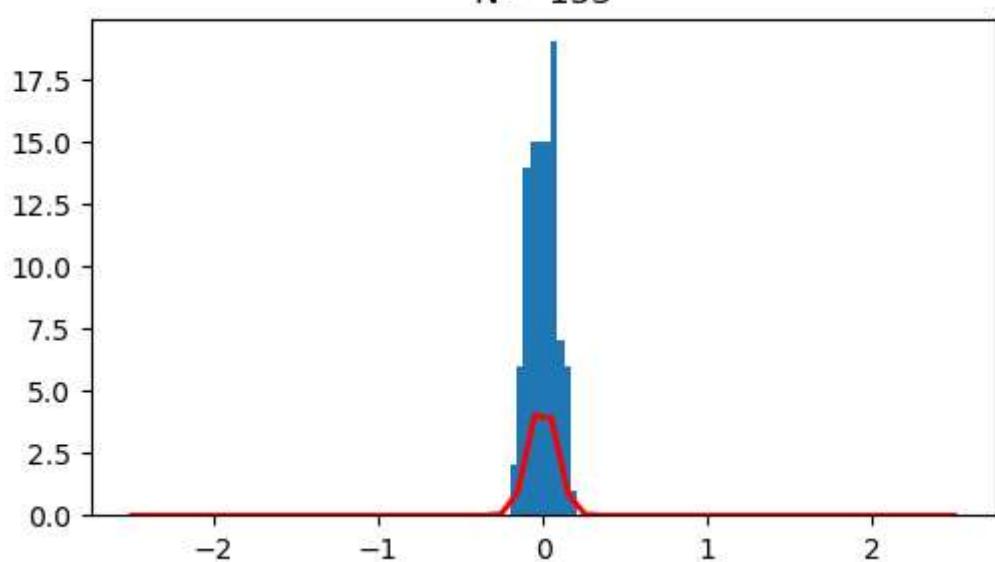


N = 133

Média = -0.0020691775330016434

Variância = 0.007016210687417645

N = 133

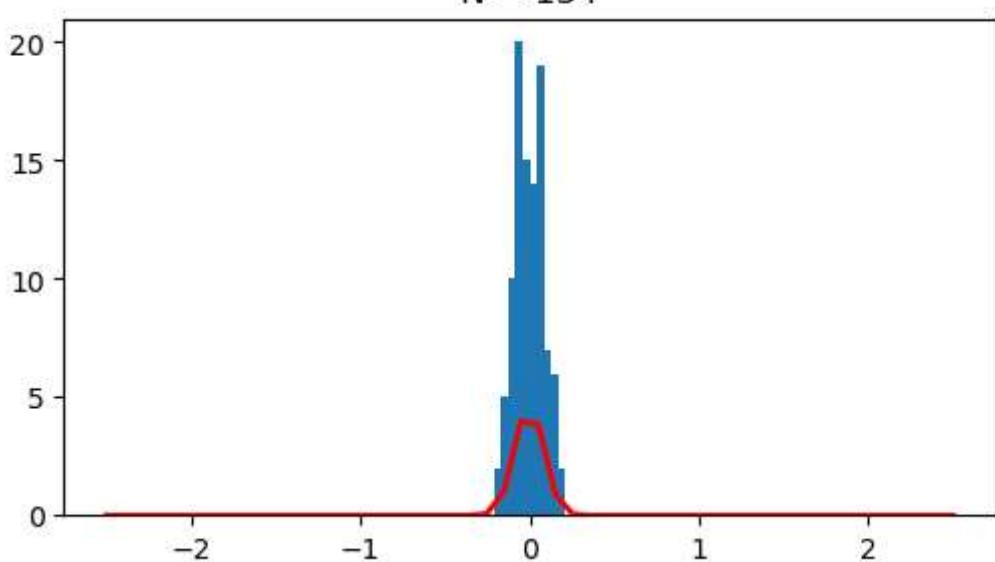


N = 134

Média = -0.003218389585948631

Variância = 0.007282445596994115

N = 134

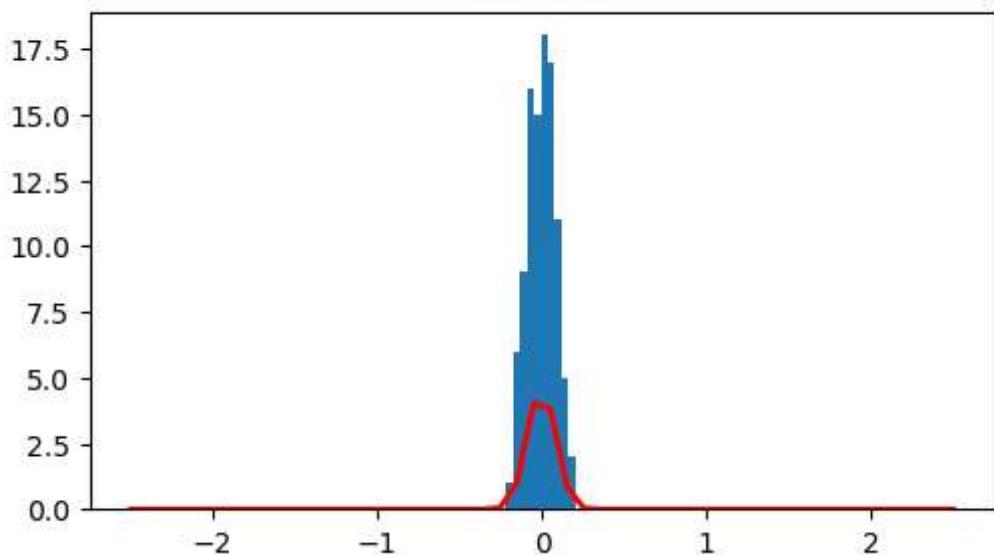


N = 135

Média = -0.004212150478353675

Variância = 0.007191469252695402

N = 135

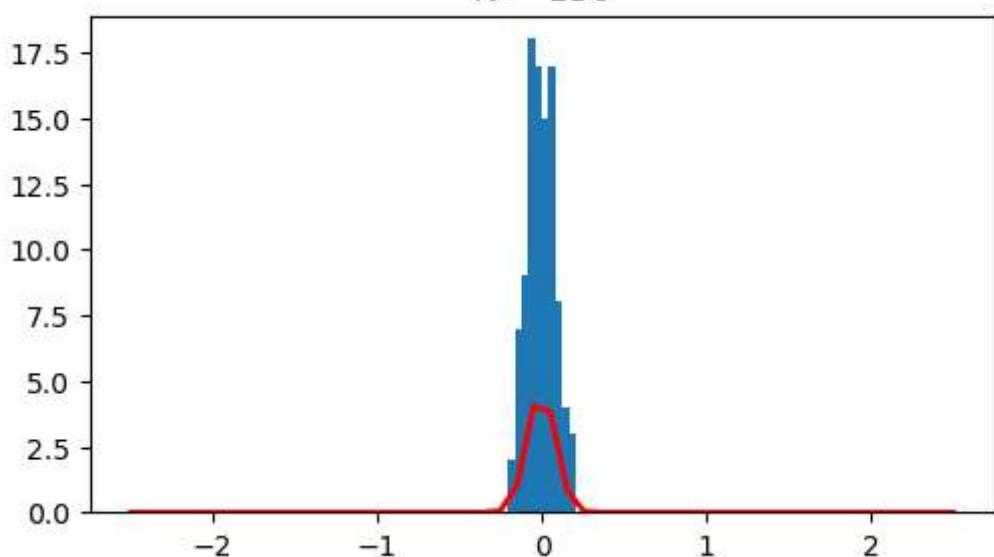


N = 136

Média = -0.004185647013615368

Variância = 0.007130007519009391

N = 136

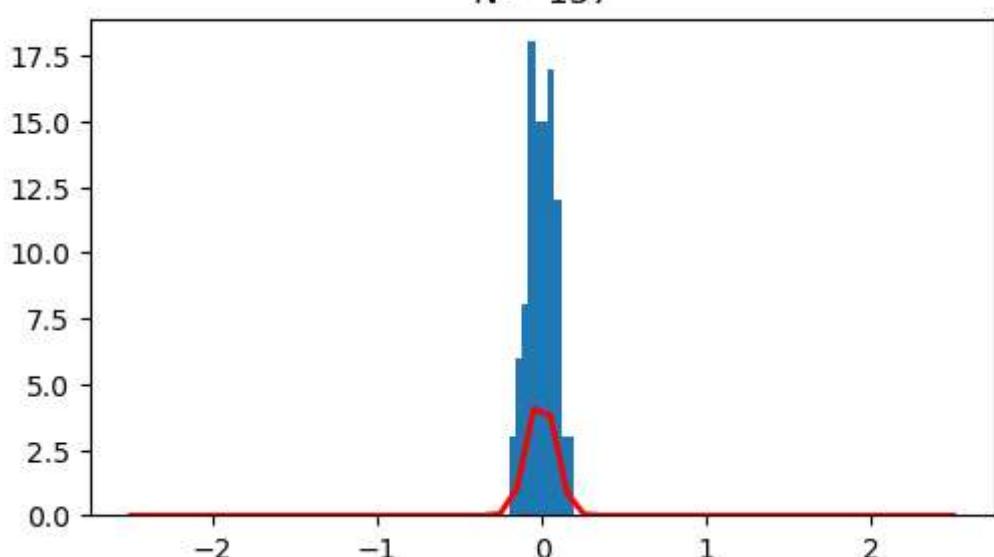


N = 137

Média = -0.004465958144445368

Variância = 0.007195430727609986

N = 137

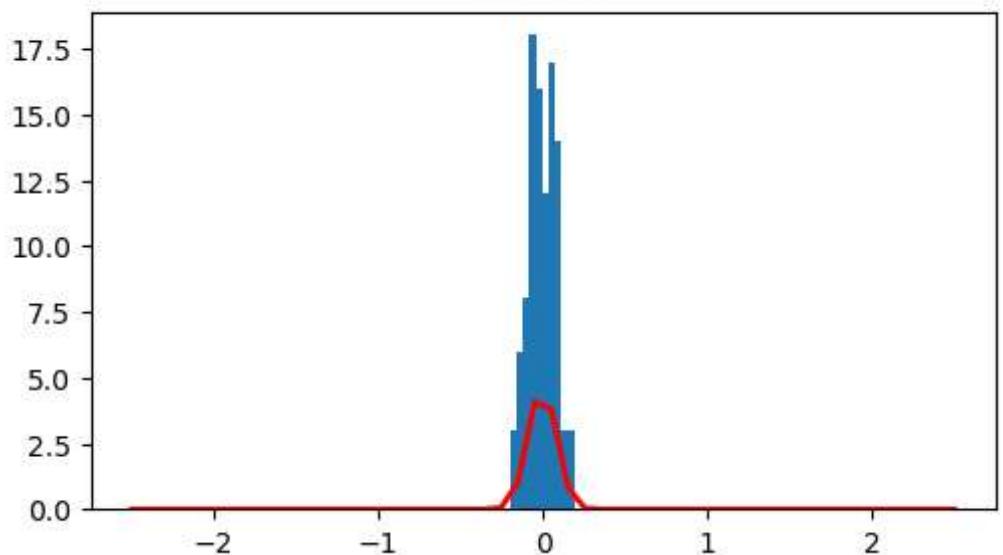


N = 138

Média = -0.005072597123877455

Variância = 0.0071184859524825415

N = 138

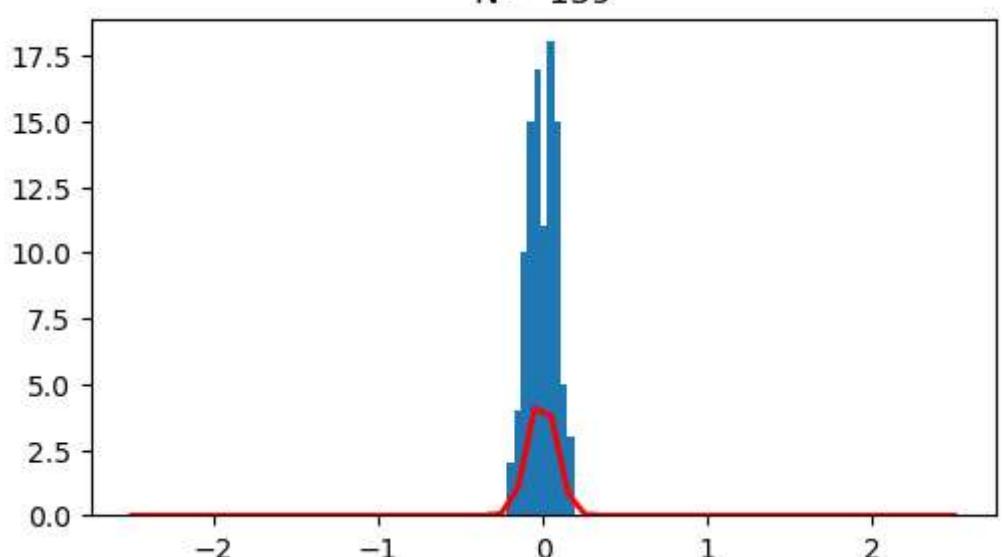


N = 139

Média = -0.005475164040087291

Variância = 0.0071983064950753625

N = 139

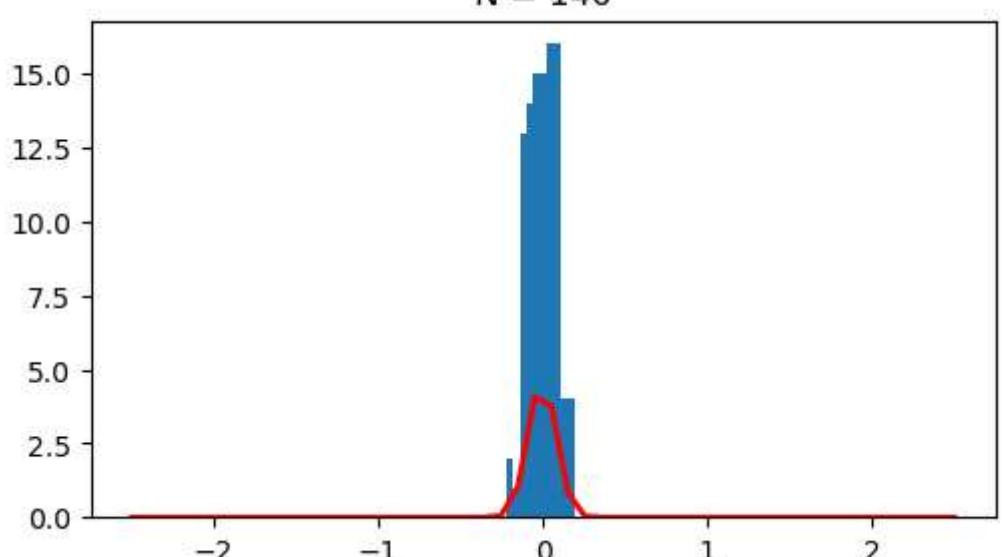


N = 140

Média = -0.005470642867350047

Variância = 0.007186979912844694

N = 140

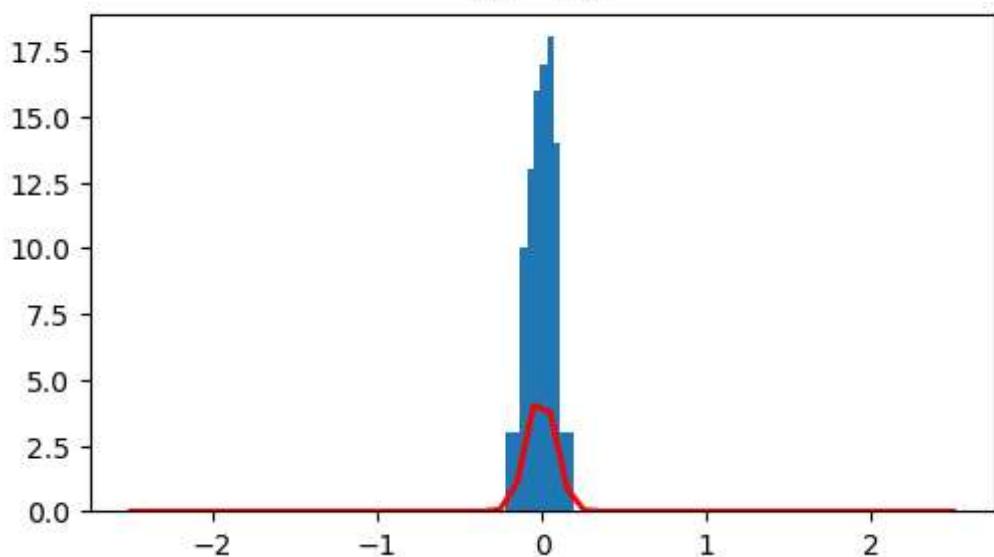


N = 141

Média = -0.005121964309085445

Variância = 0.007400035140343802

N = 141

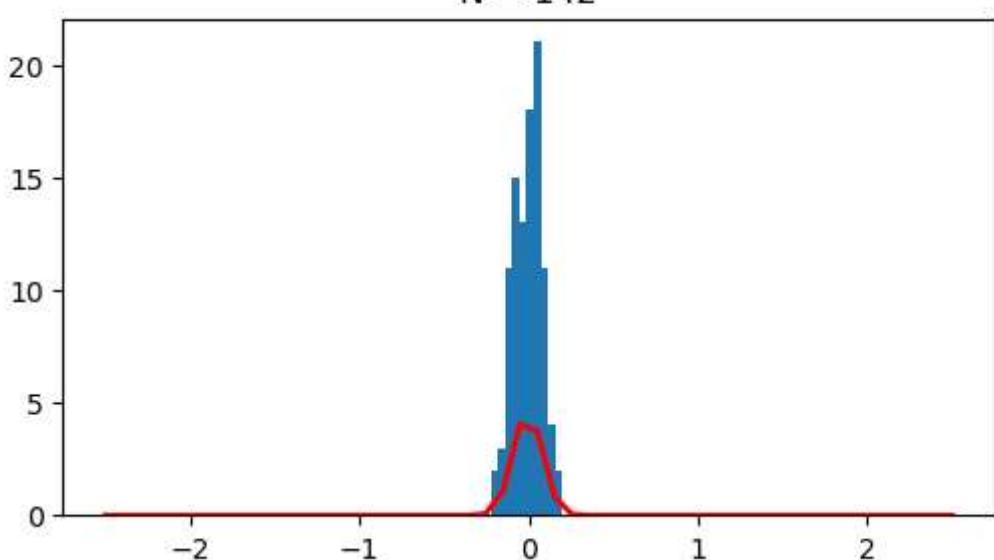


N = 142

Média = -0.005893936485176204

Variância = 0.007346635362573671

N = 142

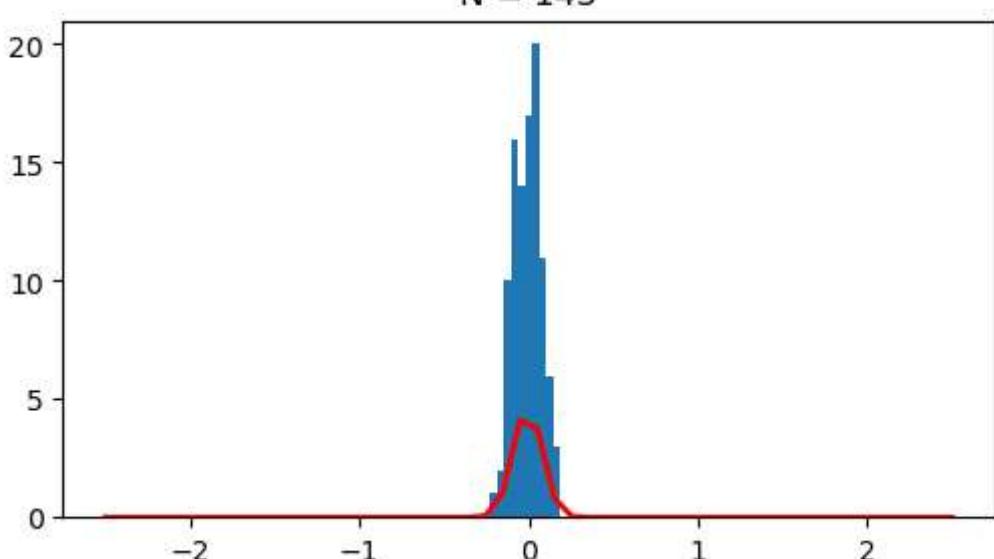


N = 143

Média = -0.006489796113016053

Variância = 0.007194044808281777

N = 143

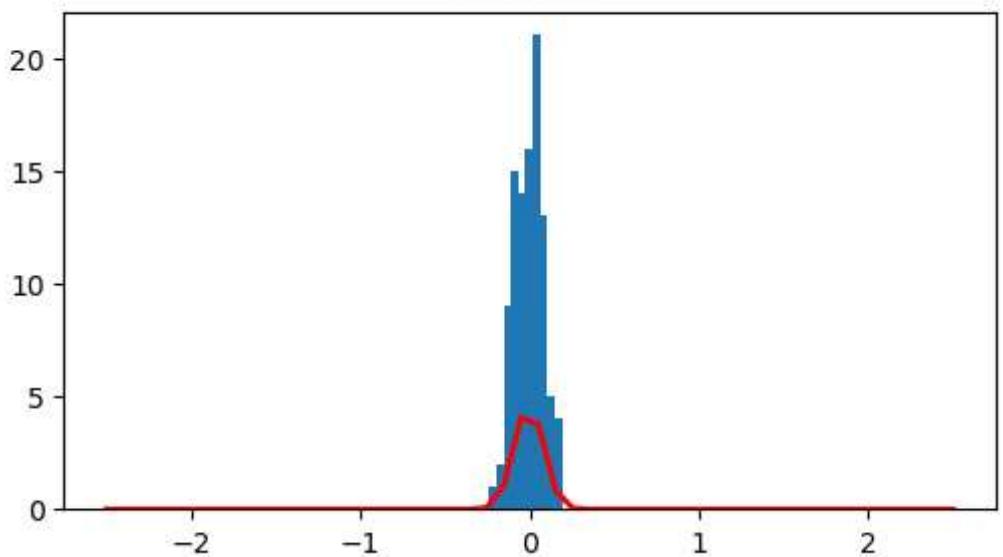


N = 144

Média = -0.005528824038075722

Variância = 0.007270399624458917

N = 144

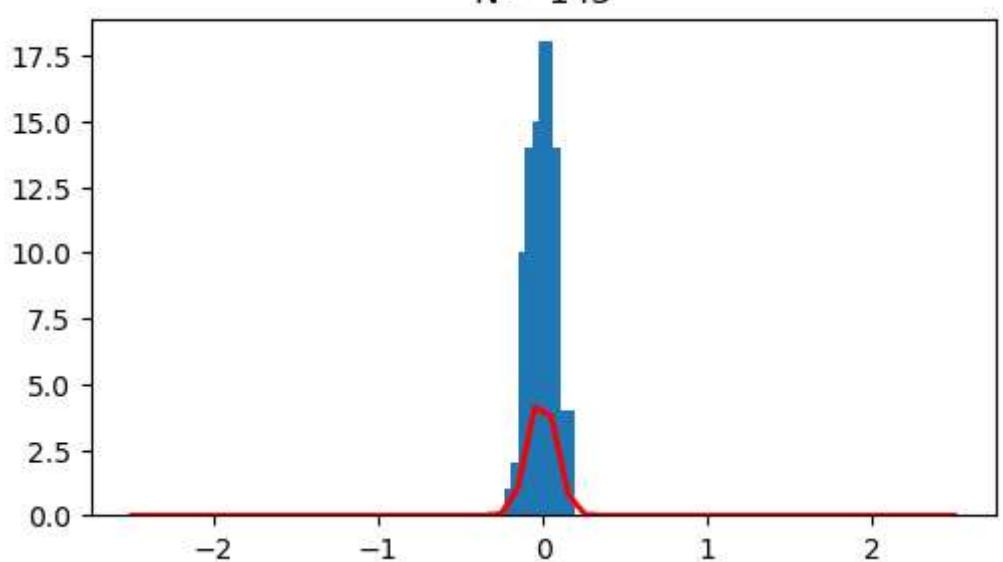


N = 145

Média = -0.006135072435521111

Variância = 0.007101995737613575

N = 145

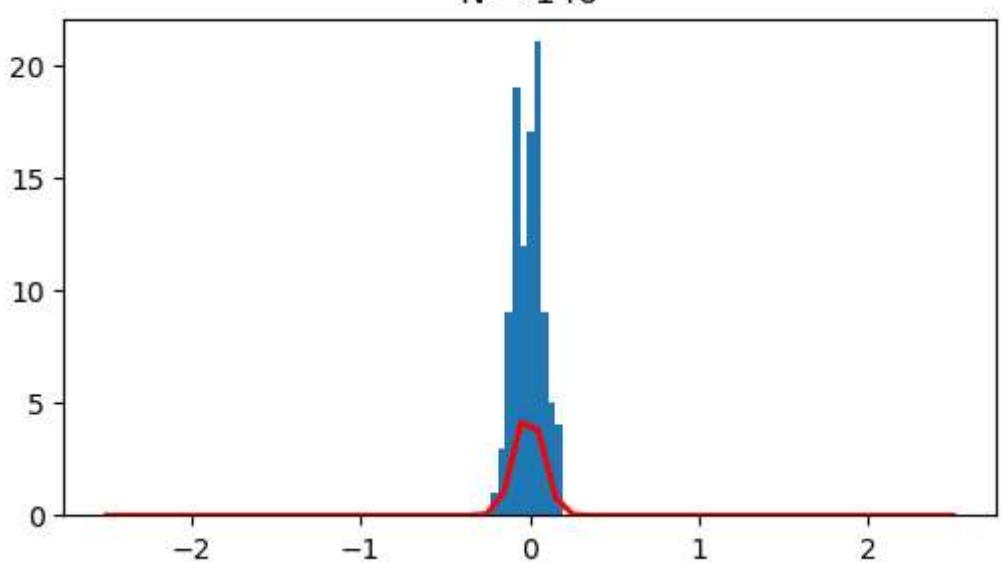


N = 146

Média = -0.006264460962983894

Variância = 0.0070405819616852165

N = 146

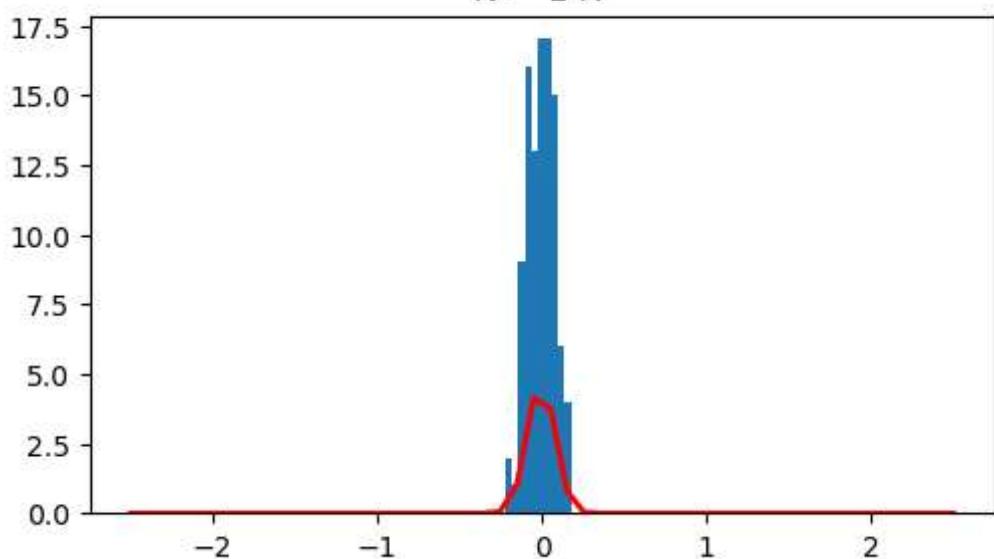


N = 147

Média = -0.006126707521546891

Variância = 0.0070338750876185446

N = 147

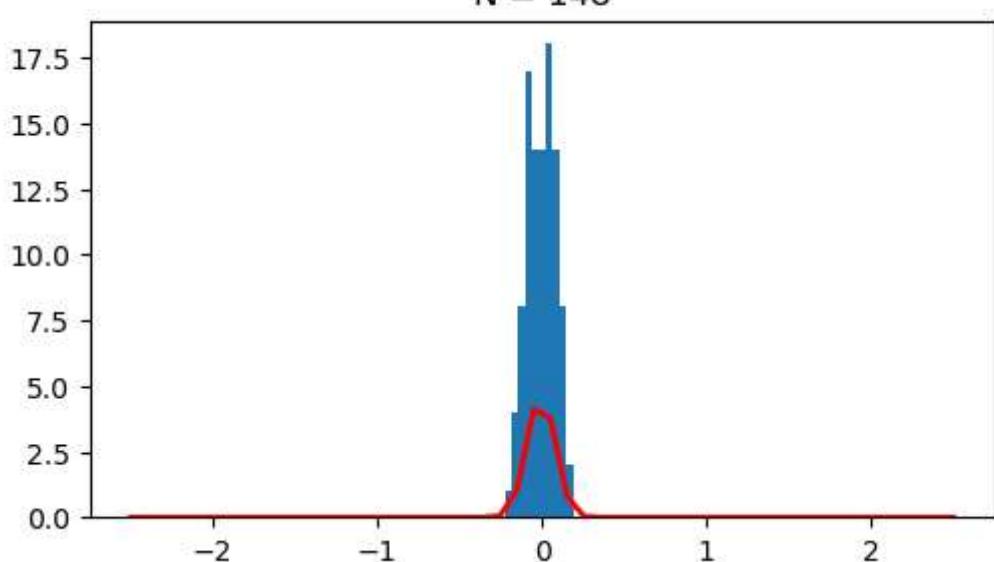


N = 148

Média = -0.005916951819021616

Variância = 0.0070801298749556

N = 148

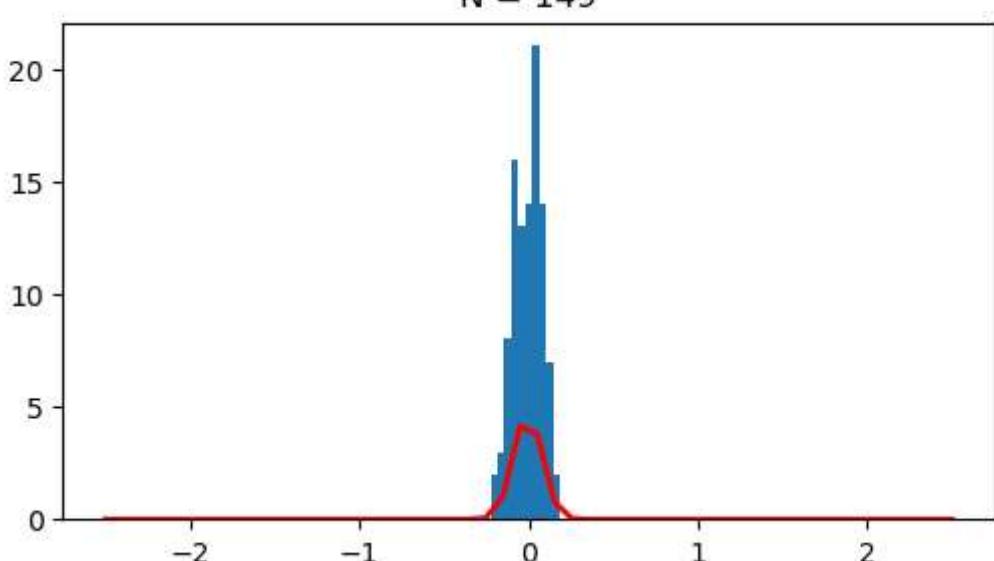


N = 149

Média = -0.0063963950788814405

Variância = 0.006947761356495939

N = 149

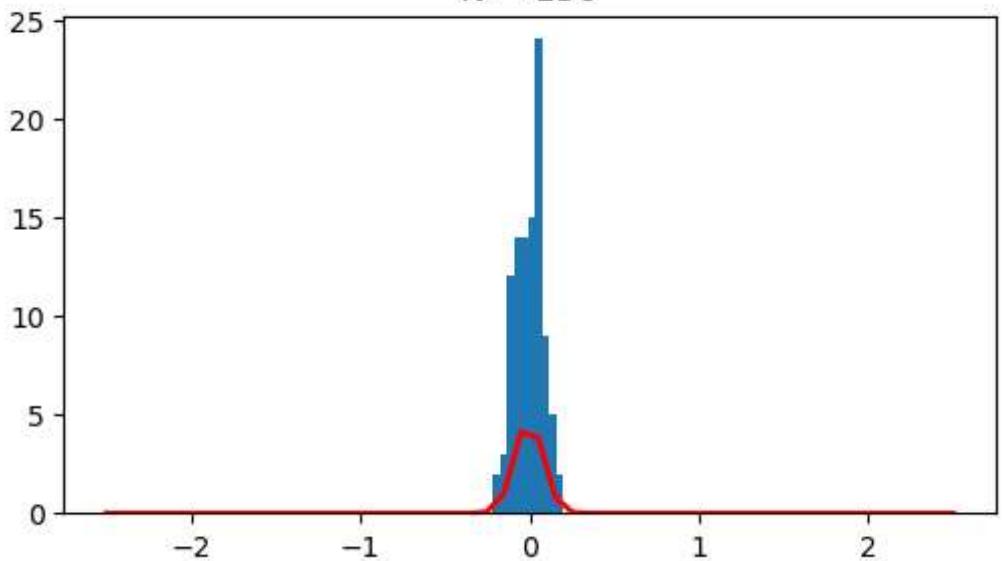


N = 150

Média = -0.005354749339738554

Variância = 0.006931873959531435

N = 150

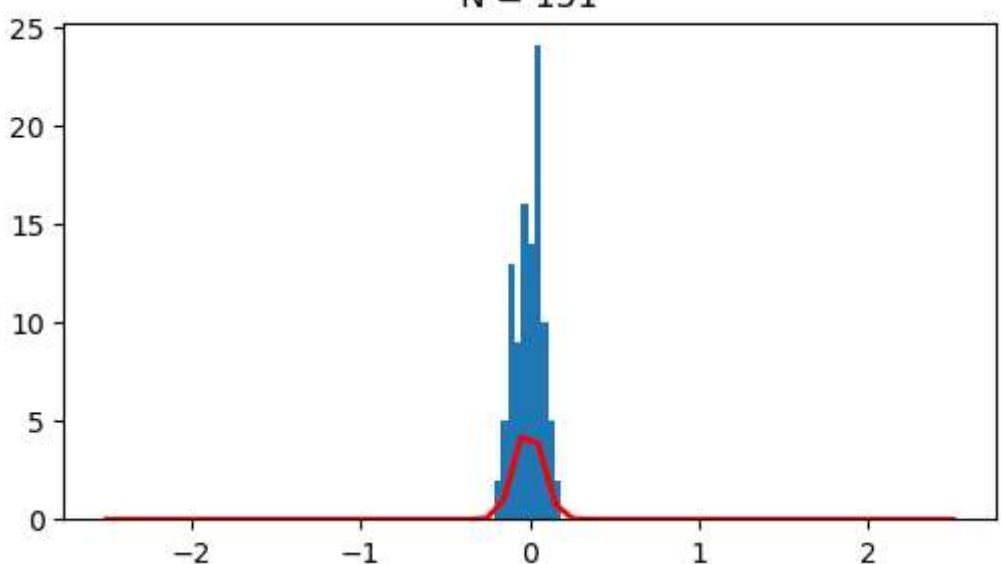


N = 151

Média = -0.005921034590174691

Variância = 0.006744538838078718

N = 151

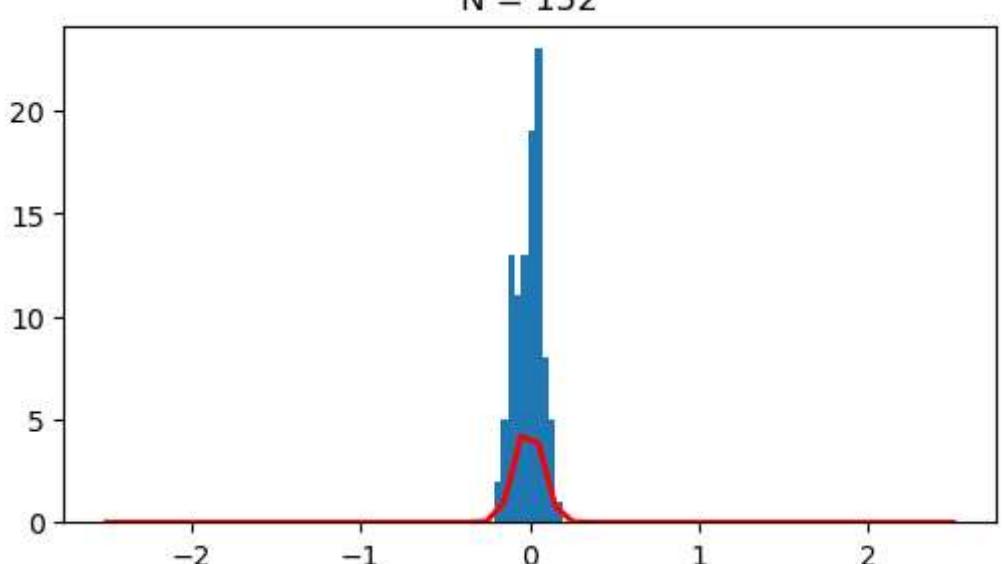


N = 152

Média = -0.005500147626663434

Variância = 0.006681821852524678

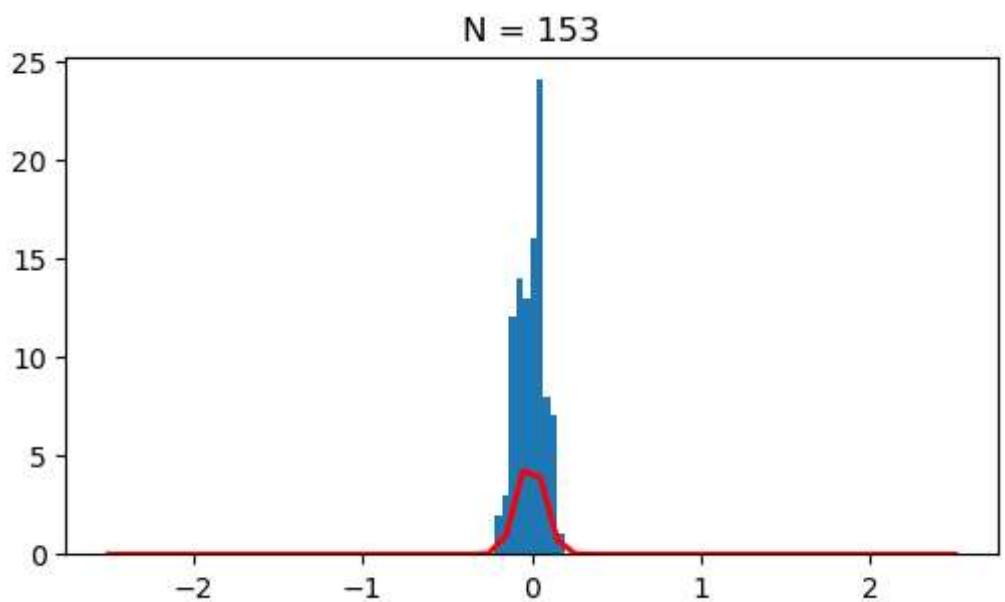
N = 152



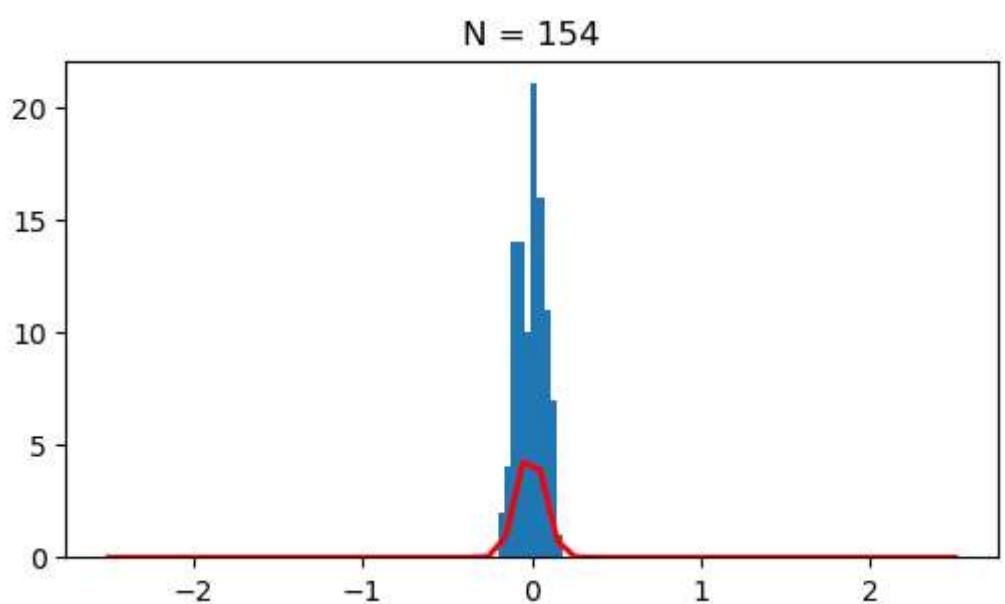
N = 153

Média = -0.0053842007025321345

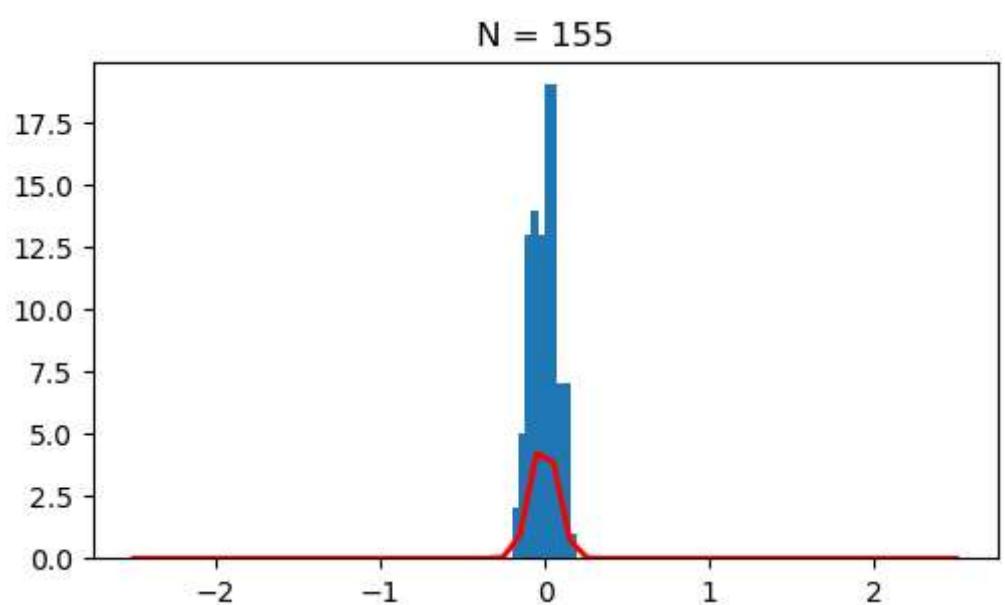
Variância = 0.006499142633760994



N = 154 Média = -0.005520259696111612 Variância = 0.006515344990890247

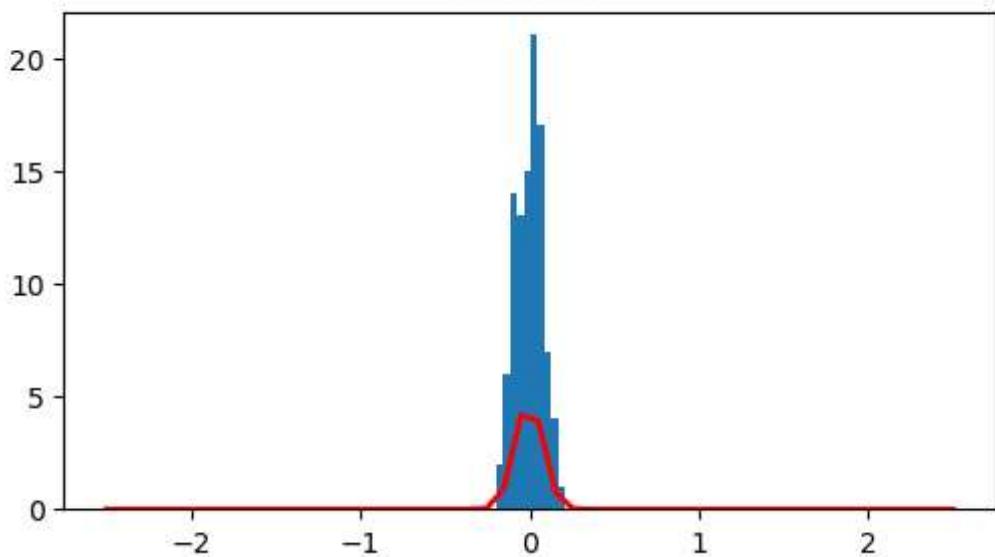


N = 155 Média = -0.005667362139143511 Variância = 0.0064932793414465345



N = 156 Média = -0.004150735256580017 Variância = 0.006517185603832419

N = 156

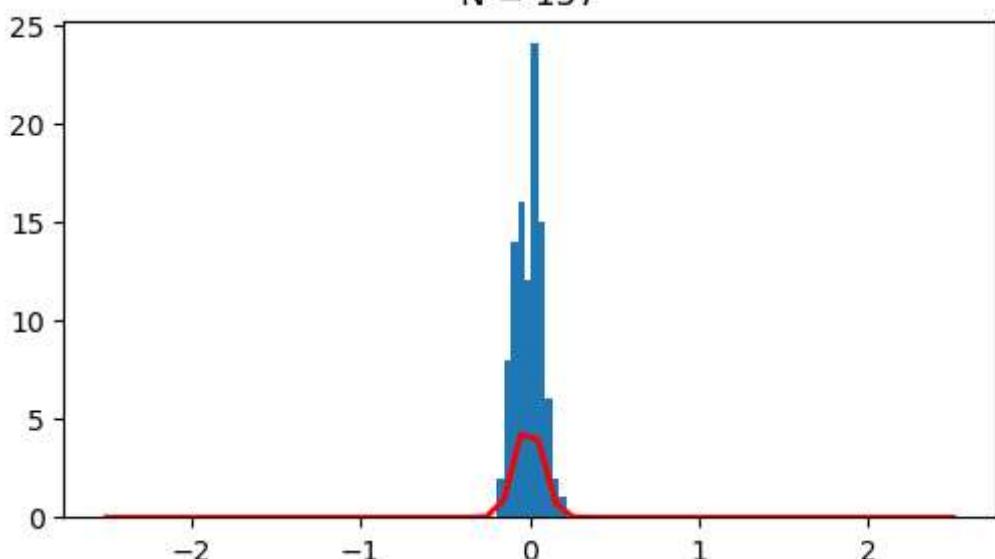


N = 157

Média = -0.0045732475305432715

Variância = 0.006395923718676338

N = 157

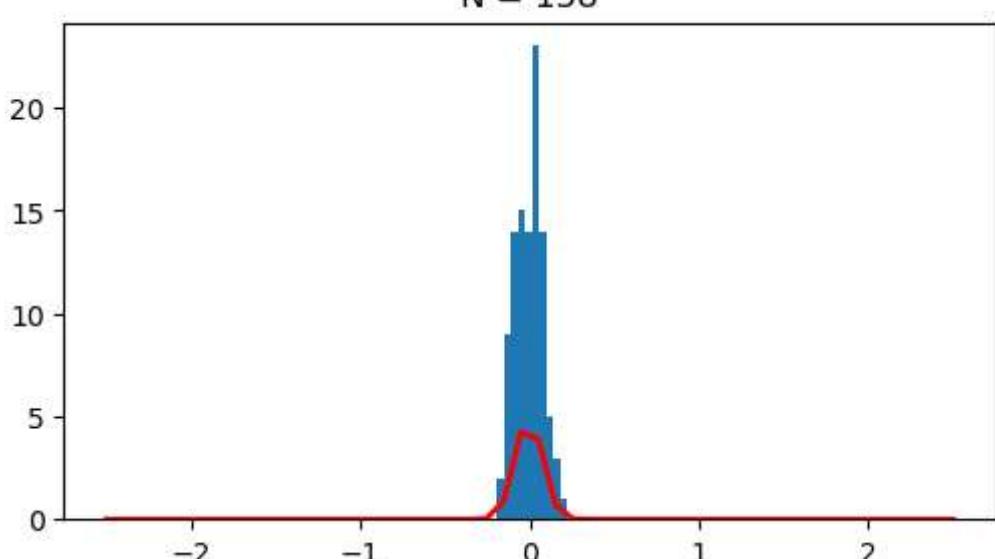


N = 158

Média = -0.005209990833463661

Variância = 0.006364110729286583

N = 158

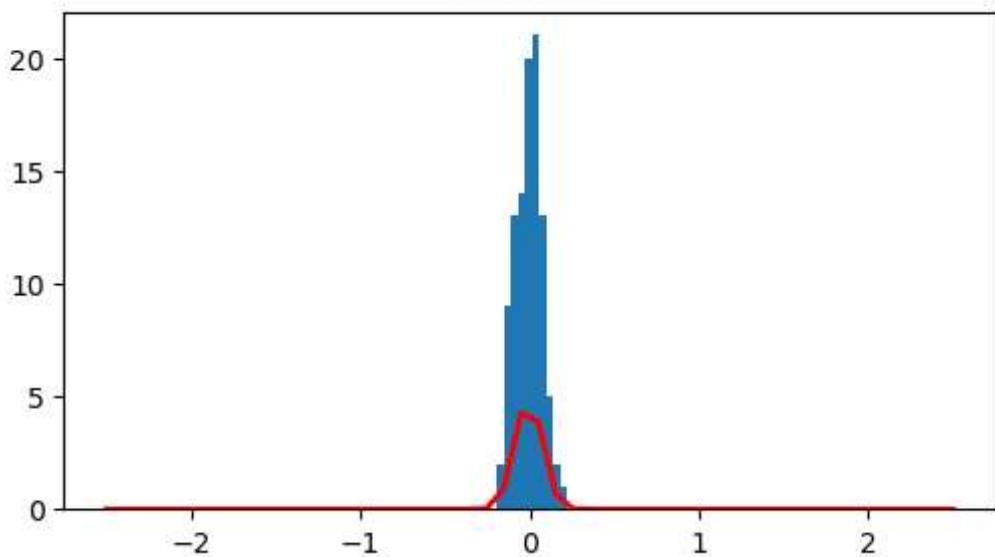


N = 159

Média = -0.005785803575602607

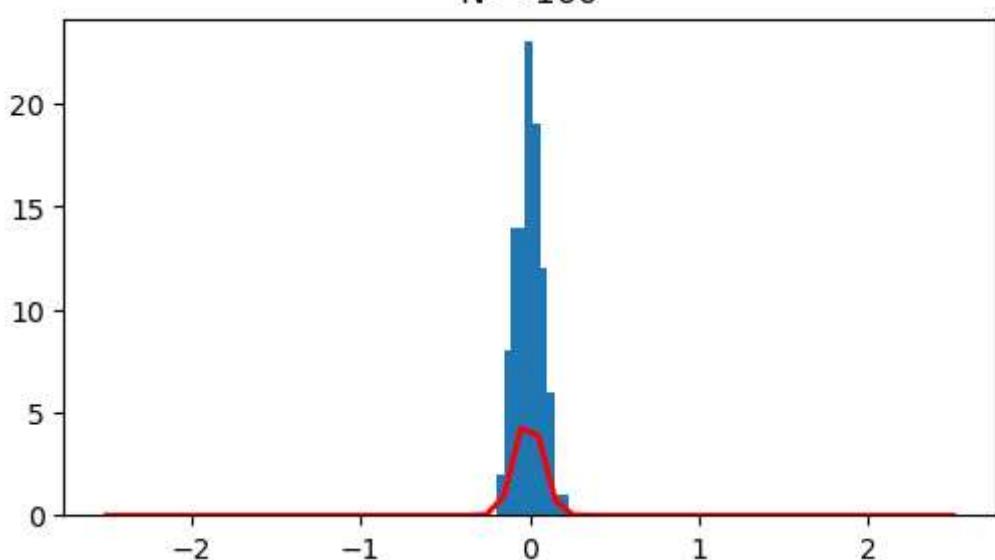
Variância = 0.006333814148641499

N = 159



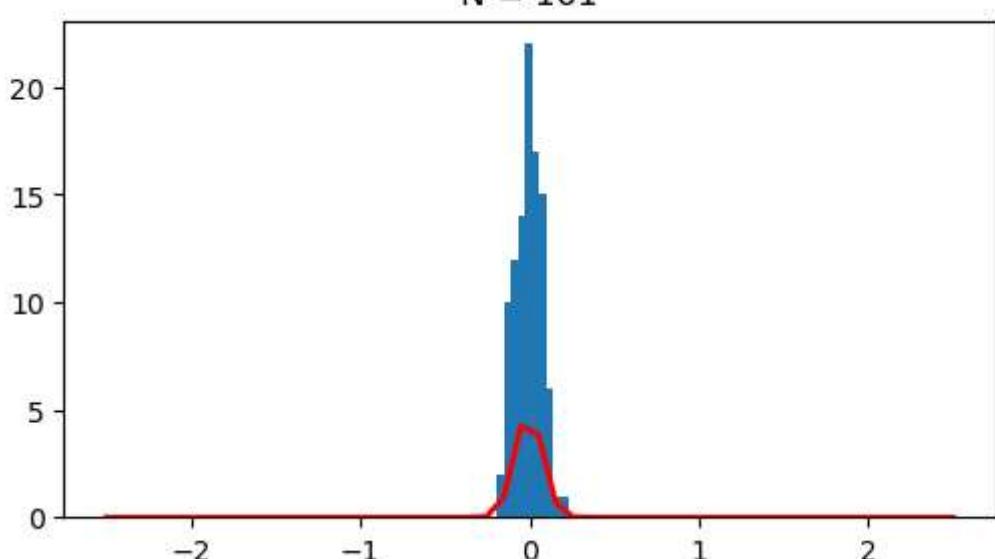
N = 160 Média = -0.005714387391324165 Variância = 0.0064654854620770745

N = 160



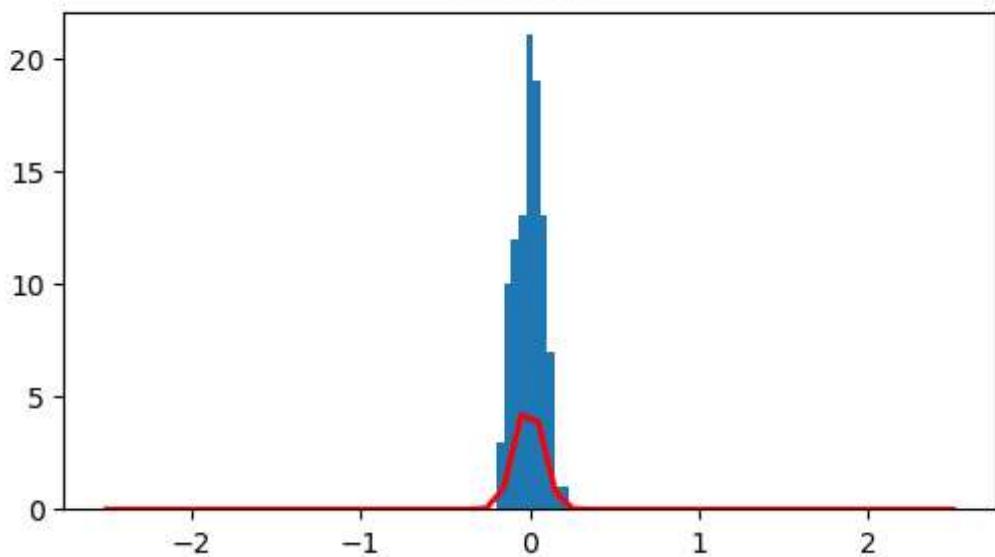
N = 161 Média = -0.006063013511558476 Variância = 0.006450238579226944

N = 161



N = 162 Média = -0.005440815858477454 Variância = 0.006660518642522411

N = 162

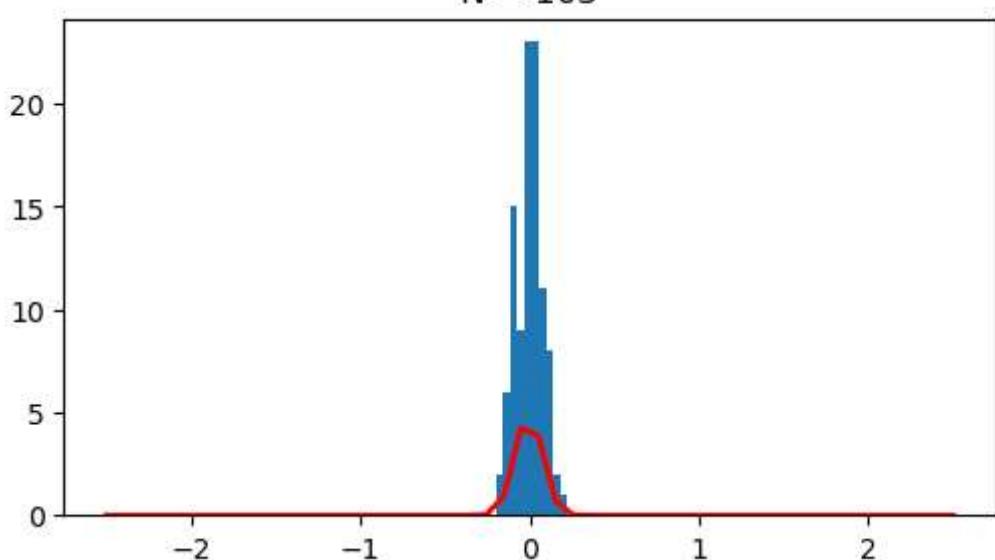


N = 163

Média = -0.006040706188629263

Variância = 0.006445621950327657

N = 163

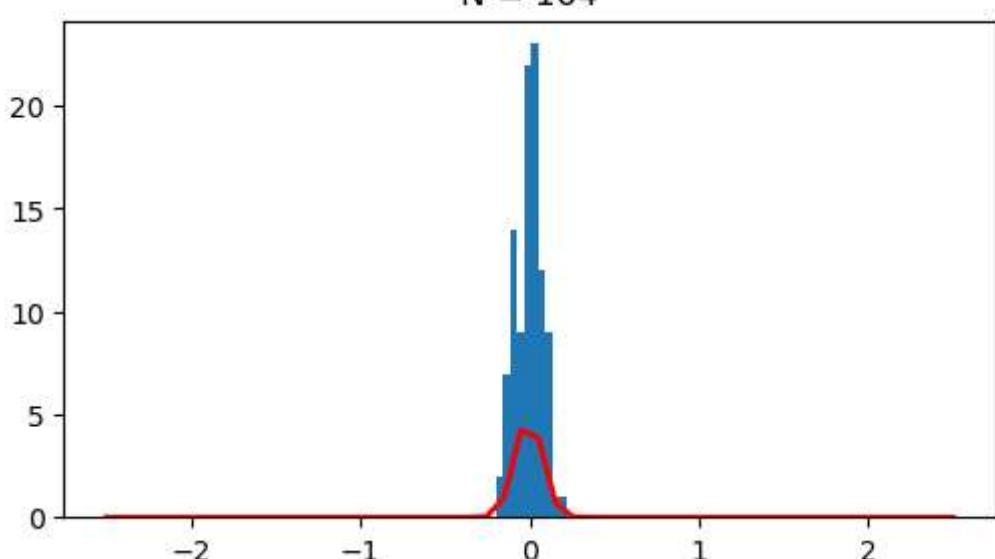


N = 164

Média = -0.00598002216943368

Variância = 0.006458208737904799

N = 164

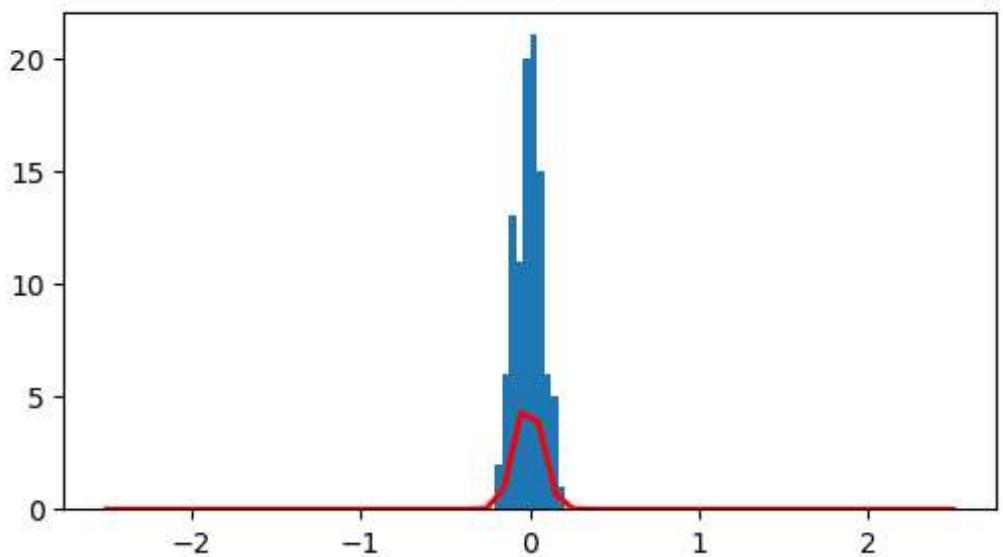


N = 165

Média = -0.005963154651911982

Variância = 0.006356219345694712

N = 165

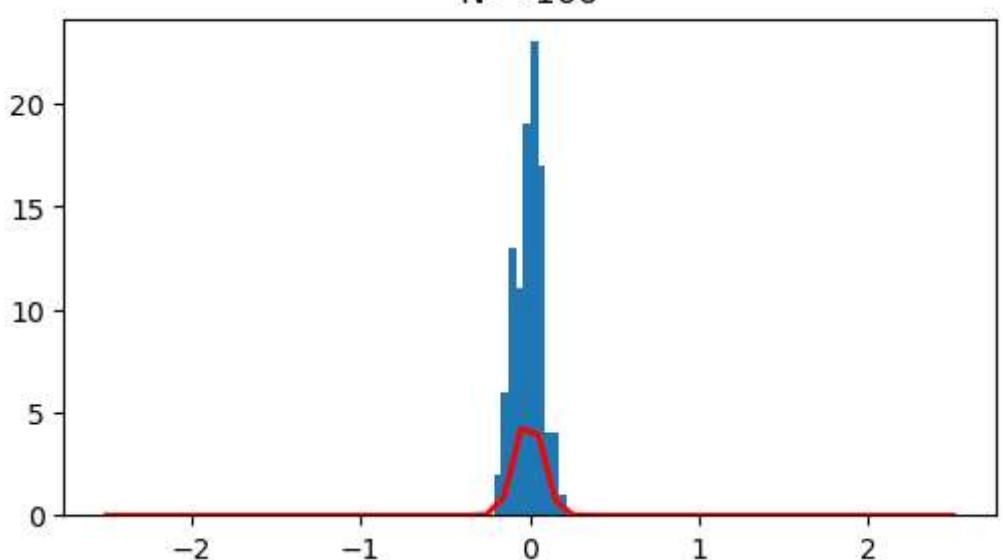


N = 166

Média = -0.0048235199861425436

Variância = 0.00636978042782533

N = 166

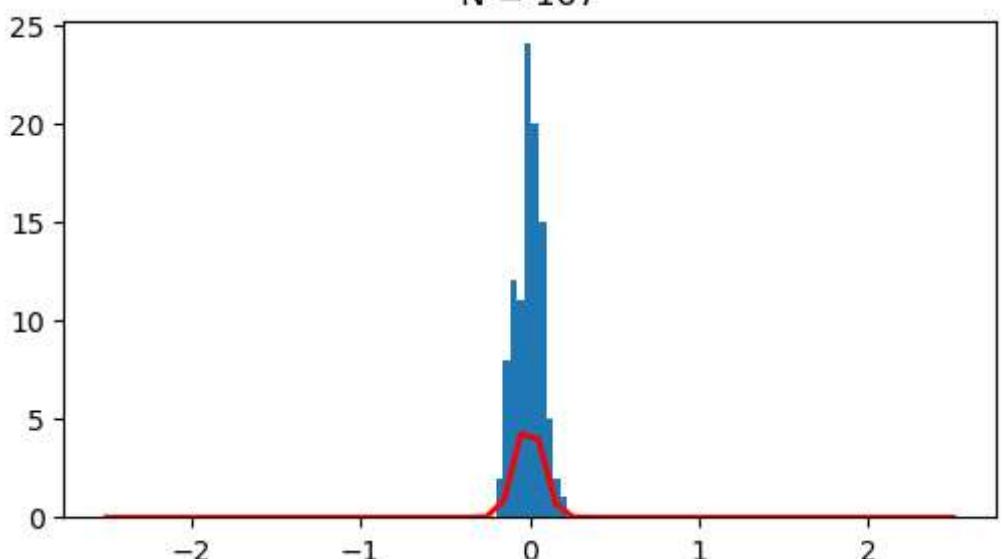


N = 167

Média = -0.0039831825685300555

Variância = 0.006243773723189671

N = 167

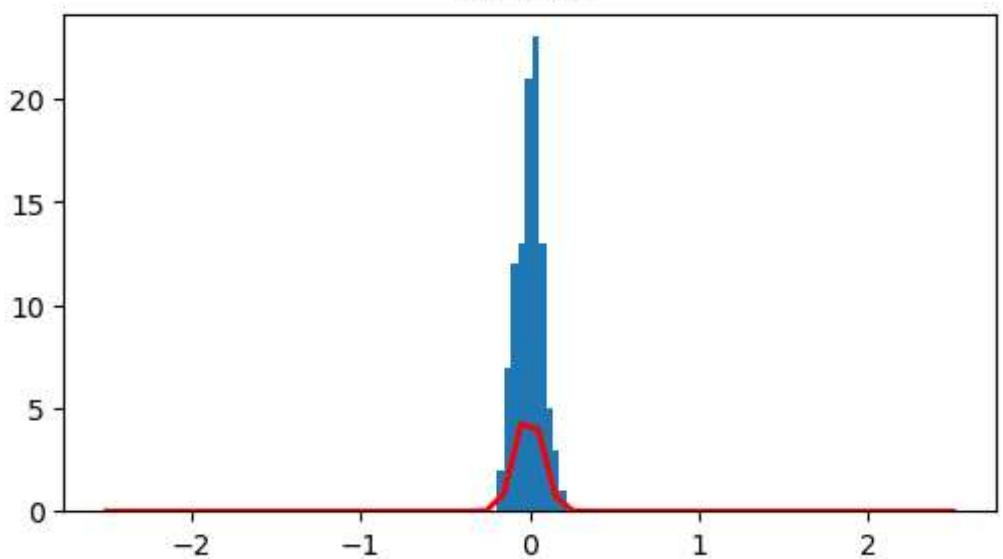


N = 168

Média = -0.004040161852161039

Variância = 0.006220130173857072

N = 168

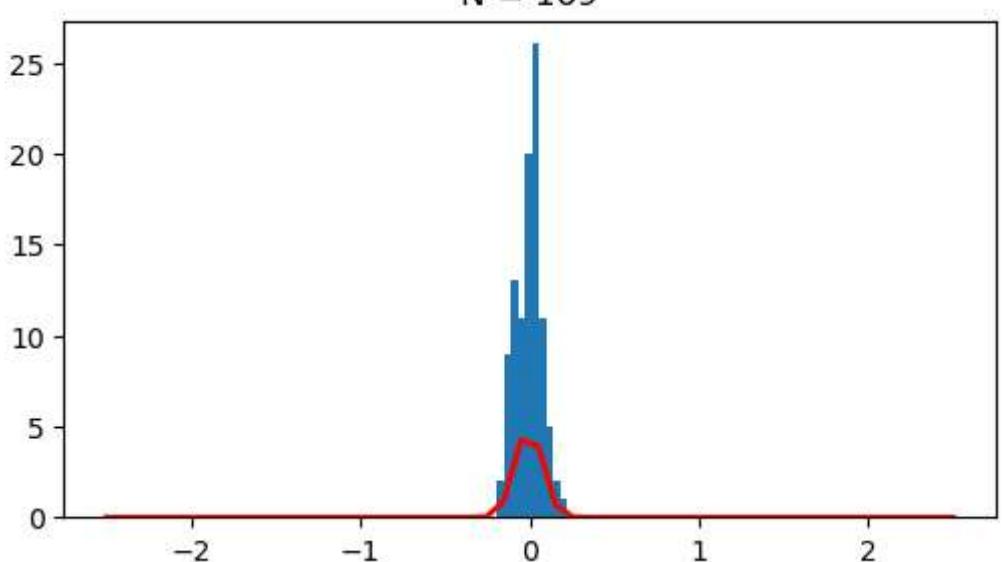


N = 169

Média = -0.005335080545648677

Variância = 0.006319197033808868

N = 169

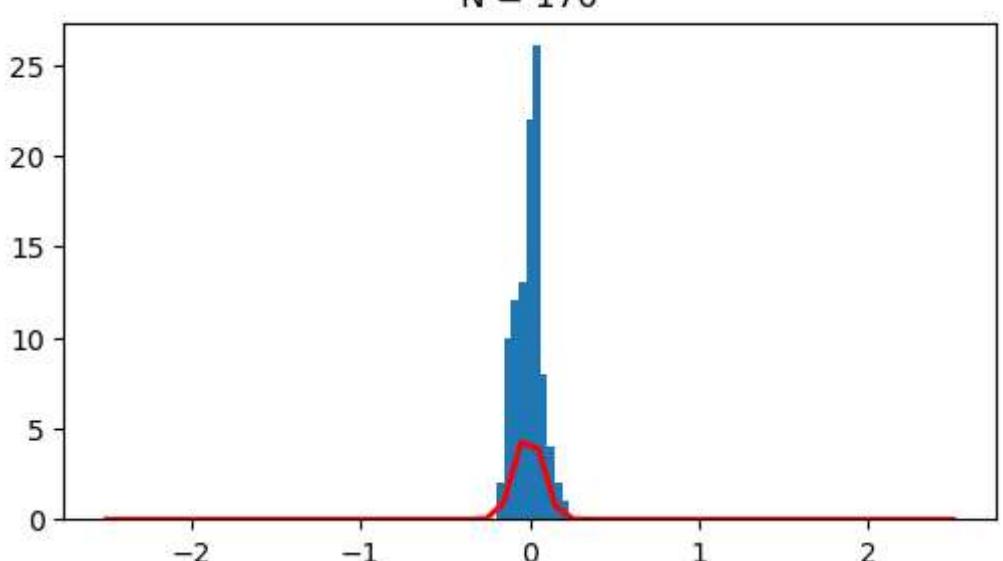


N = 170

Média = -0.005468740111270177

Variância = 0.006461246593032634

N = 170

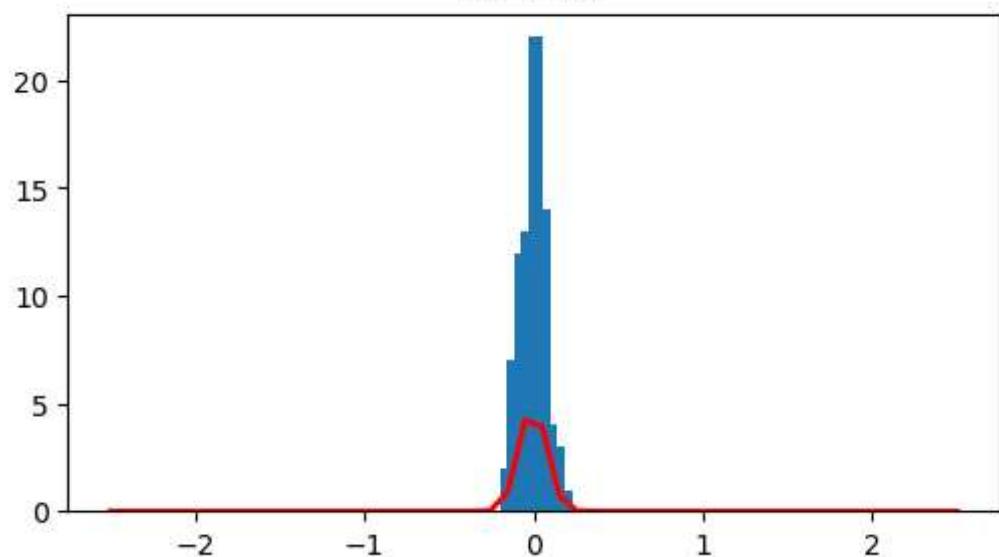


N = 171

Média = -0.004838663198774334

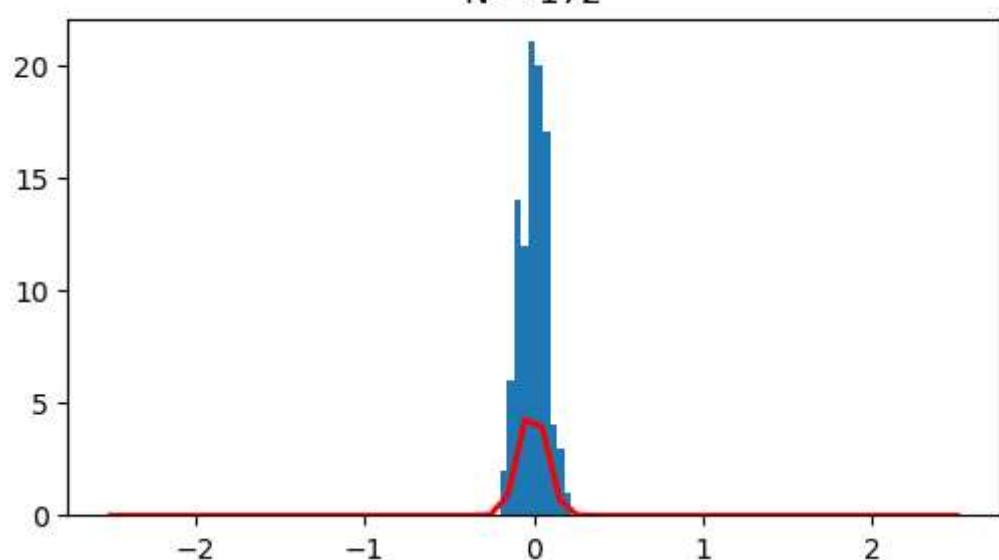
Variância = 0.006381088655359644

N = 171



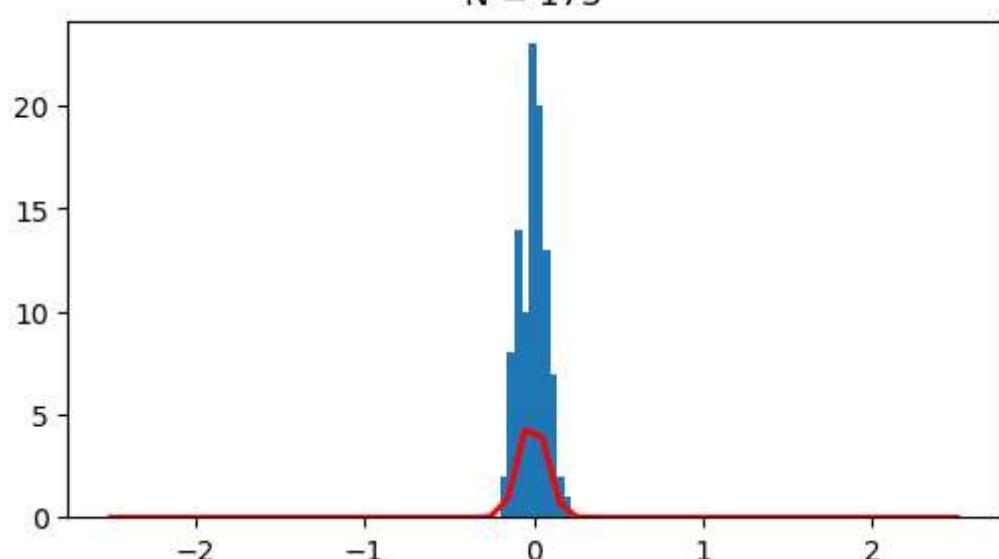
N = 172 Média = -0.005100623750912482 Variância = 0.006342007709024849

N = 172



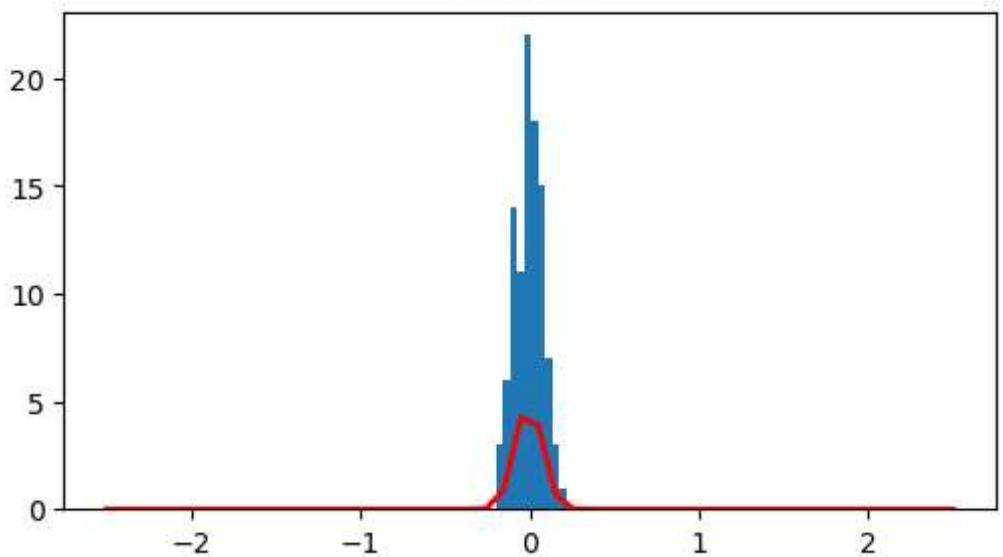
N = 173 Média = -0.005296709450743803 Variância = 0.006408322908414798

N = 173



N = 174 Média = -0.005685403236112965 Variância = 0.006321210857665485

N = 174

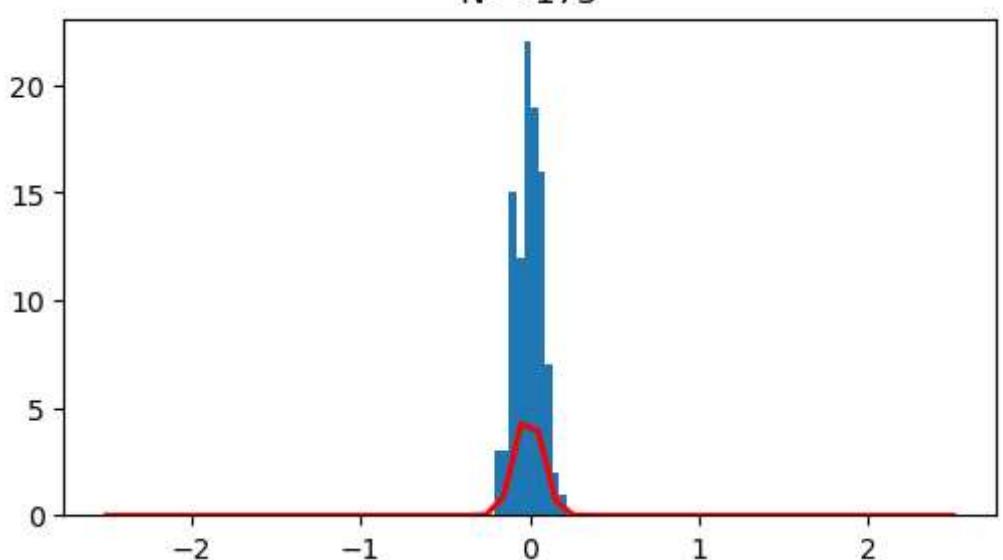


N = 175

Média = -0.005219148130767567

Variância = 0.006296688749579776

N = 175

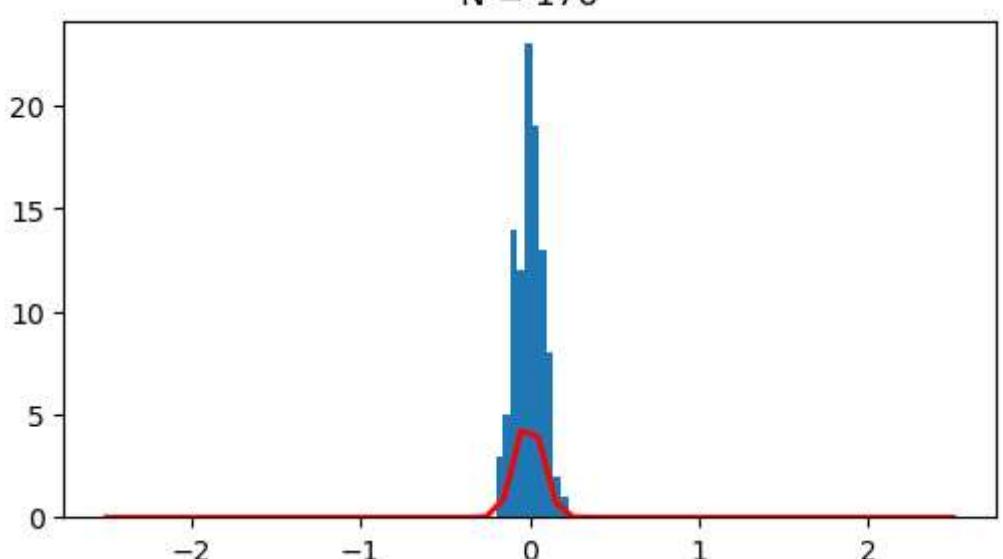


N = 176

Média = -0.004721934290668572

Variância = 0.006441732294608534

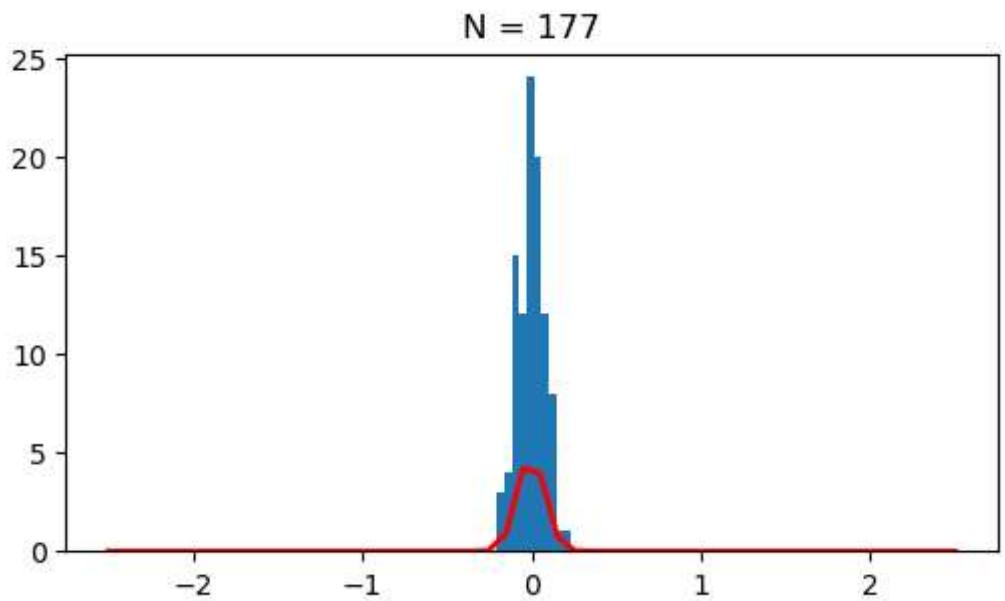
N = 176



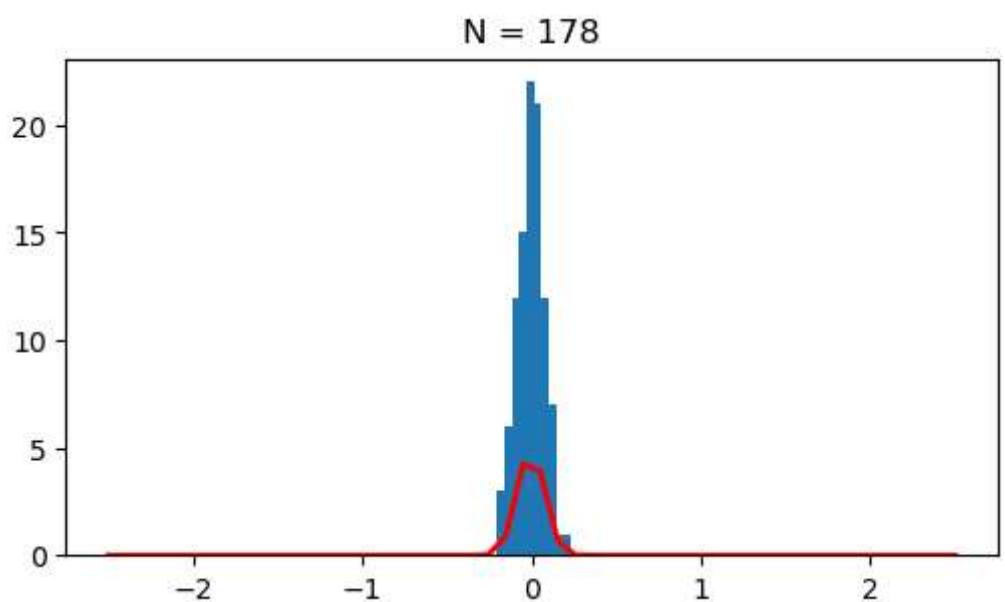
N = 177

Média = -0.004496482473233865

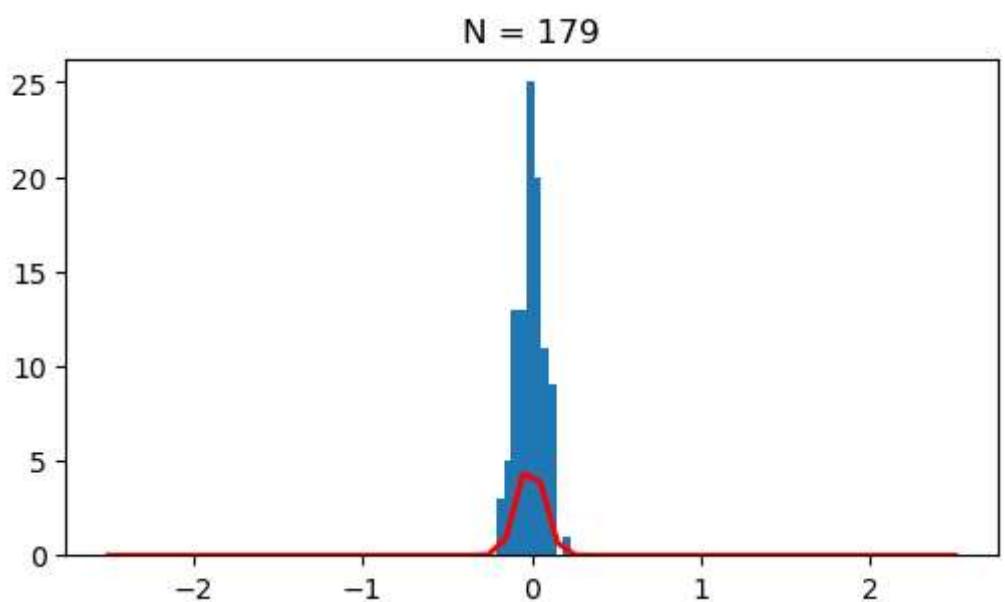
Variância = 0.006413705371112345



N = 178 Média = -0.005175312566180249 Variância = 0.006314773063843084

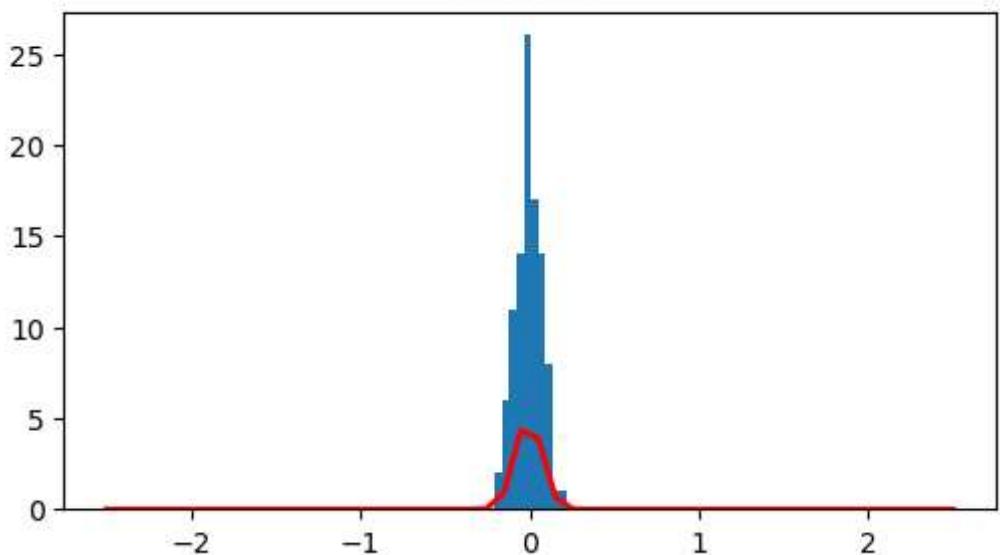


N = 179 Média = -0.006360291778301161 Variância = 0.0062350016577096615



N = 180 Média = -0.006673820050649937 Variância = 0.006157781262047308

N = 180

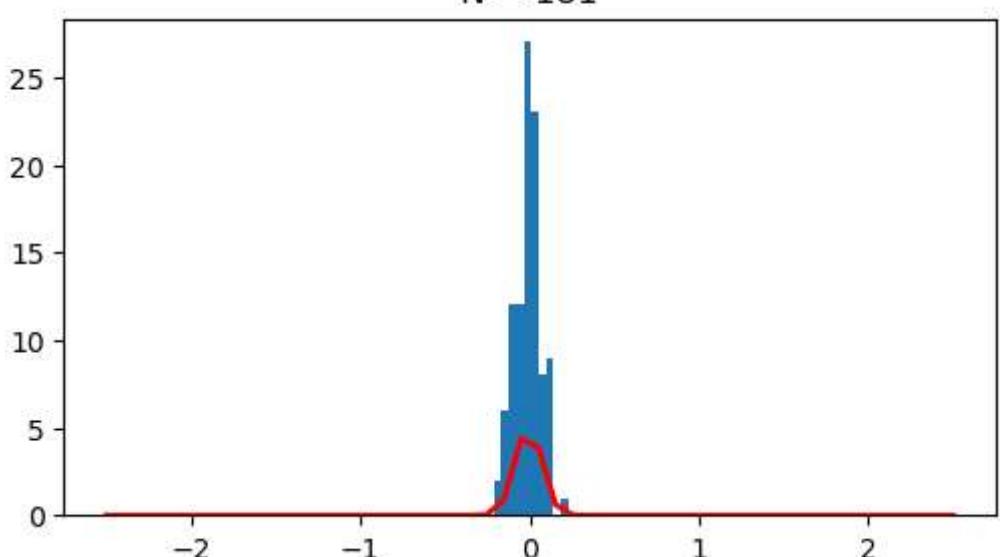


N = 181

Média = -0.007045717505621458

Variância = 0.006035688895925545

N = 181

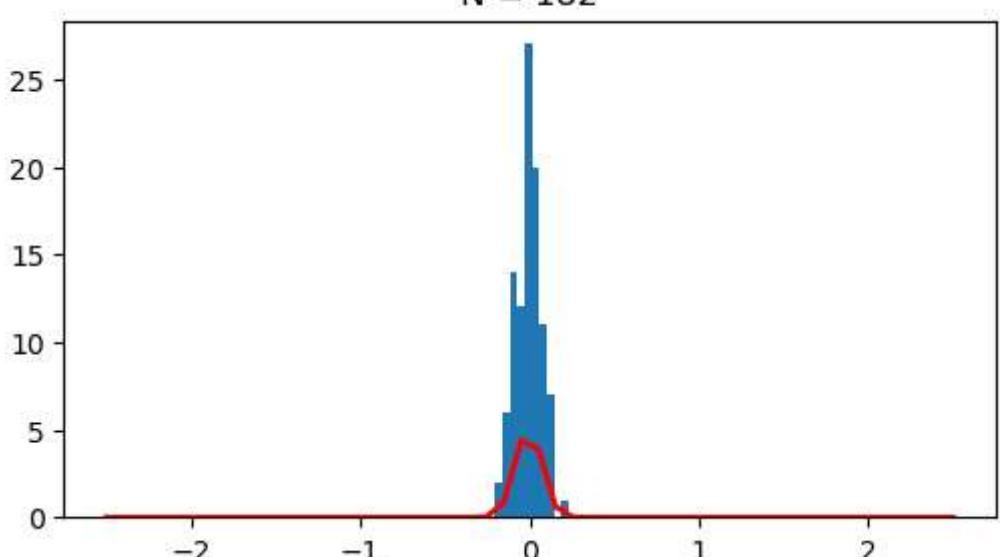


N = 182

Média = -0.006654364343131563

Variância = 0.0059547213410863515

N = 182

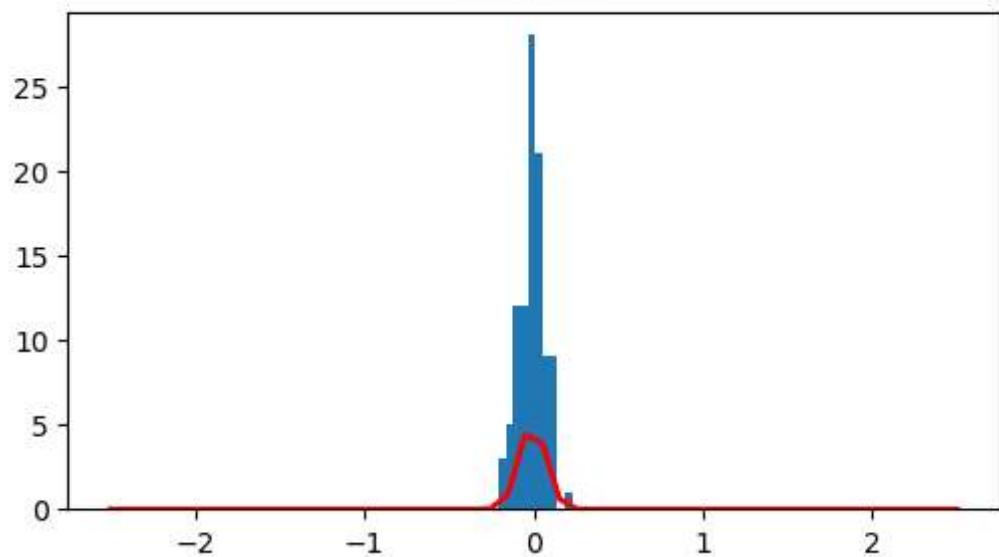


N = 183

Média = -0.006953121266803463

Variância = 0.005918060349167747

N = 183

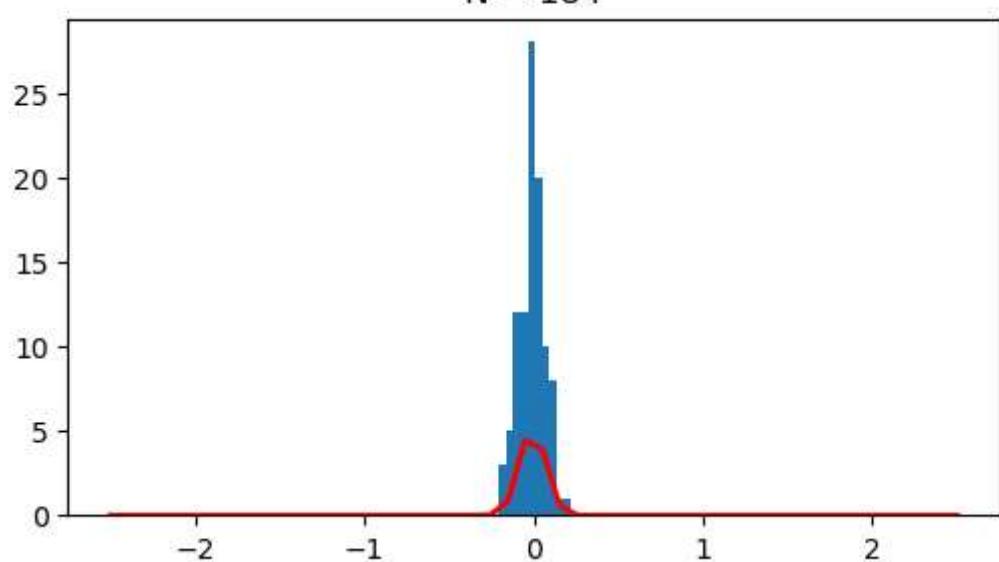


N = 184

Média = -0.007025476749245632

Variância = 0.005841433129584578

N = 184

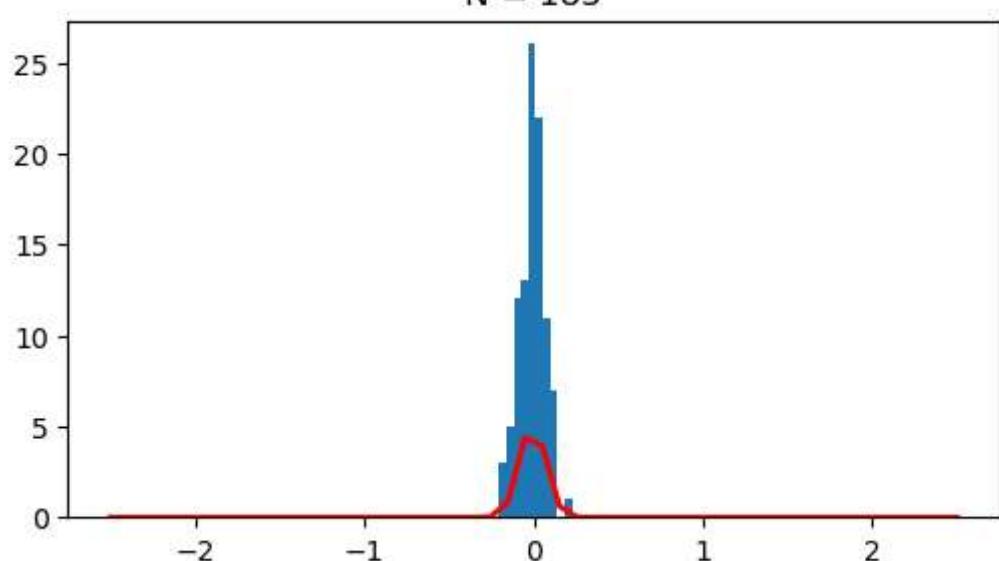


N = 185

Média = -0.006267805617438073

Variância = 0.005912324701901758

N = 185

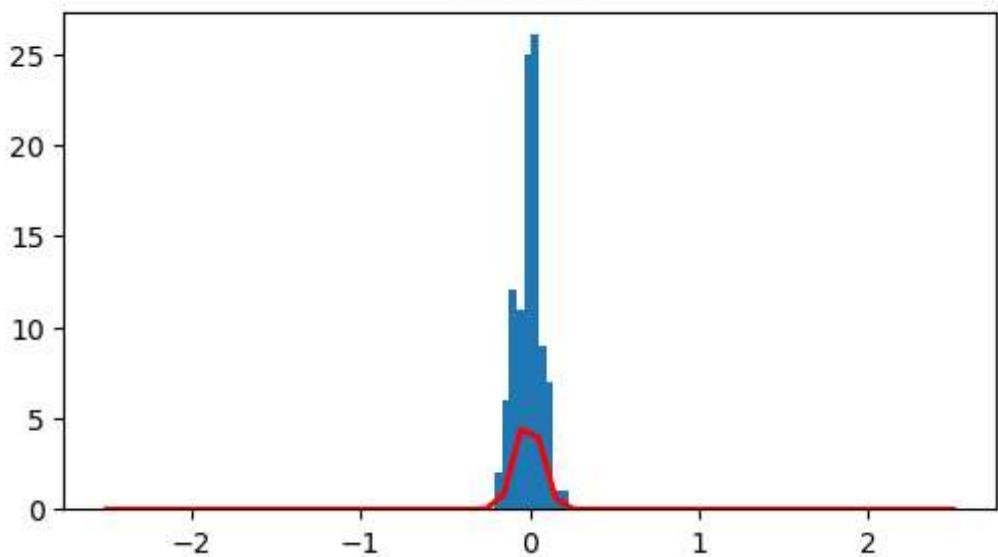


N = 186

Média = -0.005943311960578913

Variância = 0.005886930699868856

N = 186

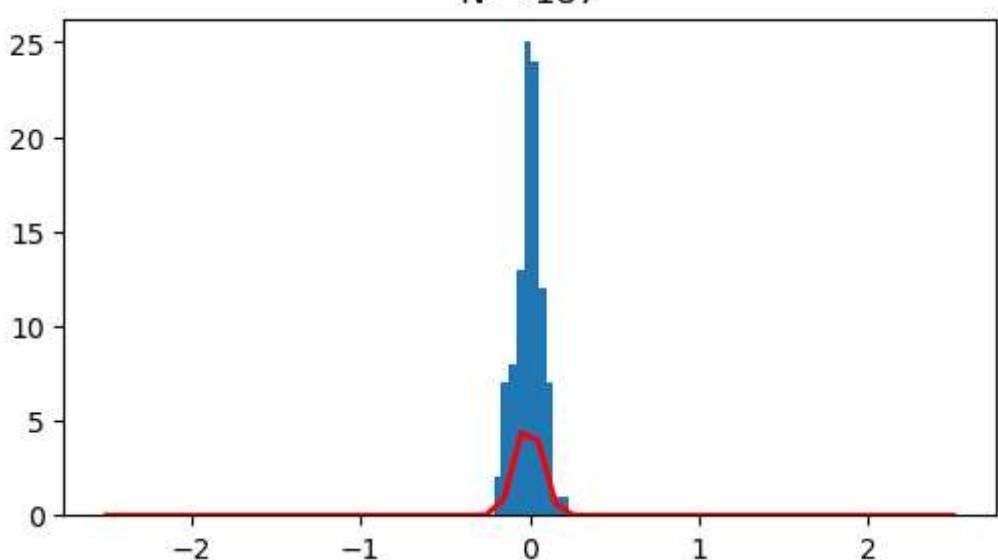


N = 187

Média = -0.005884151570325514

Variância = 0.0059962211587103135

N = 187

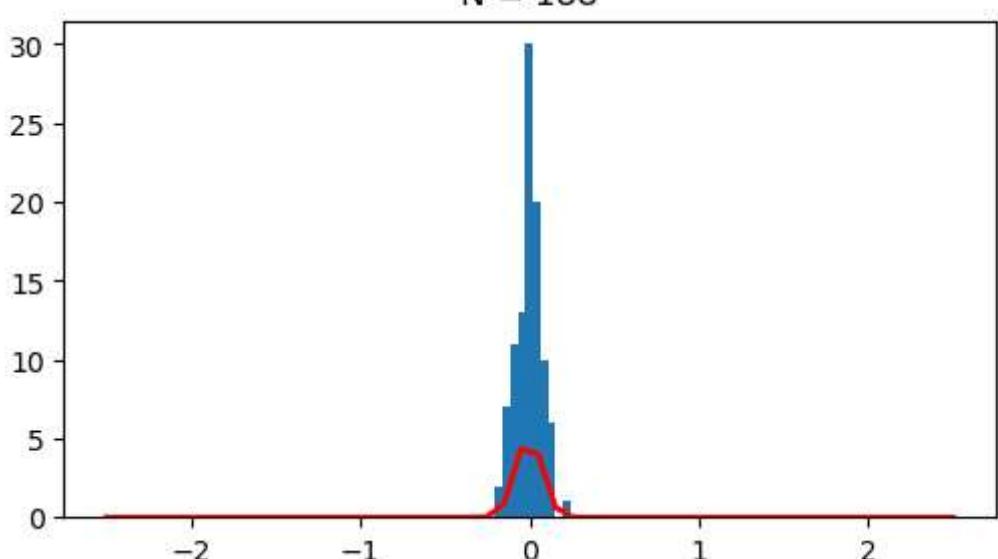


N = 188

Média = -0.005368729955042092

Variância = 0.005899103810488398

N = 188

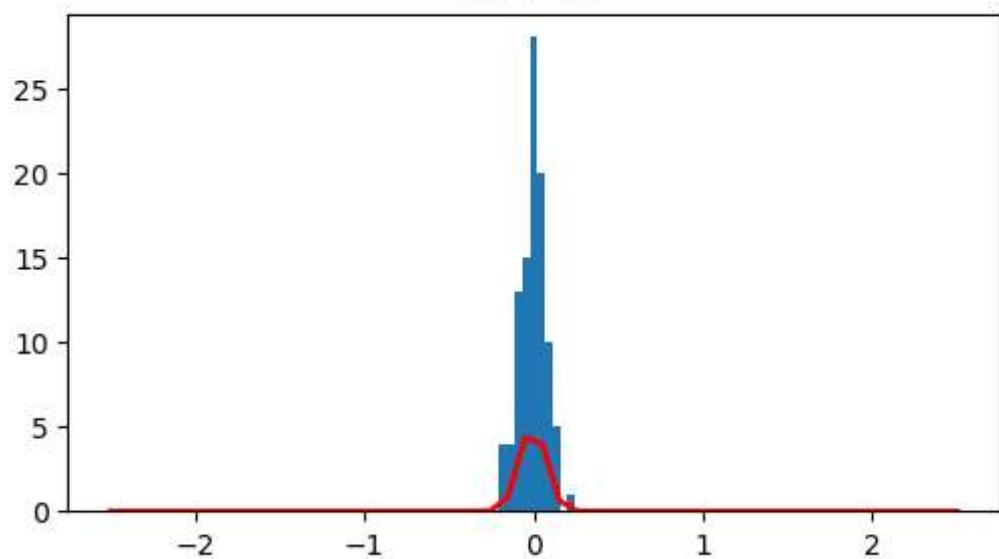


N = 189

Média = -0.005720827251481775

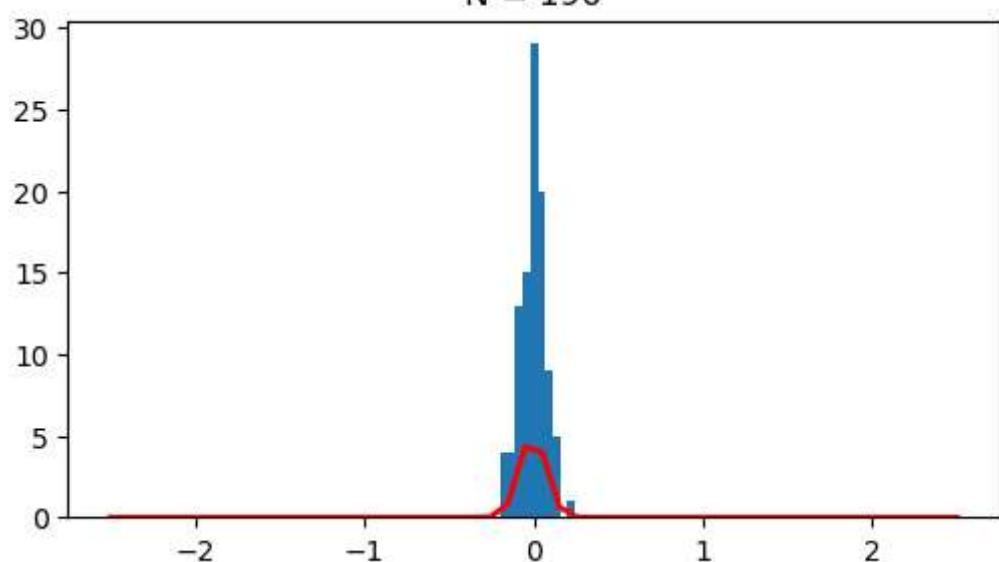
Variância = 0.005889056641009916

N = 189



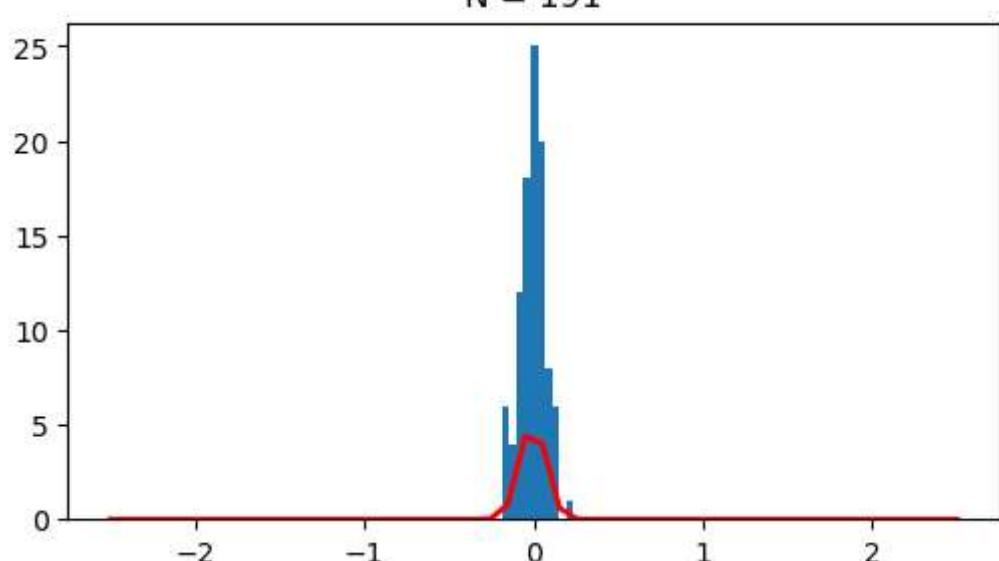
N = 190 Média = -0.005178141348266991 Variância = 0.005906370757050438

N = 190



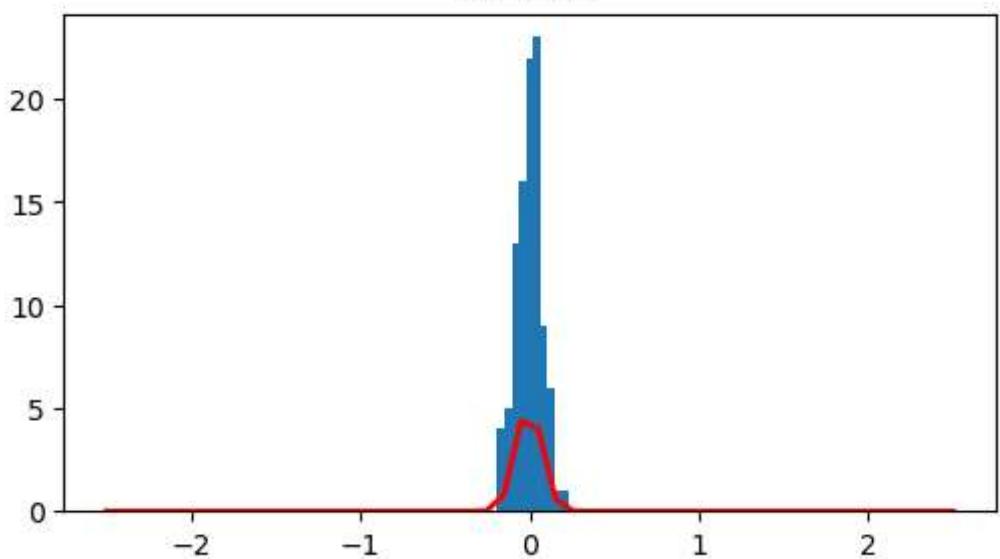
N = 191 Média = -0.005408443217162788 Variância = 0.005762970851480869

N = 191



N = 192 Média = -0.005053305991507936 Variância = 0.005777429199840652

N = 192

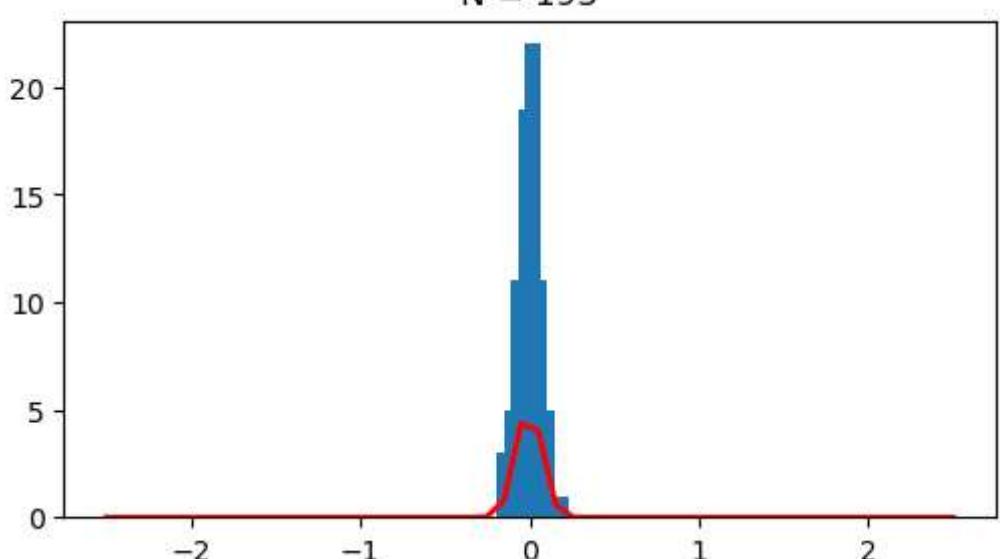


N = 193

Média = -0.004642685660459362

Variância = 0.005744429986158861

N = 193

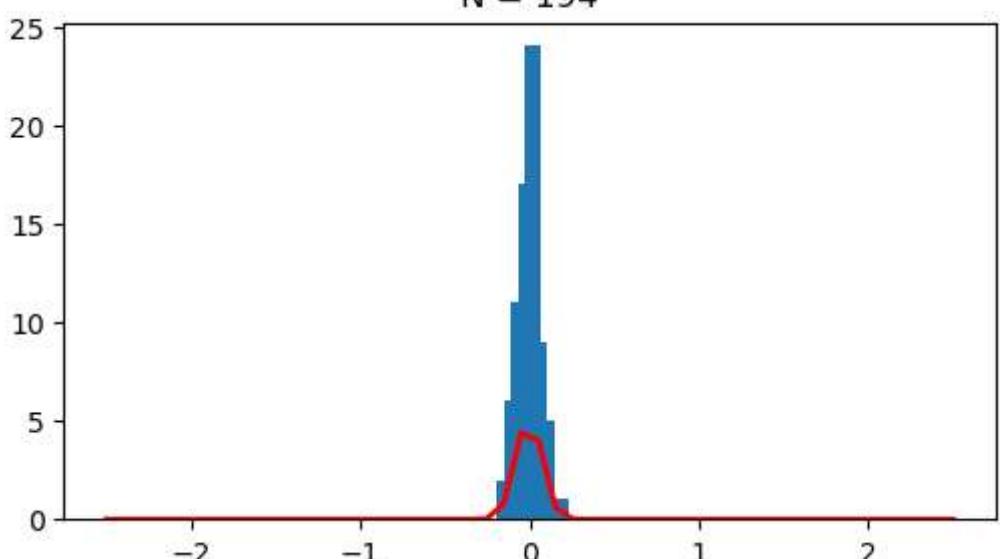


N = 194

Média = -0.005082925323909567

Variância = 0.00578555196439627

N = 194

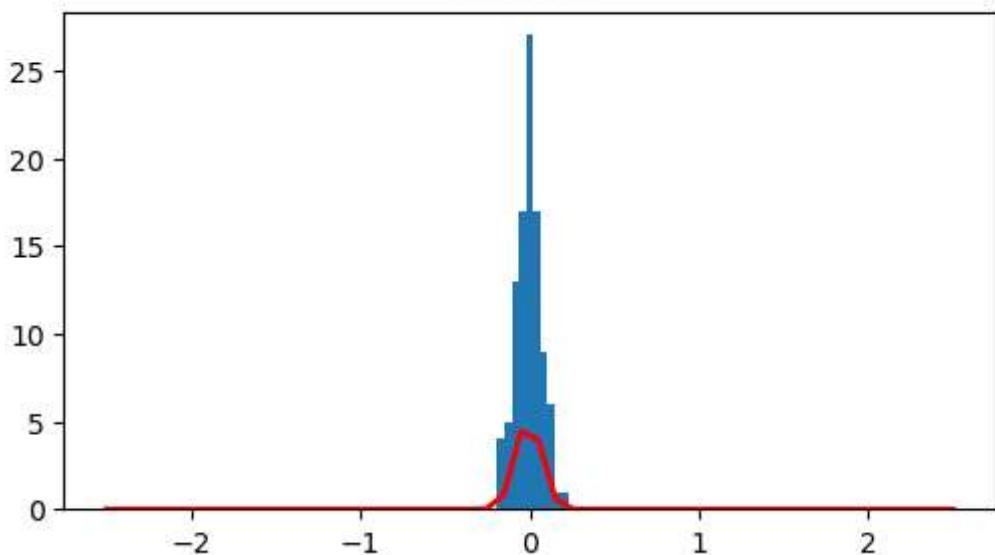


N = 195

Média = -0.006538254798284928

Variância = 0.005756023457530212

N = 195

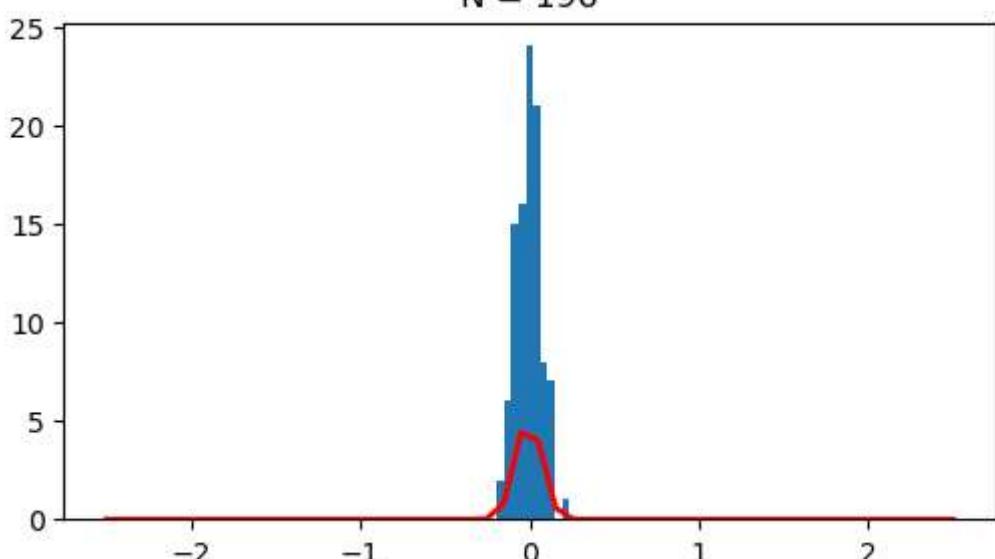


N = 196

Média = -0.006050004345887102

Variância = 0.005749940018754709

N = 196

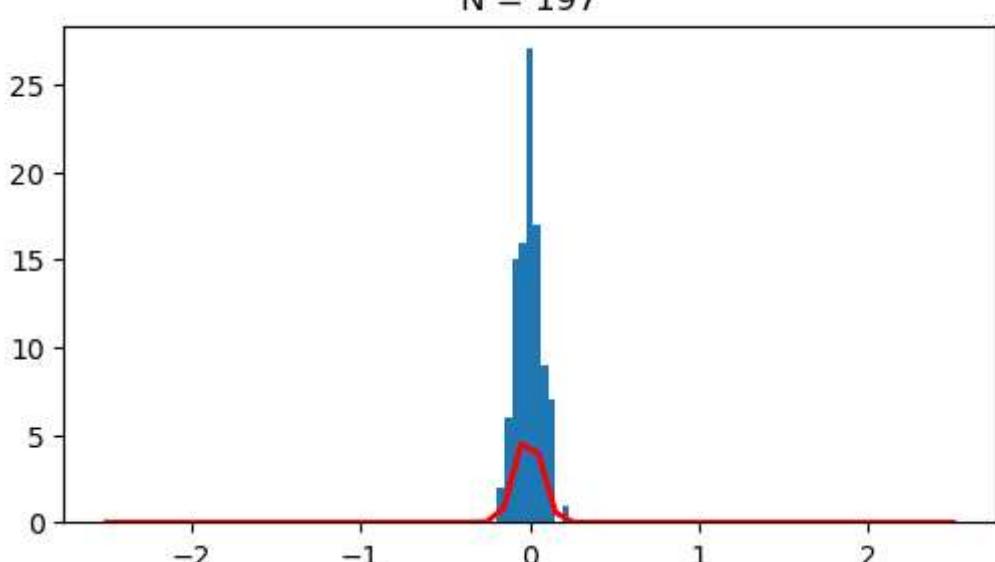


N = 197

Média = -0.0070609849415079065

Variância = 0.005667871545421828

N = 197

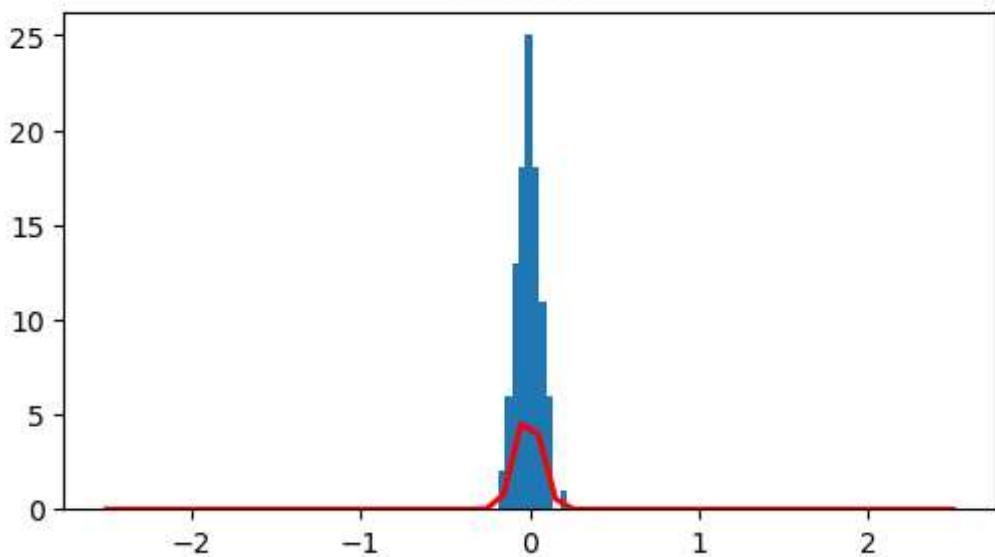


N = 198

Média = -0.007089101573760324

Variância = 0.005576059168500681

N = 198

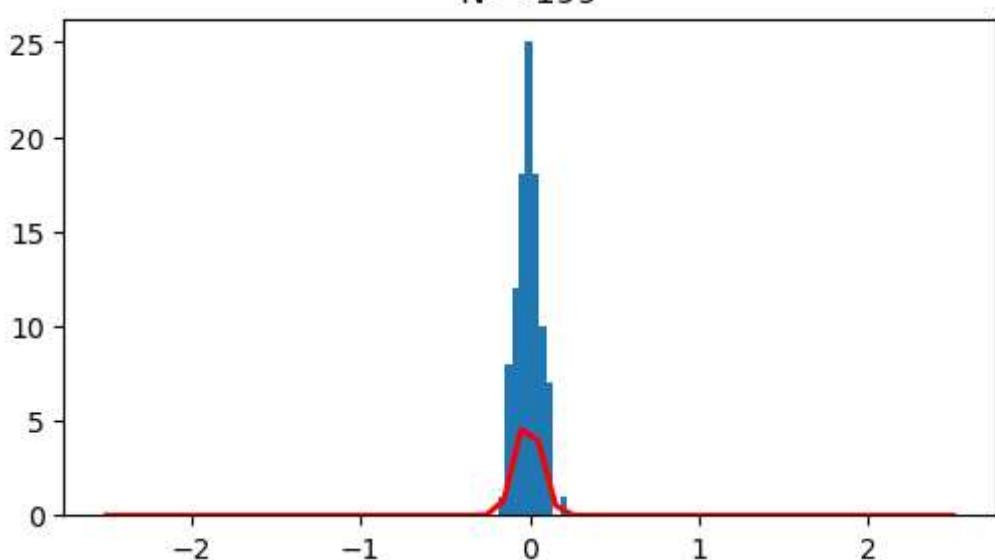


N = 199

Média = -0.007581034660518149

Variância = 0.005536390137460345

N = 199

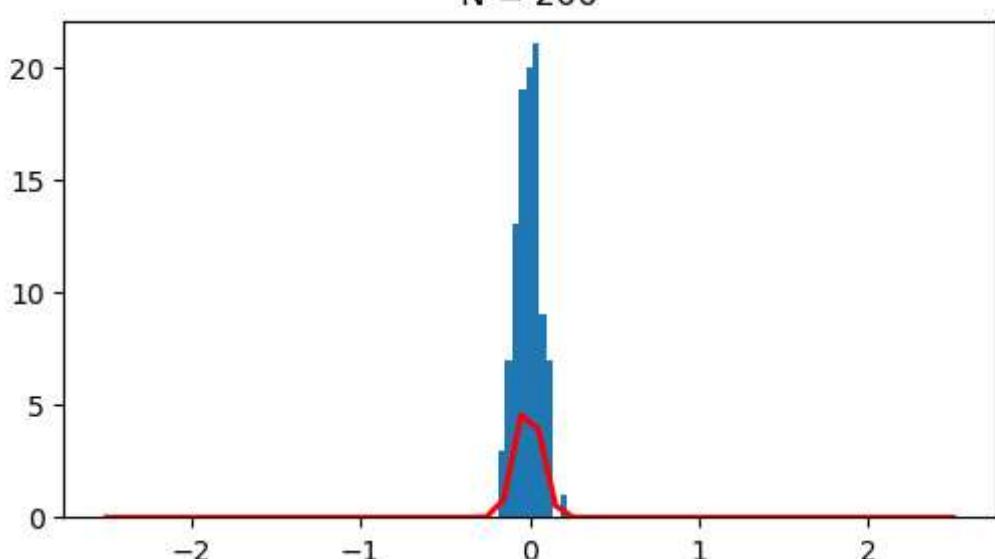


N = 200

Média = -0.007958605195874215

Variância = 0.005526430714192896

N = 200

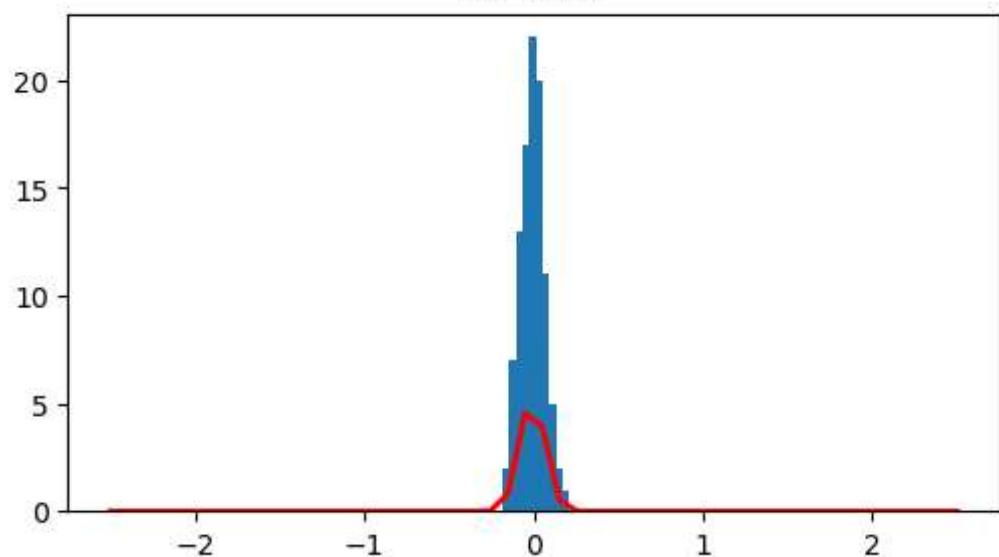


N = 201

Média = -0.008333839288080602

Variância = 0.005520086799259588

N = 201

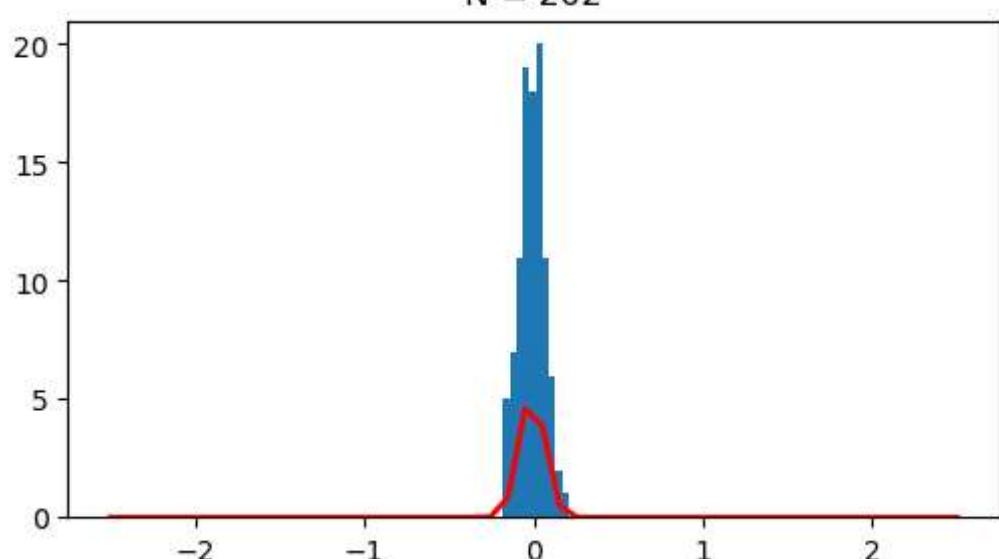


N = 202

Média = -0.00935829048906006

Variância = 0.005551227729562338

N = 202

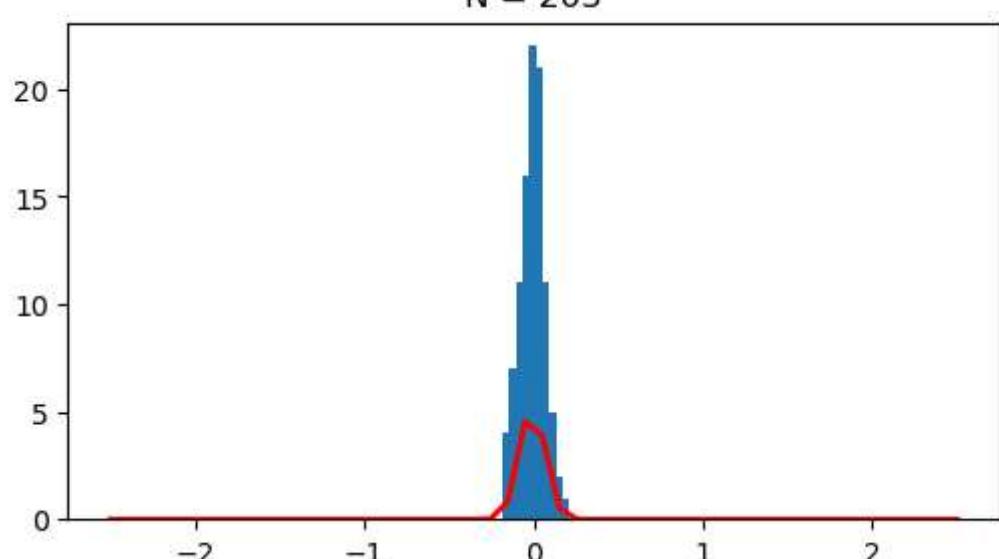


N = 203

Média = -0.008835517516581787

Variância = 0.0055886536189942645

N = 203

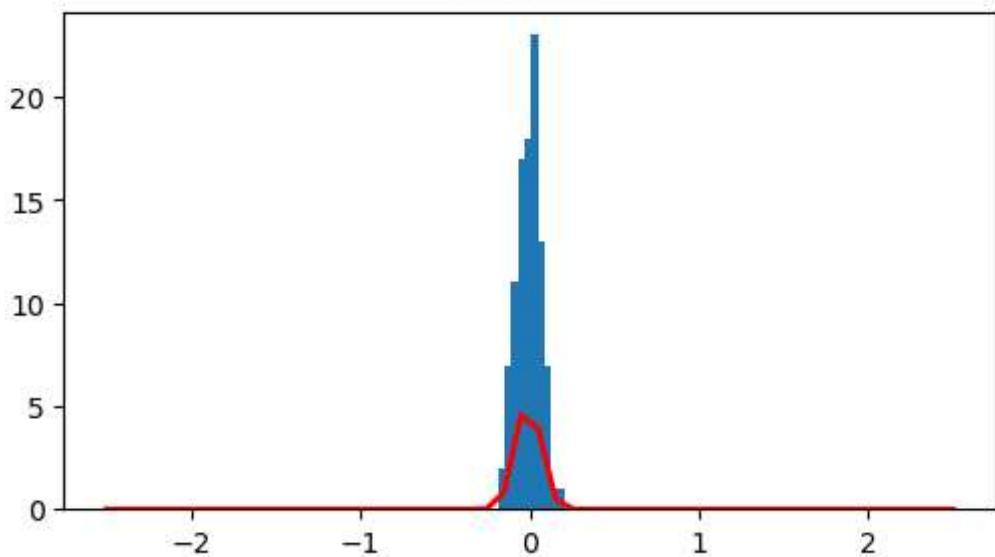


N = 204

Média = -0.008757146888672759

Variância = 0.005457572221013772

N = 204

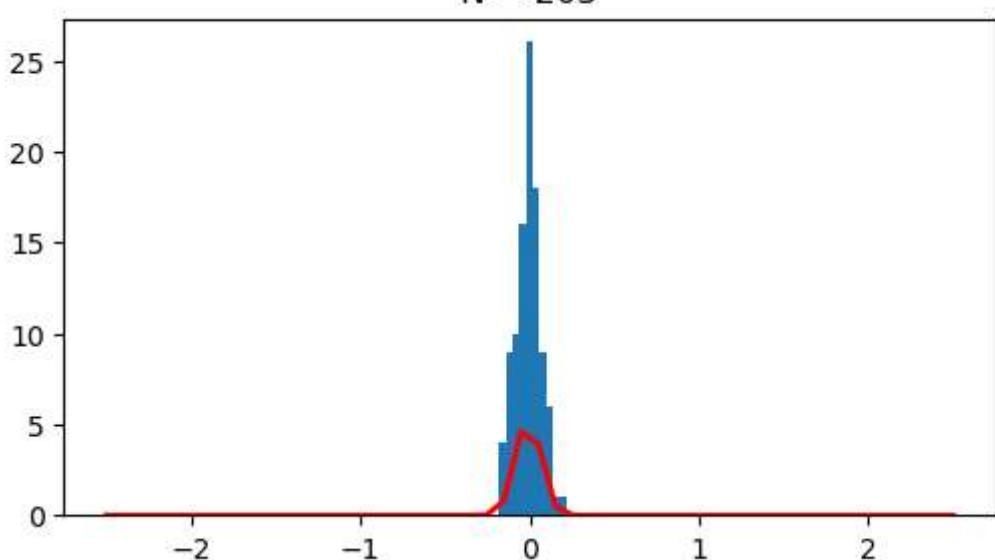


N = 205

Média = -0.008393122139350487

Variância = 0.00540018261709446

N = 205

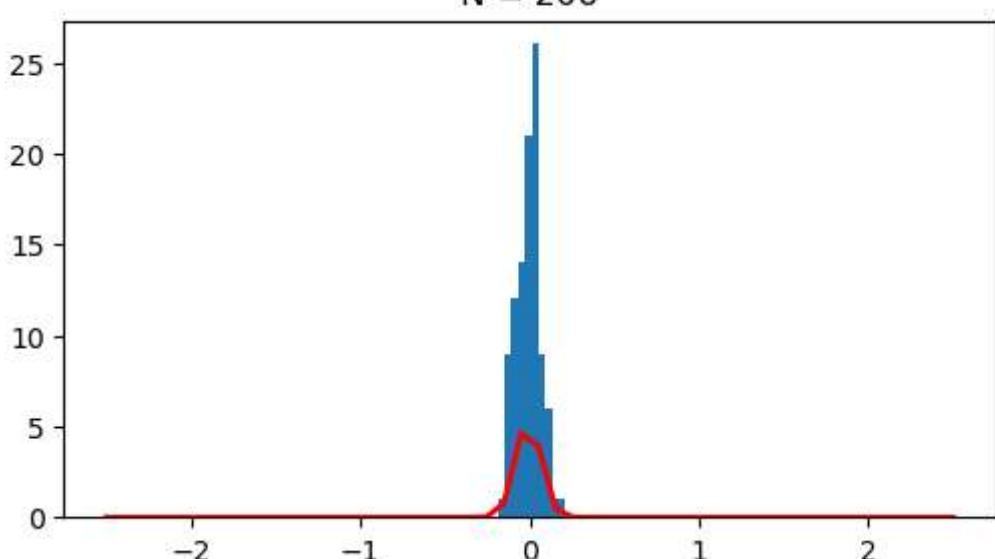


N = 206

Média = -0.008287809140067317

Variância = 0.005346748482280536

N = 206

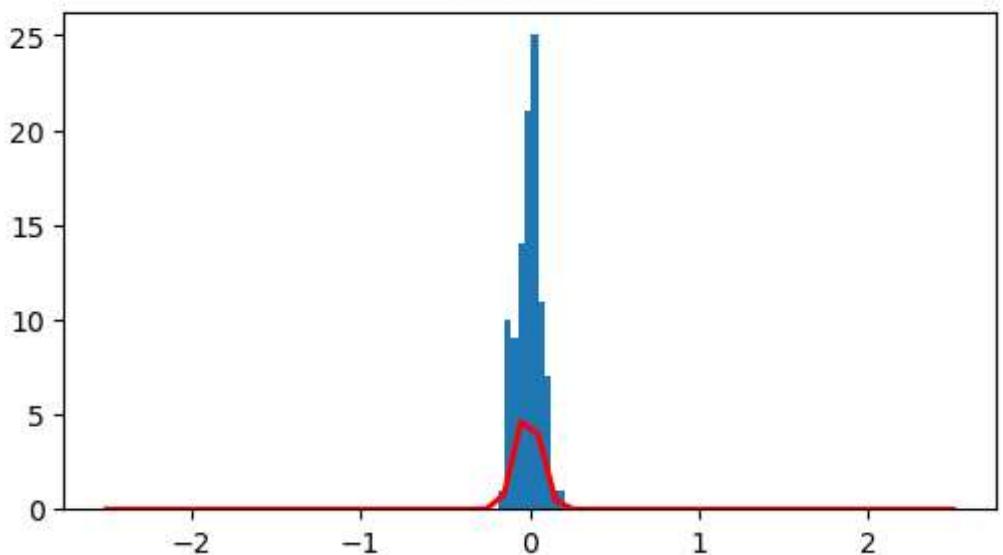


N = 207

Média = -0.008351369441340678

Variância = 0.005281073122296566

N = 207

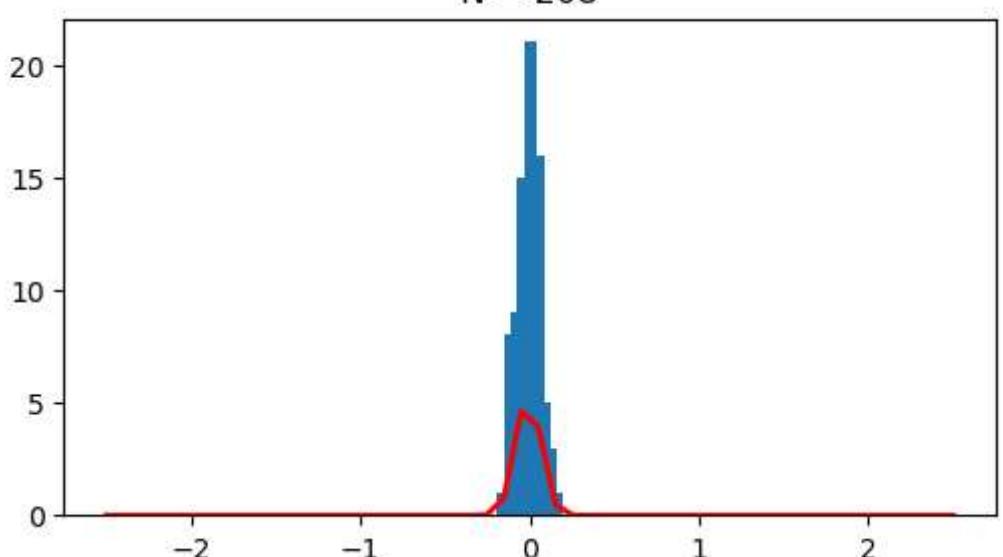


N = 208

Média = -0.008318839868732929

Variância = 0.005291303912954885

N = 208

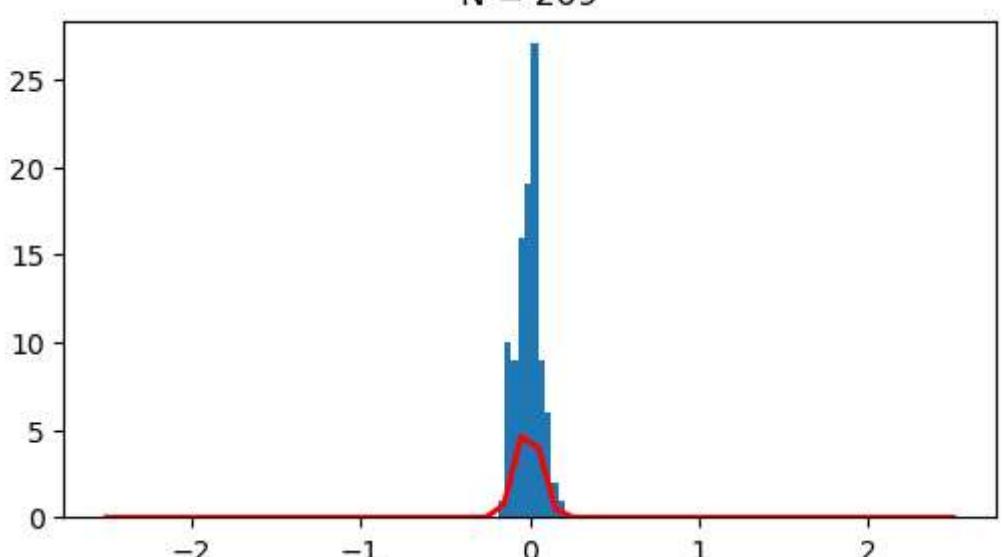


N = 209

Média = -0.007181708549250536

Variância = 0.005237374122617371

N = 209

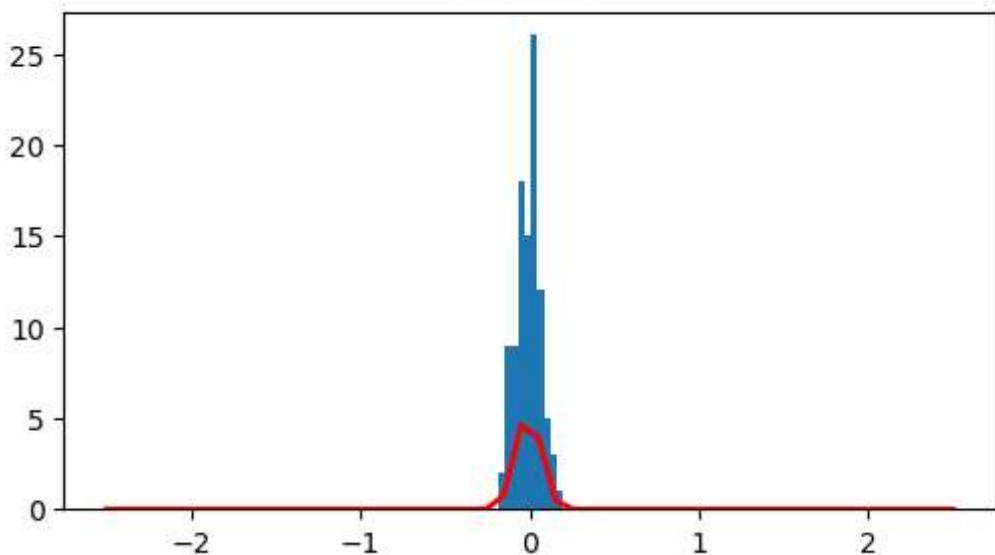


N = 210

Média = -0.007806170468352271

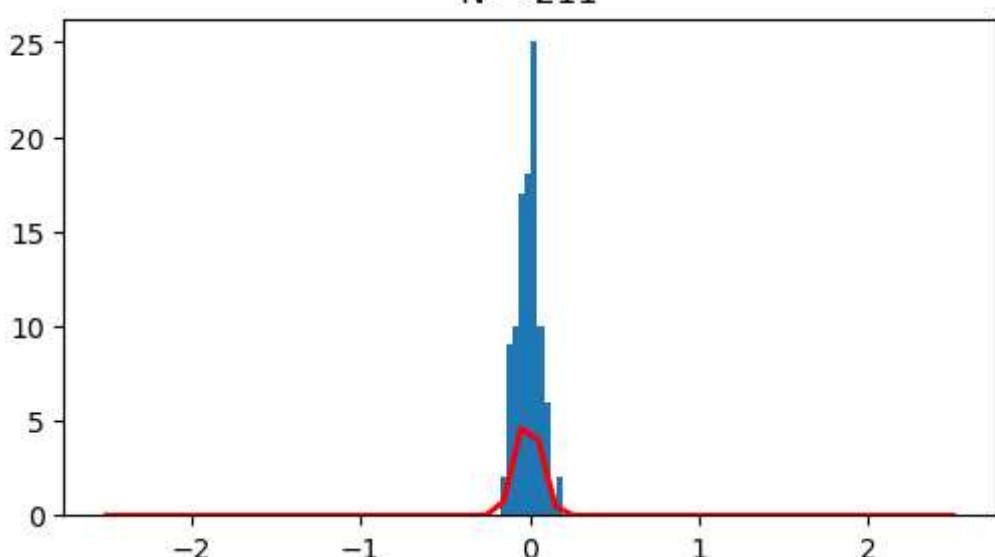
Variância = 0.00530369632620657

N = 210



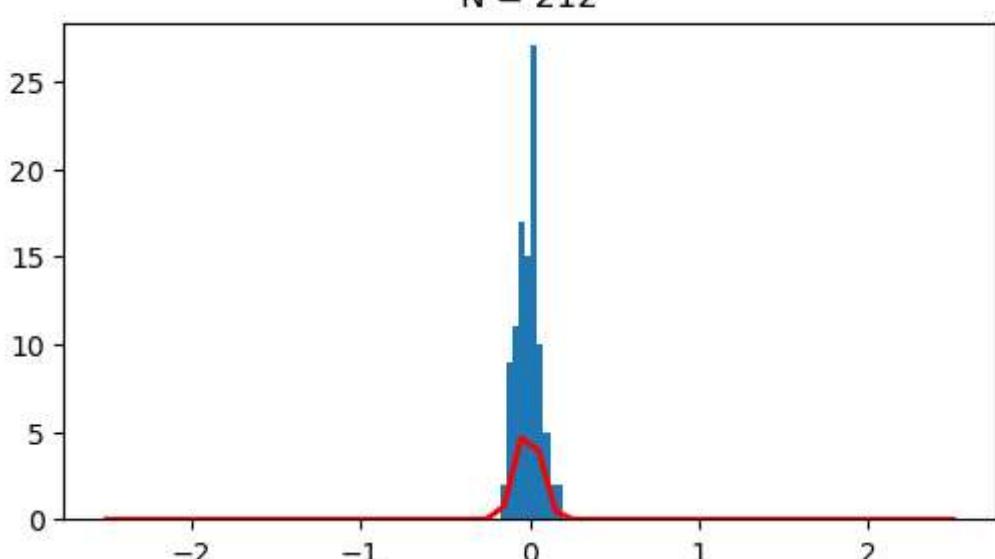
N = 211 Média = -0.007684639222891084 Variância = 0.005269097845254741

N = 211



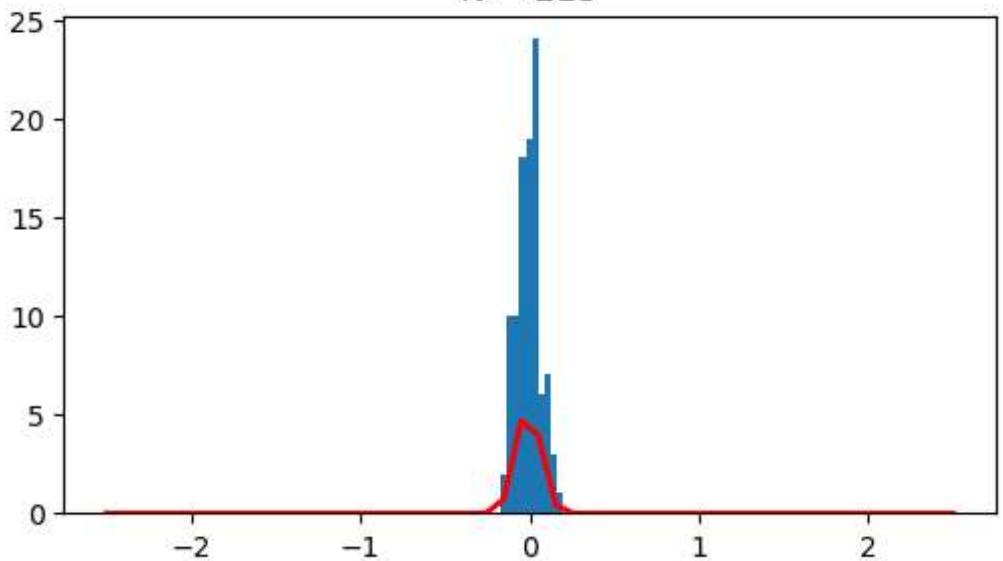
N = 212 Média = -0.008075940083583366 Variância = 0.005202443005856621

N = 212



N = 213 Média = -0.008505525006796324 Variância = 0.005078409580666659

N = 213

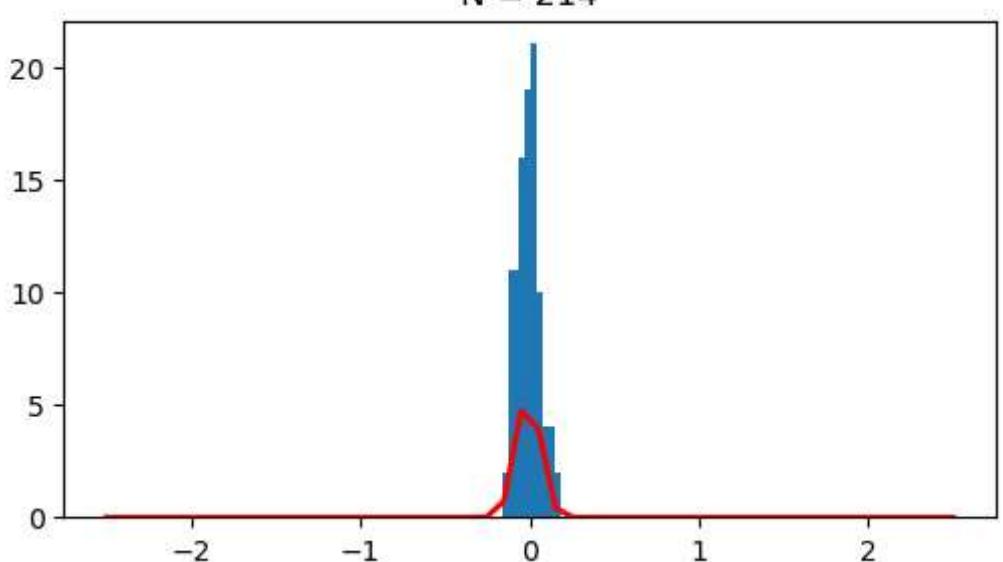


N = 214

Média = -0.008893955117262995

Variância = 0.005039565011759087

N = 214

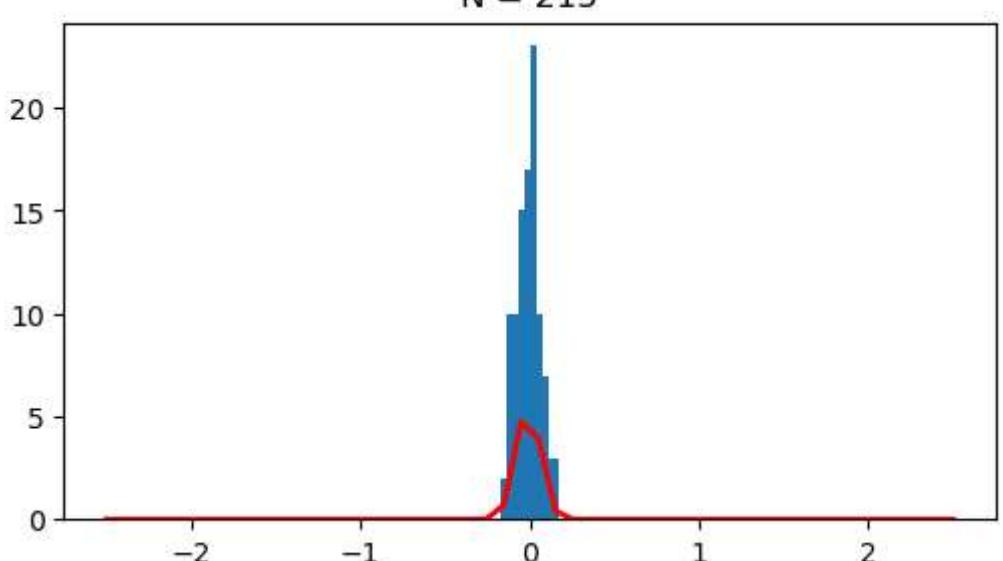


N = 215

Média = -0.009016005945374982

Variância = 0.004971848719036806

N = 215

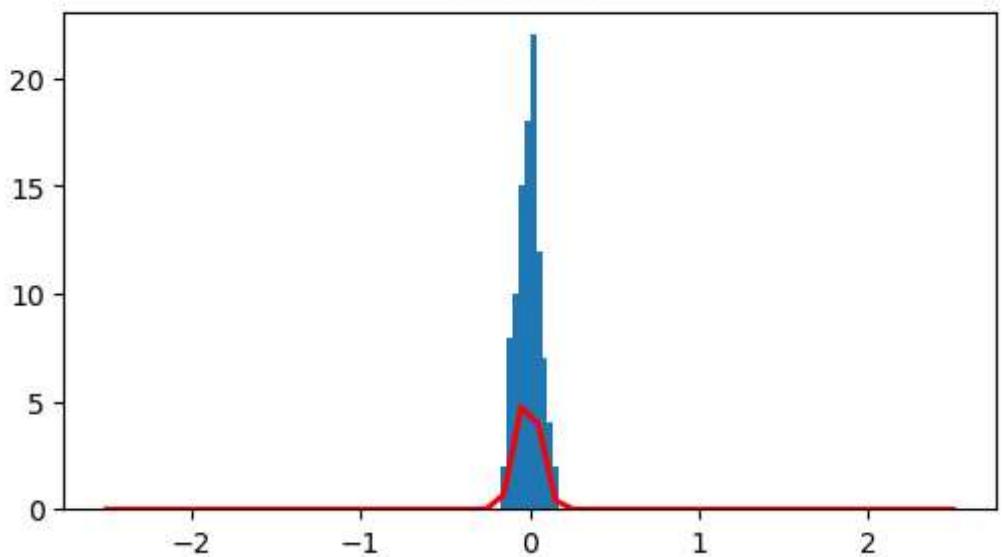


N = 216

Média = -0.008585234504184532

Variância = 0.004934648689787081

N = 216

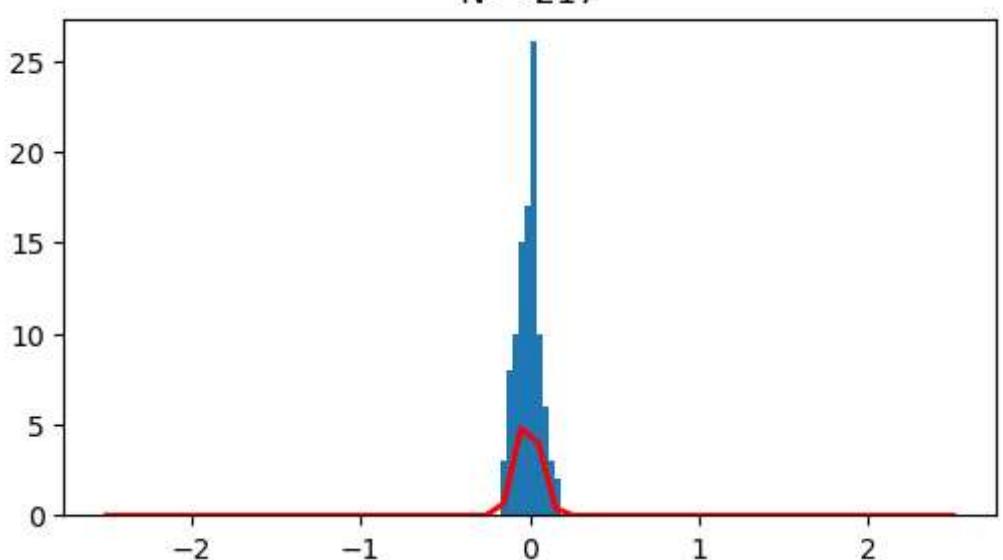


N = 217

Média = -0.008863531175535969

Variância = 0.0048154670790172835

N = 217

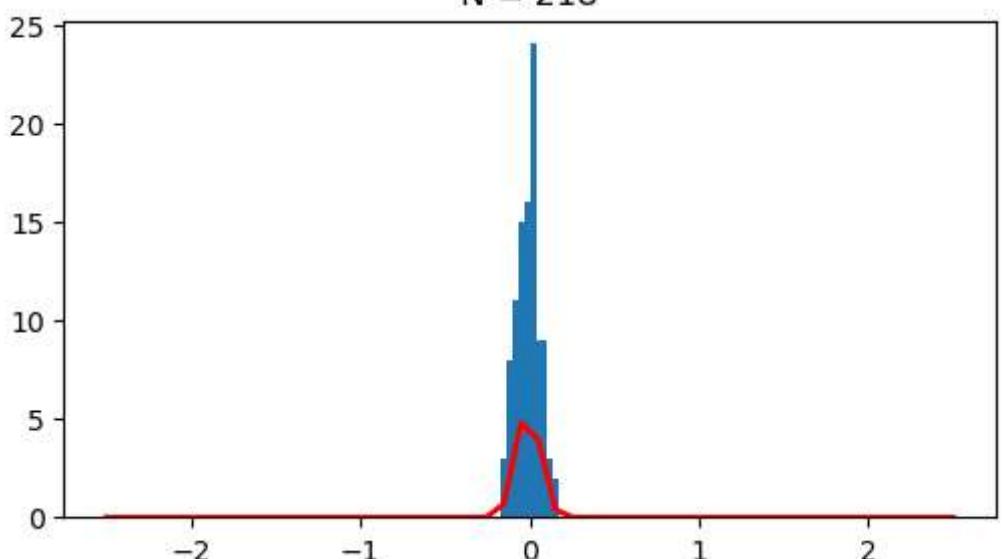


N = 218

Média = -0.00922131168464909

Variância = 0.004844988625066358

N = 218

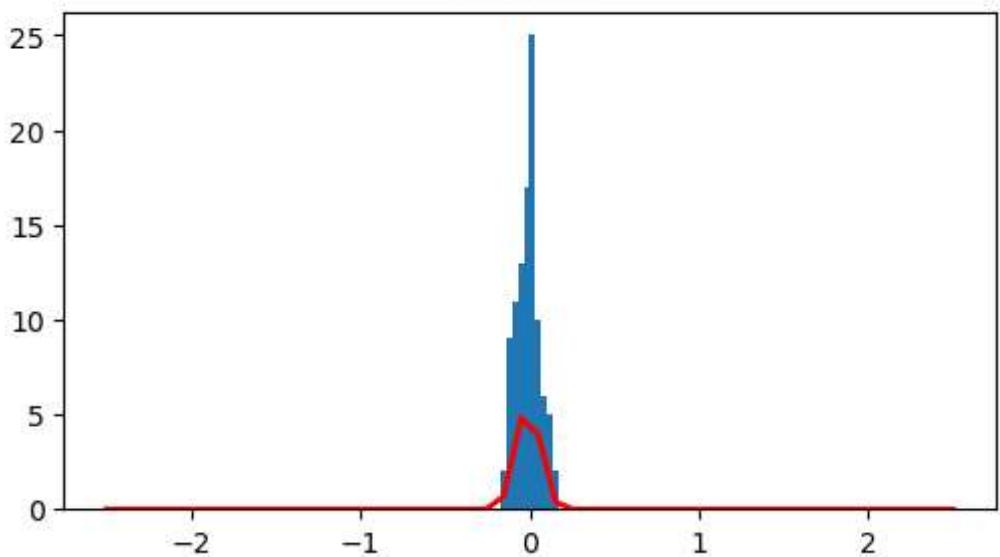


N = 219

Média = -0.009655396449582887

Variância = 0.004851255014293287

N = 219

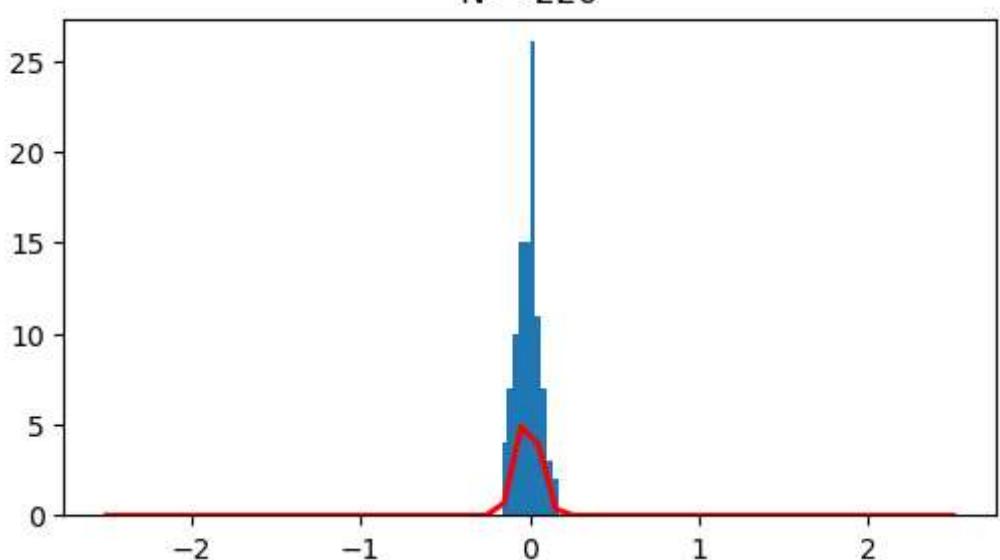


N = 220

Média = -0.010030409429767979

Variância = 0.004740650650660106

N = 220

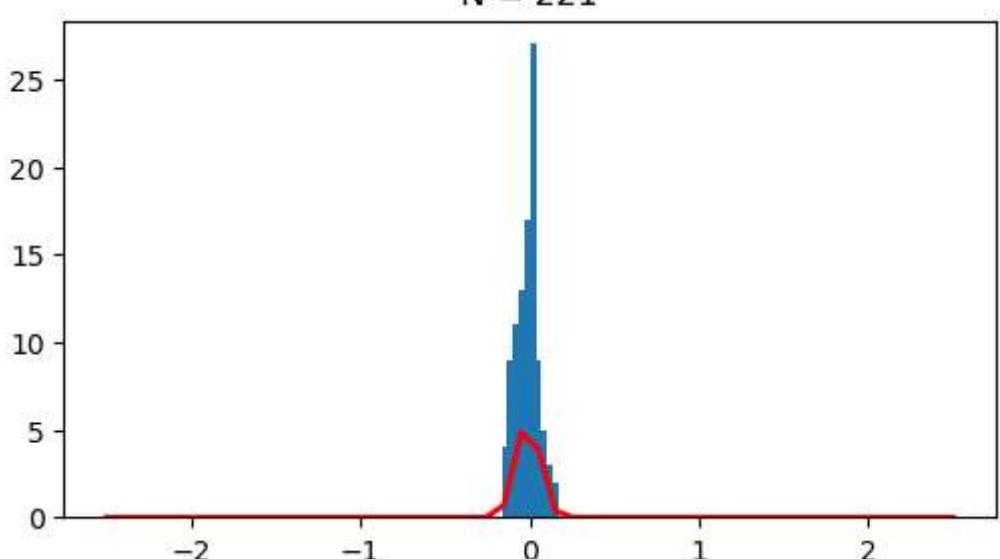


N = 221

Média = -0.010243793876766865

Variância = 0.0048447610978252596

N = 221

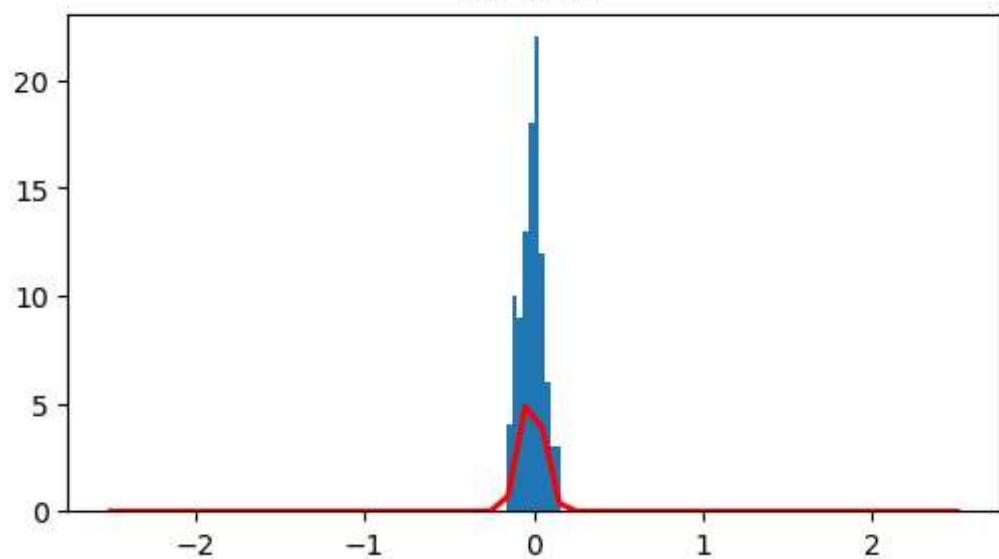


N = 222

Média = -0.010255576514315214

Variância = 0.004772089270167353

N = 222

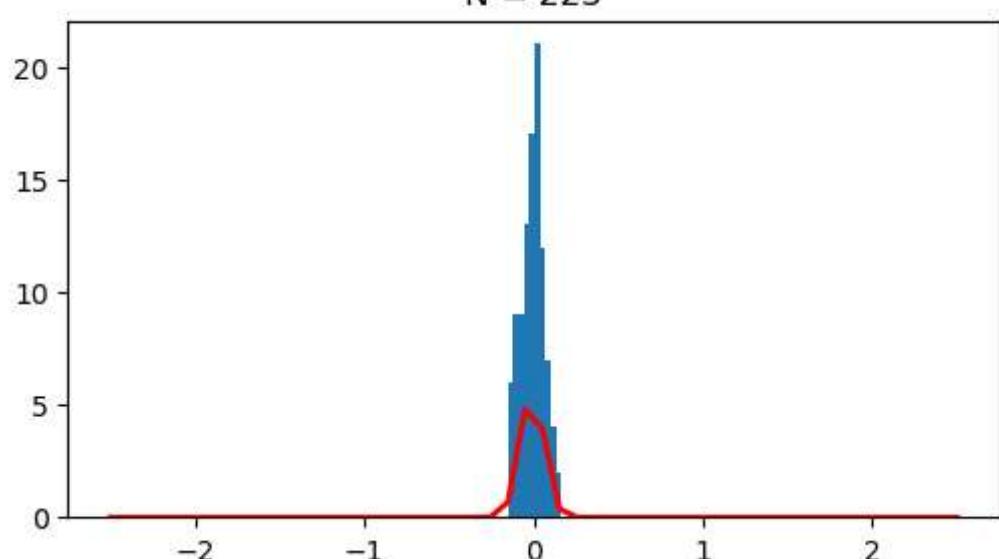


N = 223

Média = -0.00936258825036035

Variância = 0.004828021031125422

N = 223

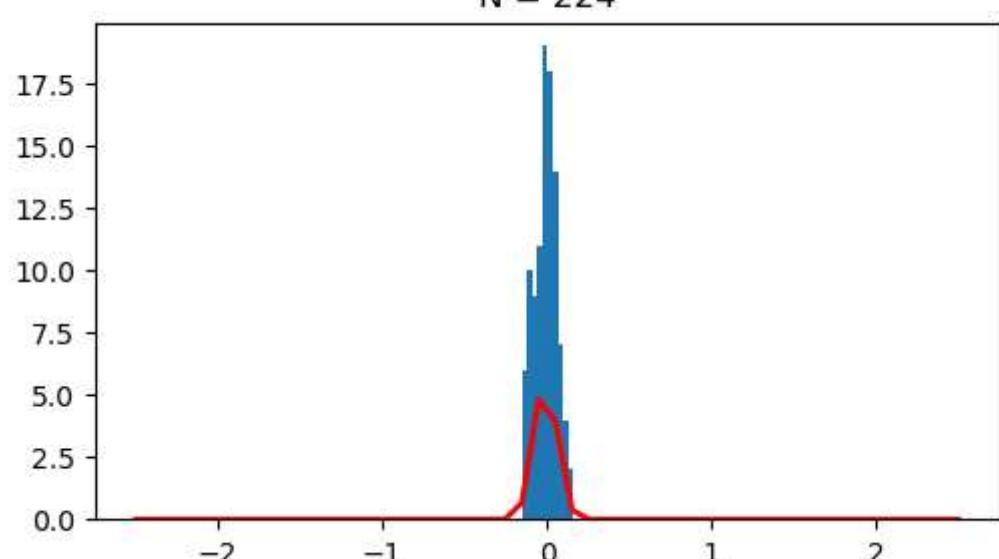


N = 224

Média = -0.009216067311639963

Variância = 0.004773938799815992

N = 224

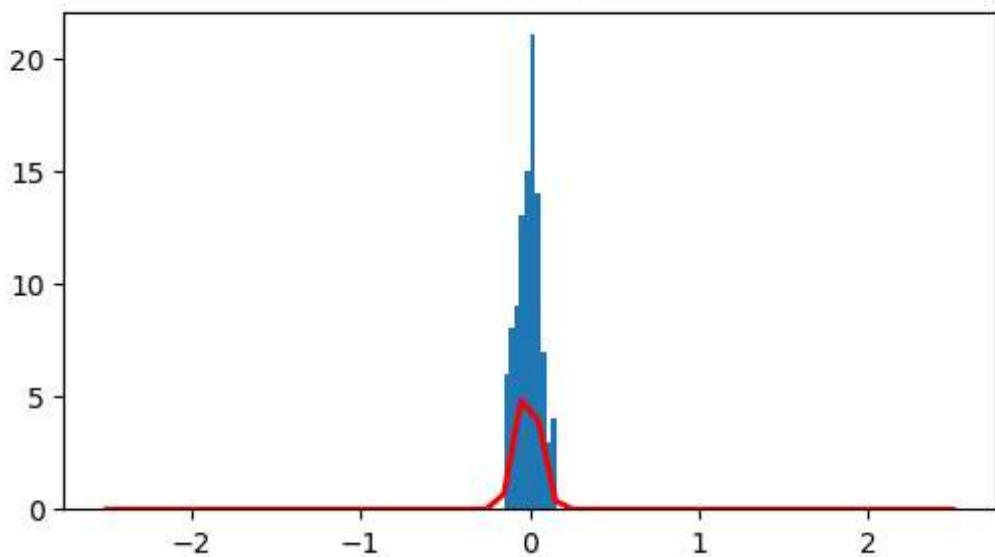


N = 225

Média = -0.009544482470223705

Variância = 0.004790297764057002

N = 225

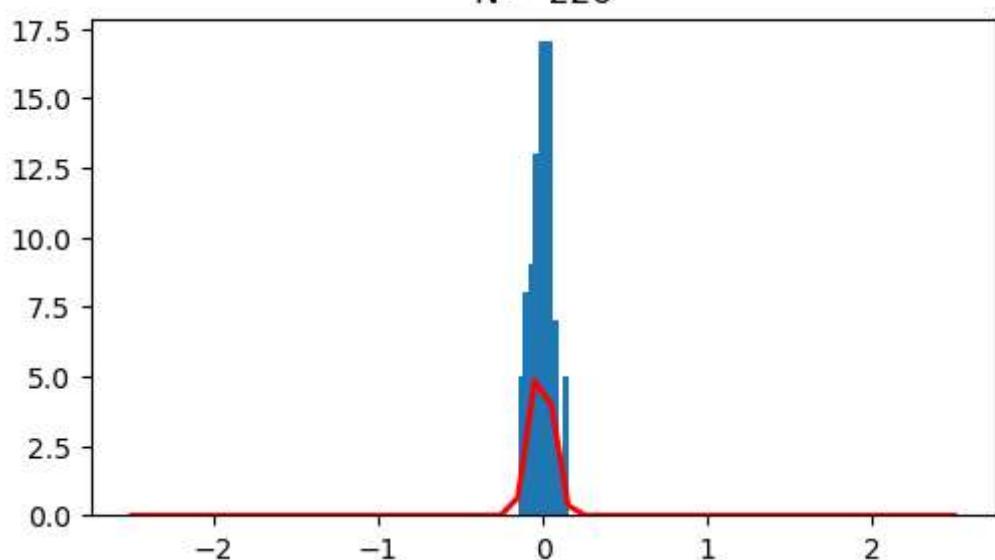


N = 226

Média = -0.009025145101533549

Variância = 0.00467534527300828

N = 226

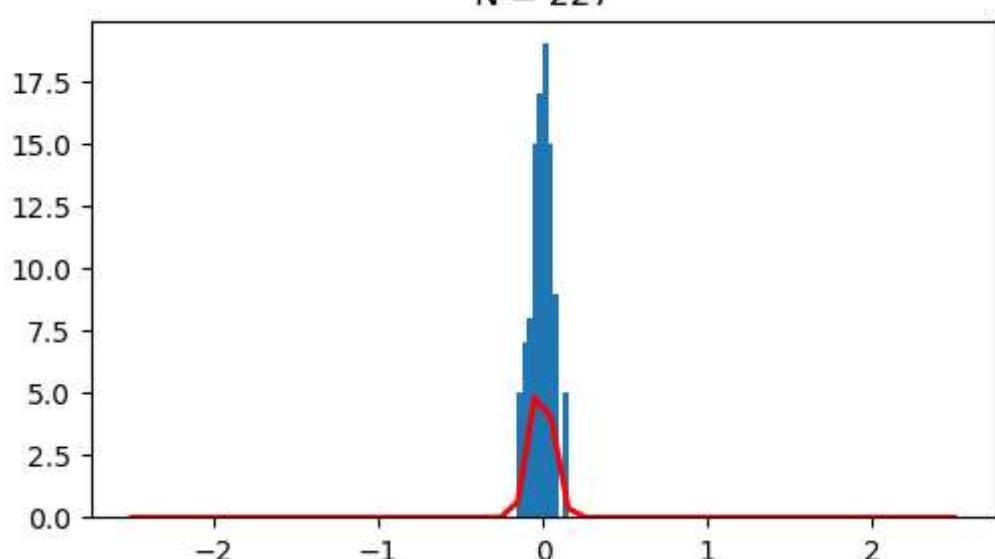


N = 227

Média = -0.008729562828536768

Variância = 0.0046910451800957

N = 227

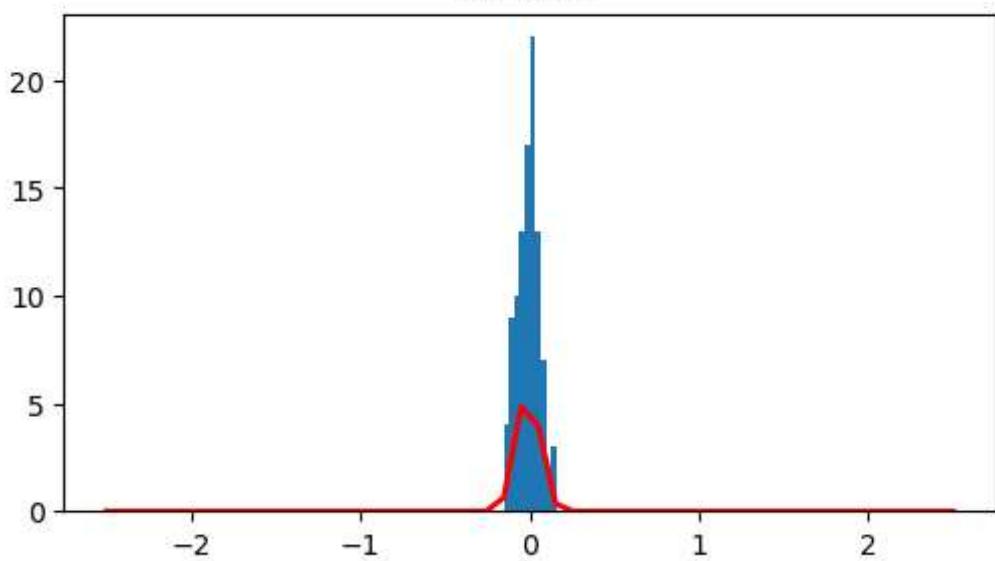


N = 228

Média = -0.009093817119460324

Variância = 0.0046730480110870306

N = 228

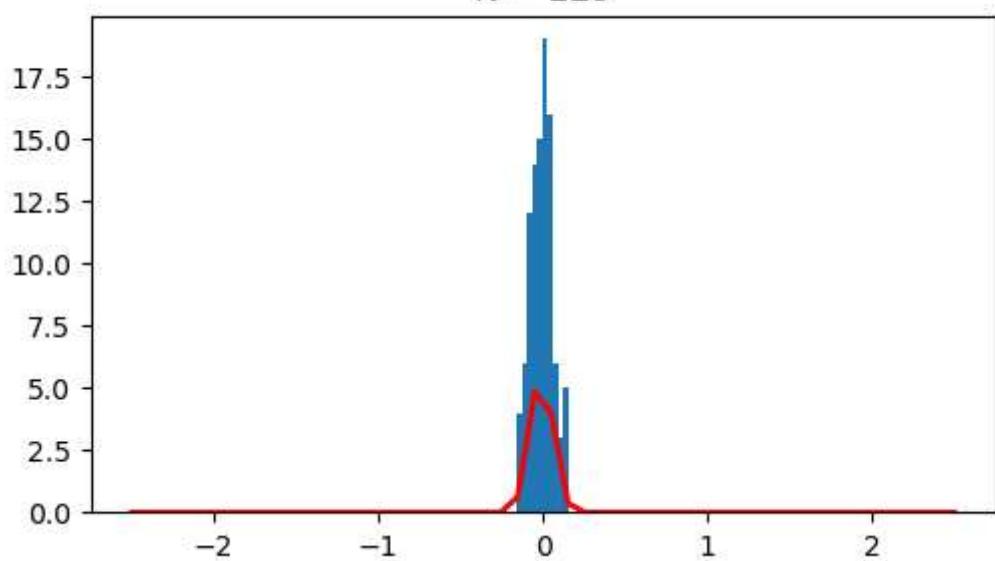


N = 229

Média = -0.009008858875500975

Variância = 0.004675546482328561

N = 229

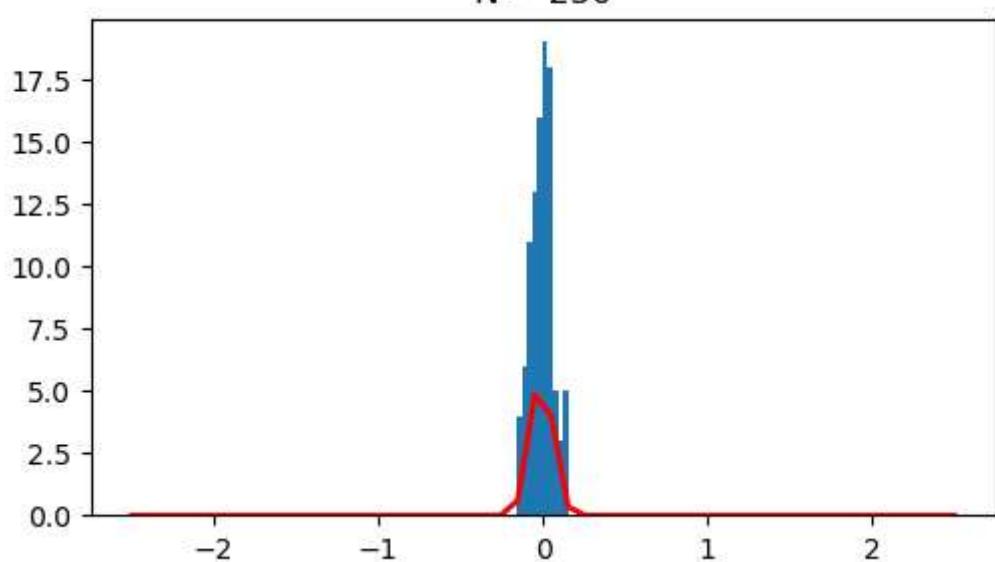


N = 230

Média = -0.008682781129907577

Variância = 0.004588618063011671

N = 230

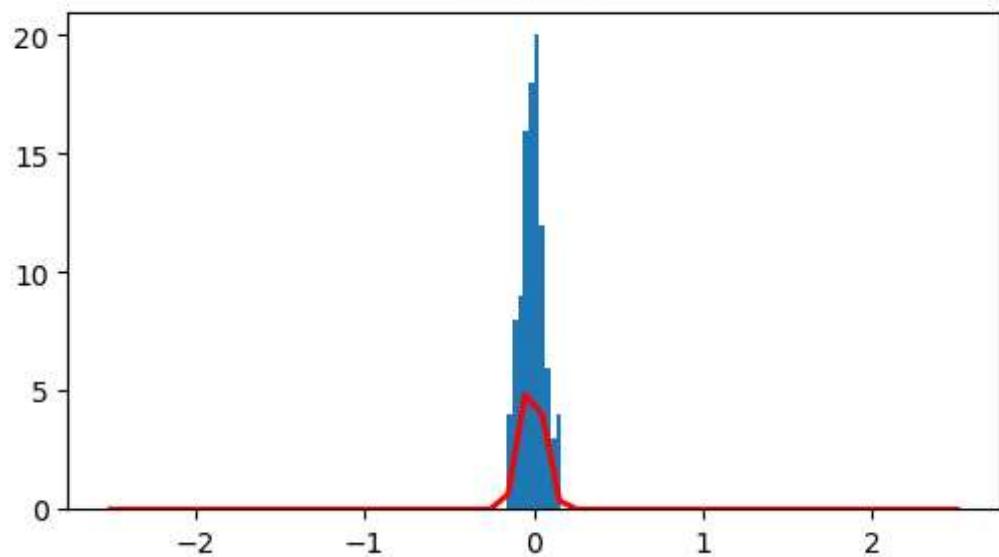


N = 231

Média = -0.008710060562719342

Variância = 0.004657449937327482

N = 231

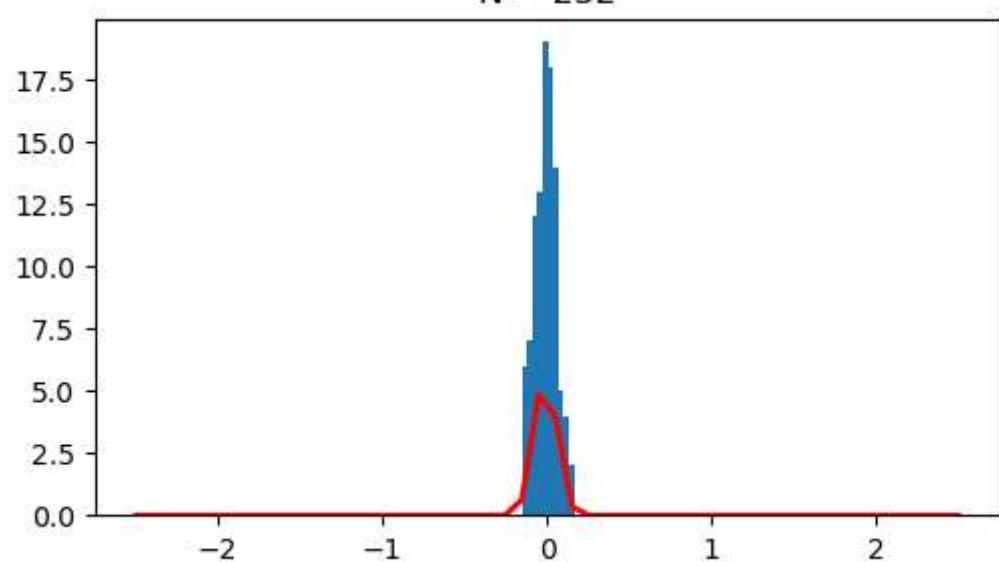


N = 232

Média = -0.008856522482059054

Variância = 0.00461328154748181

N = 232

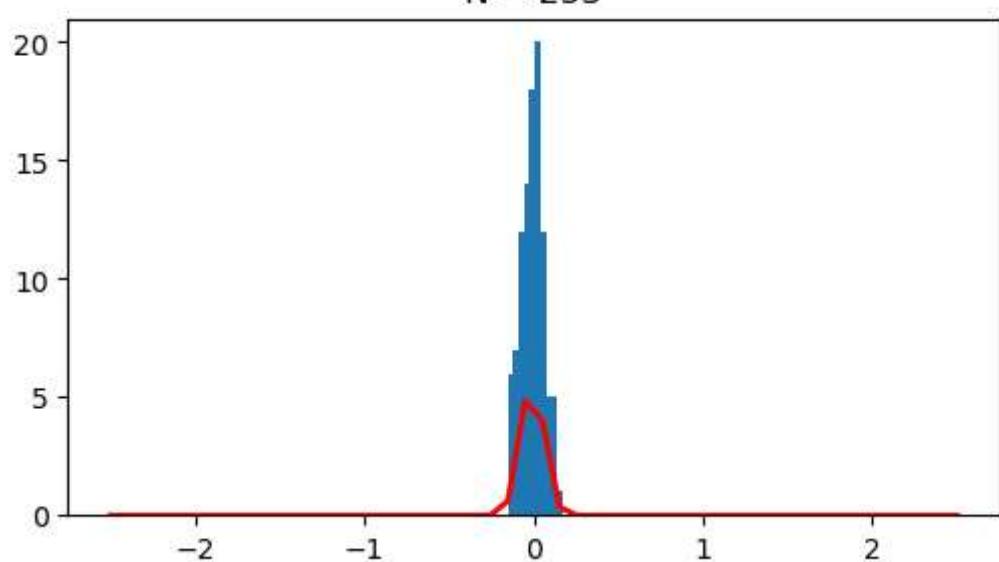


N = 233

Média = -0.008405330347876553

Variância = 0.004587308712363136

N = 233

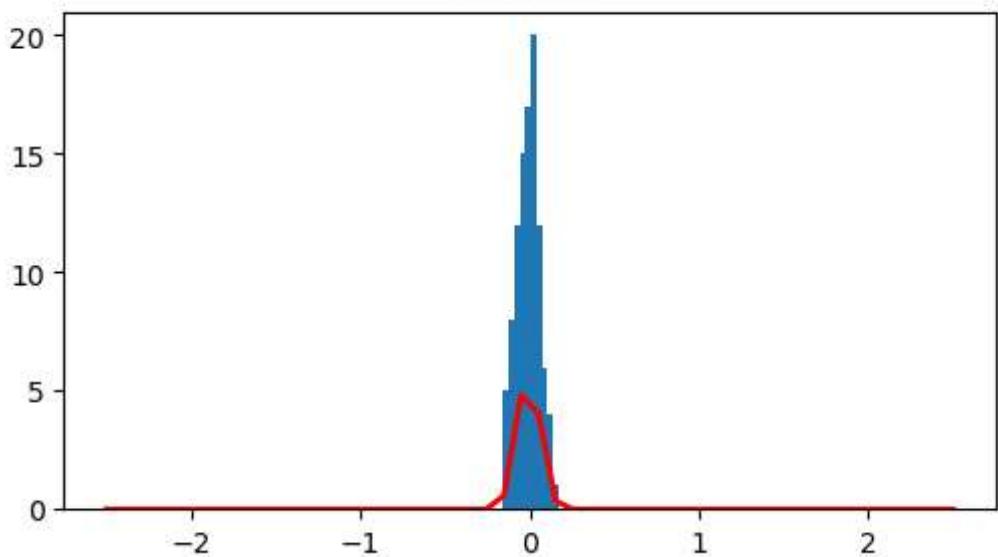


N = 234

Média = -0.007558758200027469

Variância = 0.004537019978606599

N = 234

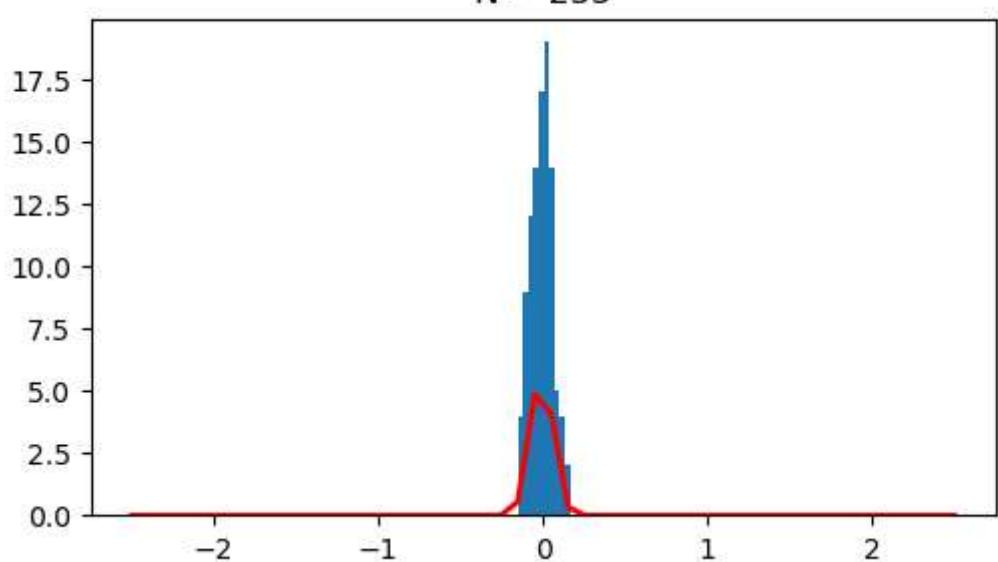


N = 235

Média = -0.007597710066553396

Variância = 0.004436855755045537

N = 235

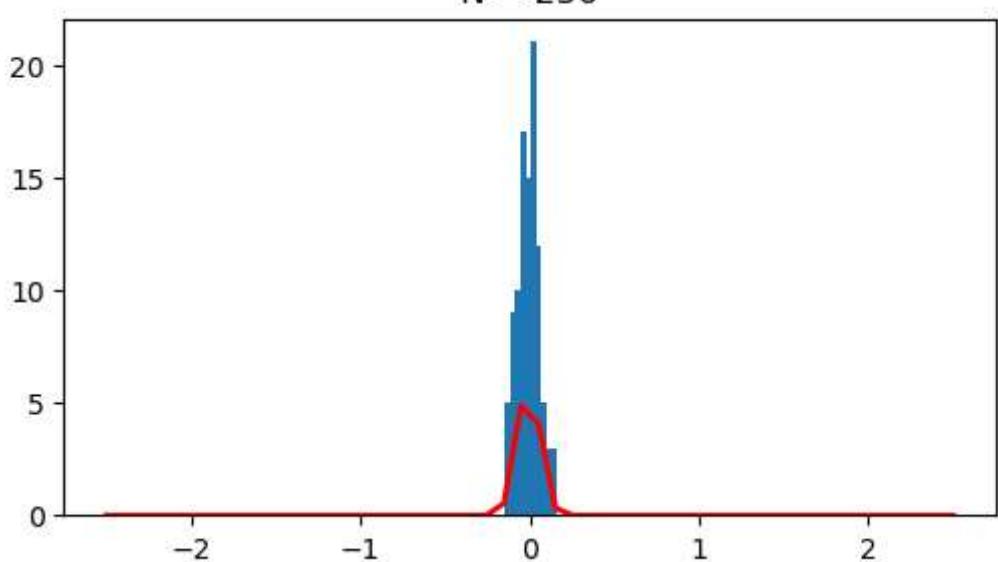


N = 236

Média = -0.007367574951977069

Variância = 0.004380810676492814

N = 236

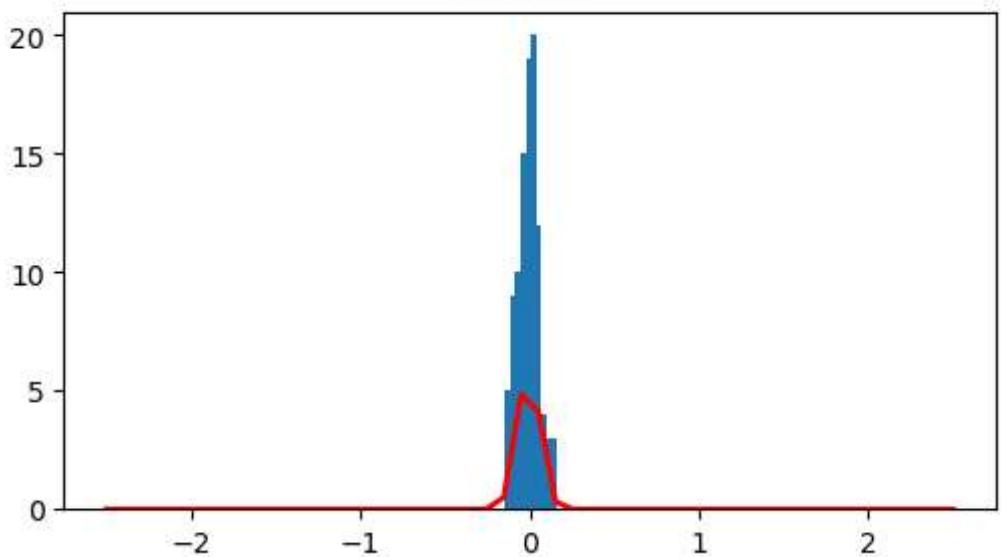


N = 237

Média = -0.006805480308928059

Variância = 0.0043194091341379895

N = 237

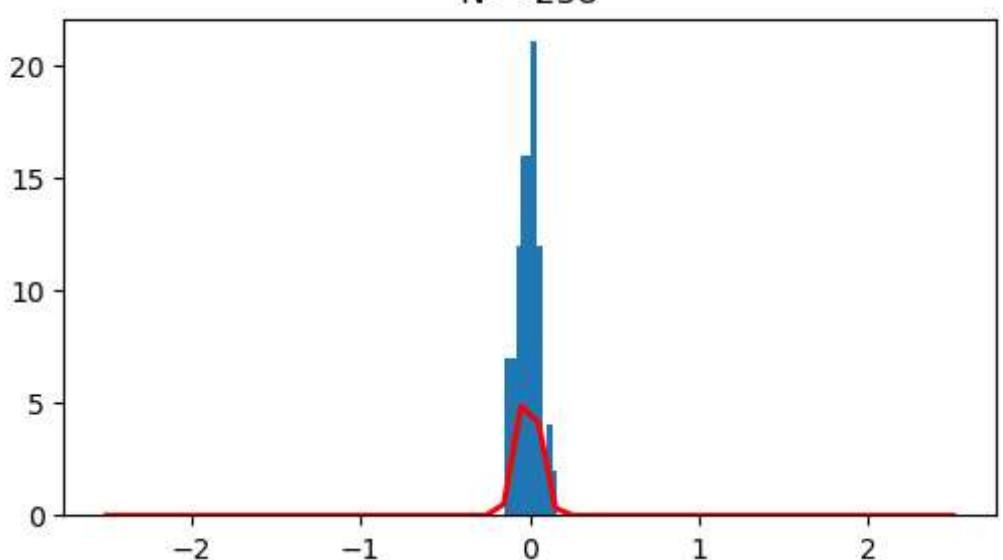


N = 238

Média = -0.0066082461662213

Variância = 0.004301263884794982

N = 238

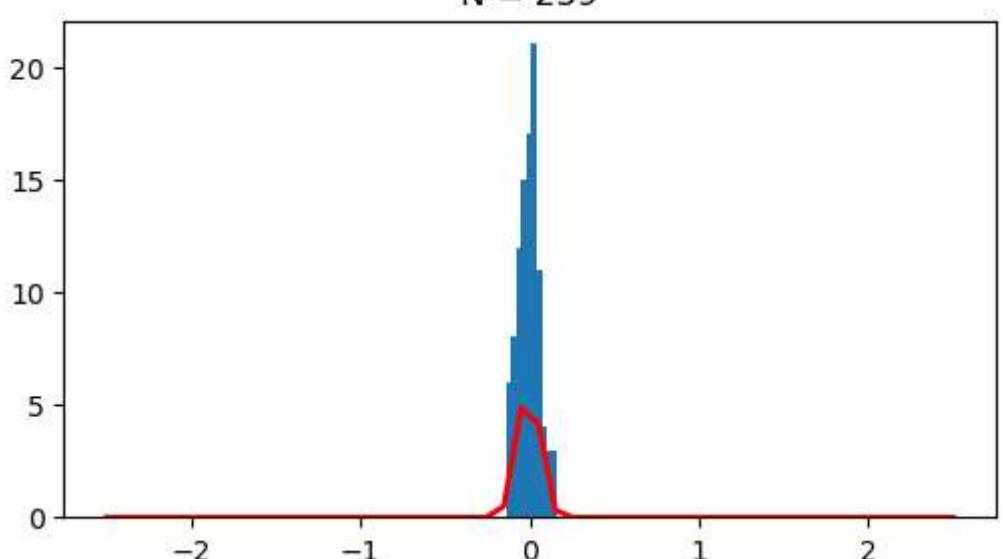


N = 239

Média = -0.006541380822635506

Variância = 0.004267112594321019

N = 239

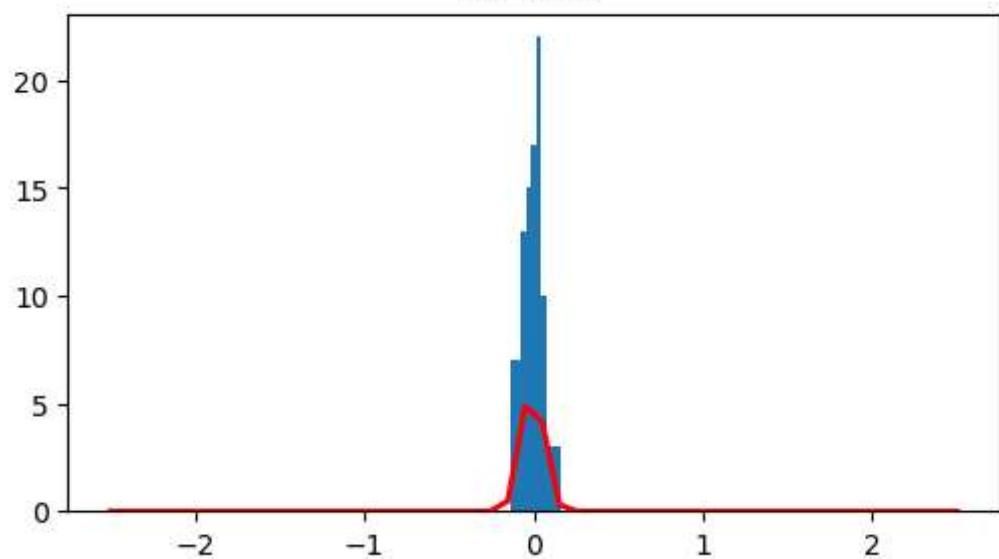


N = 240

Média = -0.006691822546665726

Variância = 0.004202682742577651

N = 240

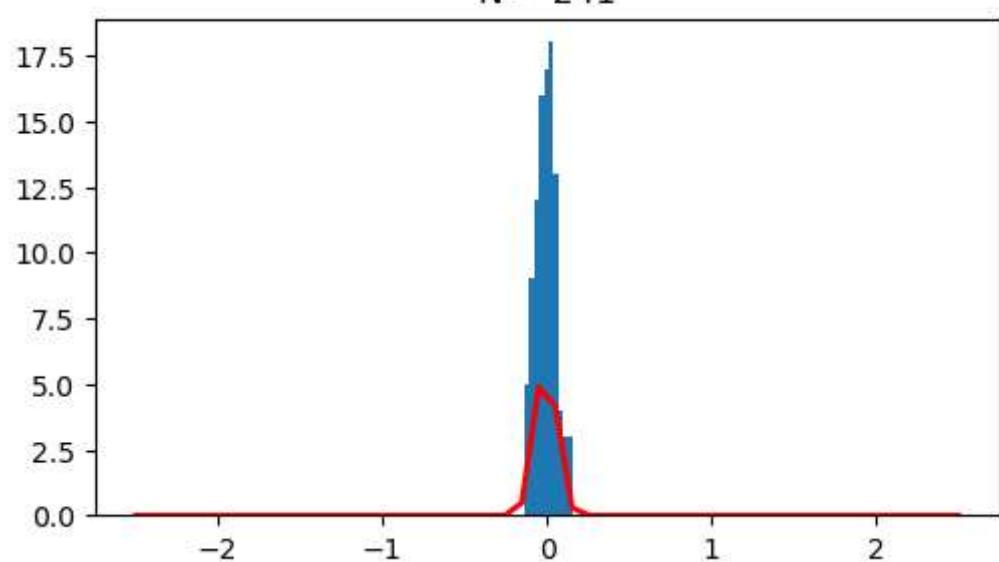


N = 241

Média = -0.006861626811952288

Variância = 0.004180223576841842

N = 241

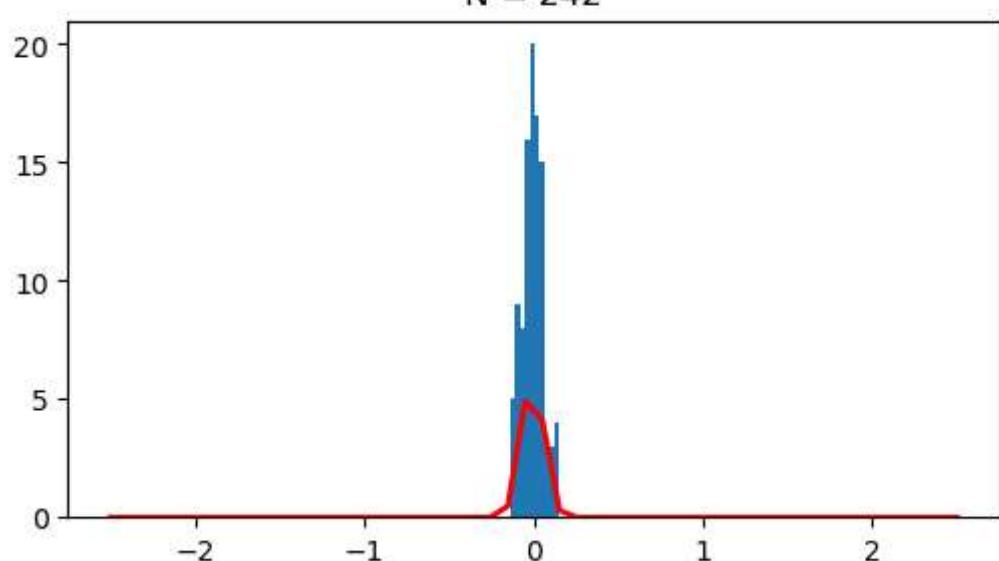


N = 242

Média = -0.007008069864218216

Variância = 0.004161121718564639

N = 242

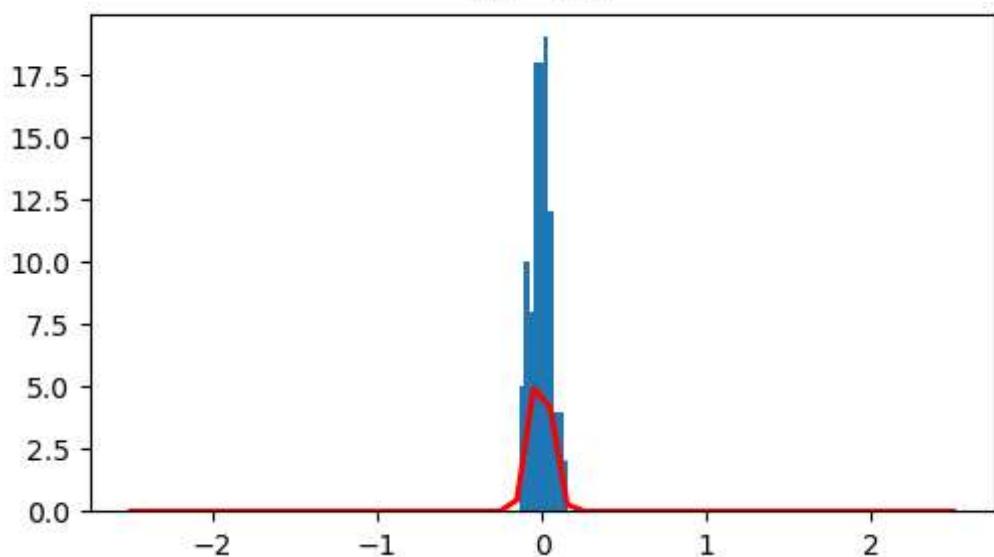


N = 243

Média = -0.006803783286278941

Variância = 0.004058079678591368

N = 243

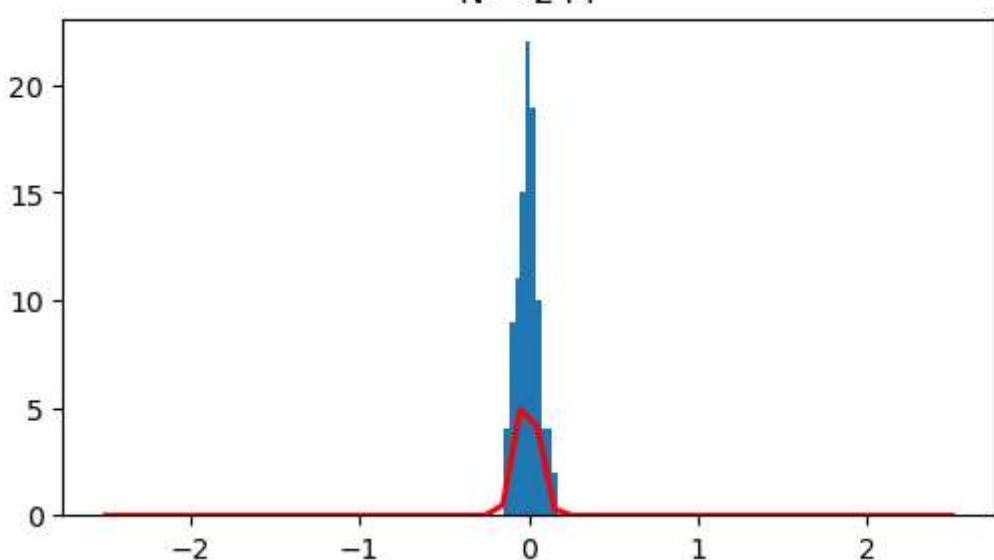


N = 244

Média = -0.007196192889322747

Variância = 0.0041604524512703495

N = 244

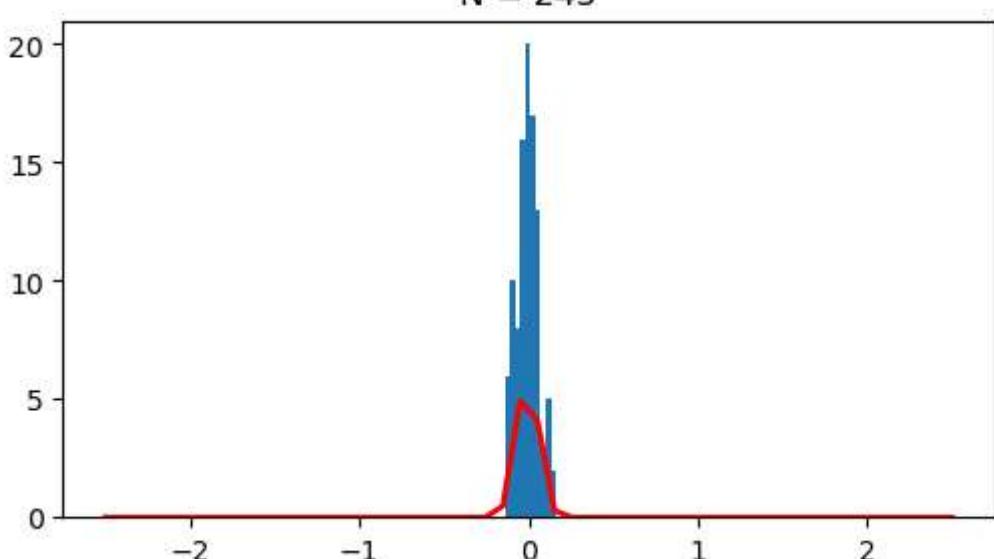


N = 245

Média = -0.007287549364158522

Variância = 0.004150465964297122

N = 245

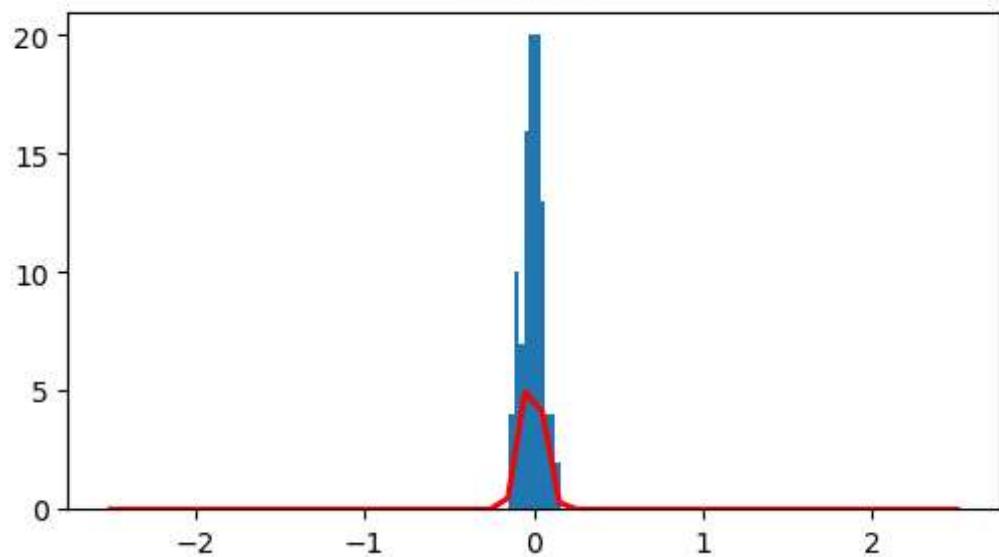


N = 246

Média = -0.007443535311510286

Variância = 0.00409778141168157

N = 246

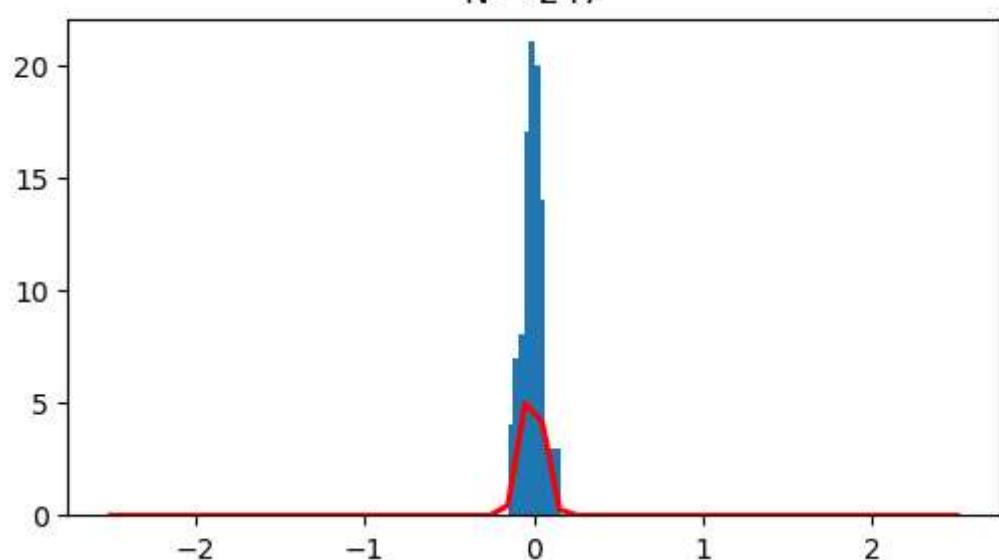


N = 247

Média = -0.007267146388483114

Variância = 0.003999829973318695

N = 247

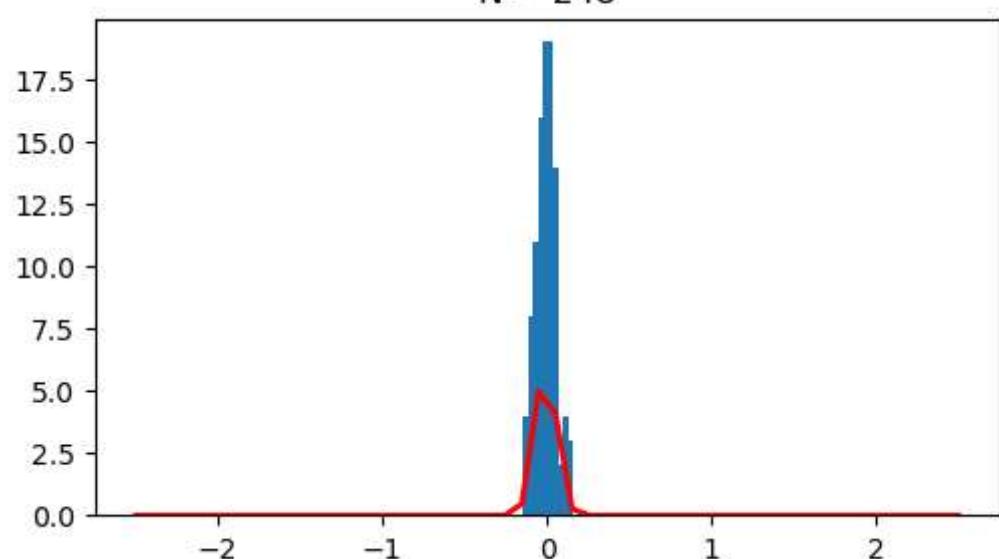


N = 248

Média = -0.007716966666856109

Variância = 0.0040611866793385755

N = 248

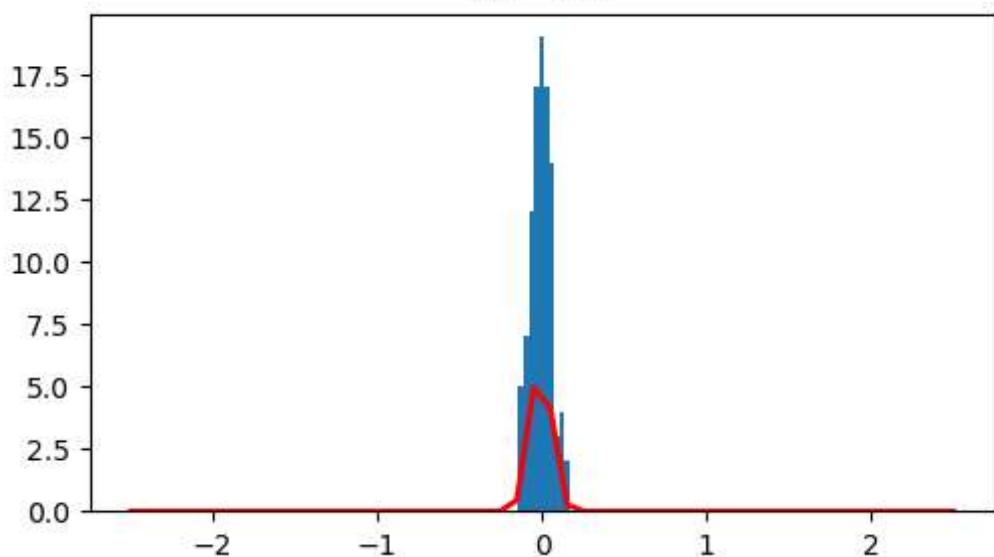


N = 249

Média = -0.007153707649540325

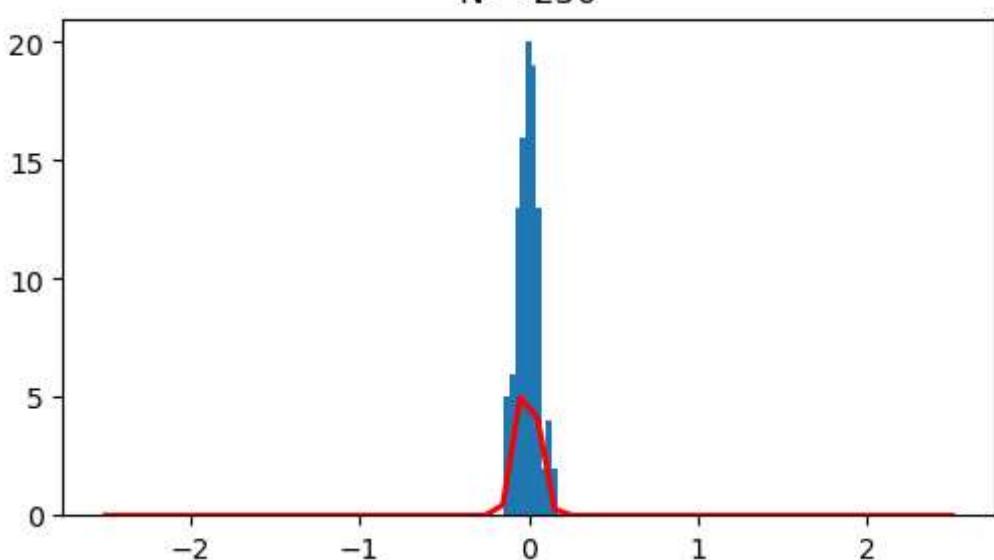
Variância = 0.004019425236777429

N = 249



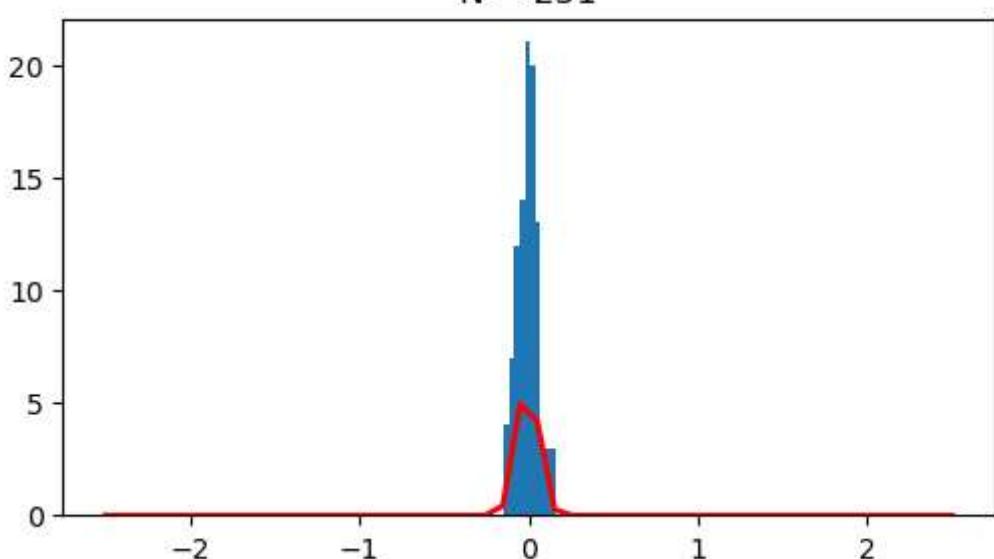
N = 250 Média = -0.007096990375595874 Variância = 0.0039898410741577295

N = 250



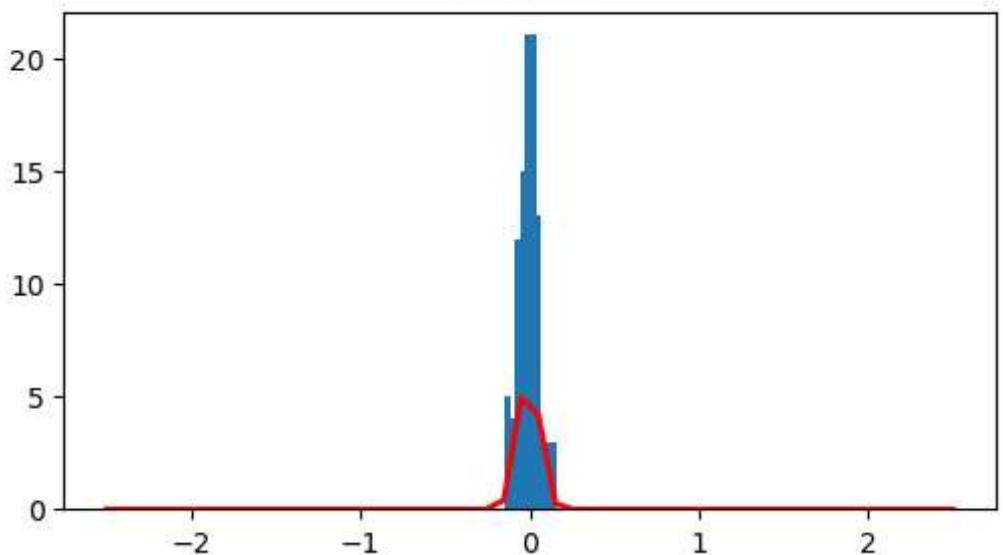
N = 251 Média = -0.006424828049907184 Variância = 0.003978374797622653

N = 251



N = 252 Média = -0.006156494604135983 Variância = 0.00391992155978173

N = 252

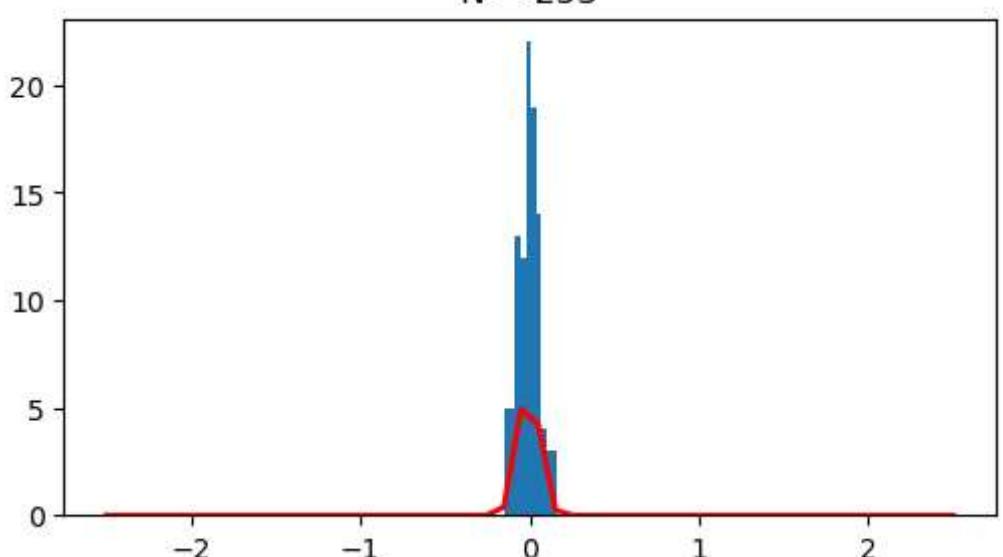


N = 253

Média = -0.0059743467712252895

Variância = 0.003847583272598178

N = 253

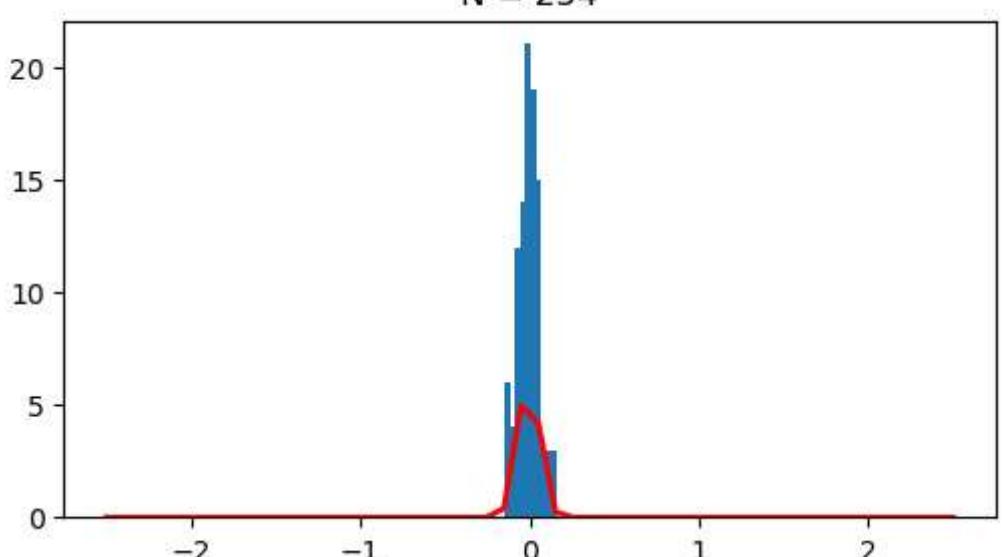


N = 254

Média = -0.0062460708598574555

Variância = 0.0038787675821960917

N = 254

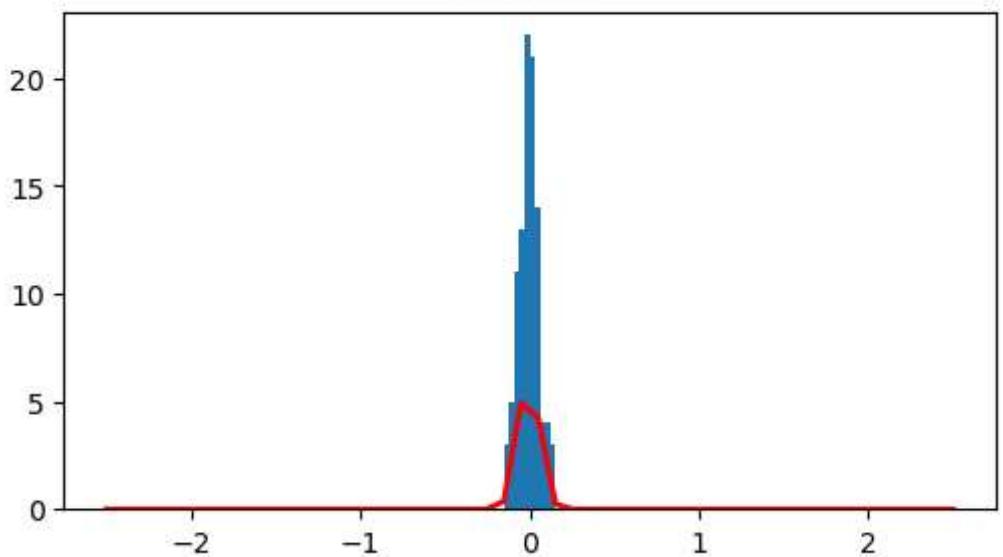


N = 255

Média = -0.005745820482922868

Variância = 0.0038041097049729216

N = 255

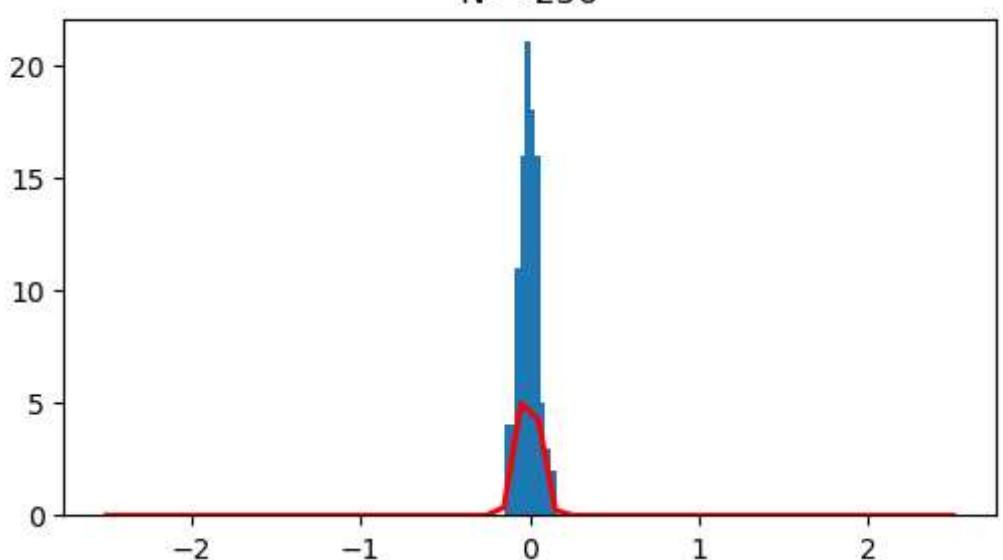


N = 256

Média = -0.005654679779432539

Variância = 0.0037168347342082524

N = 256

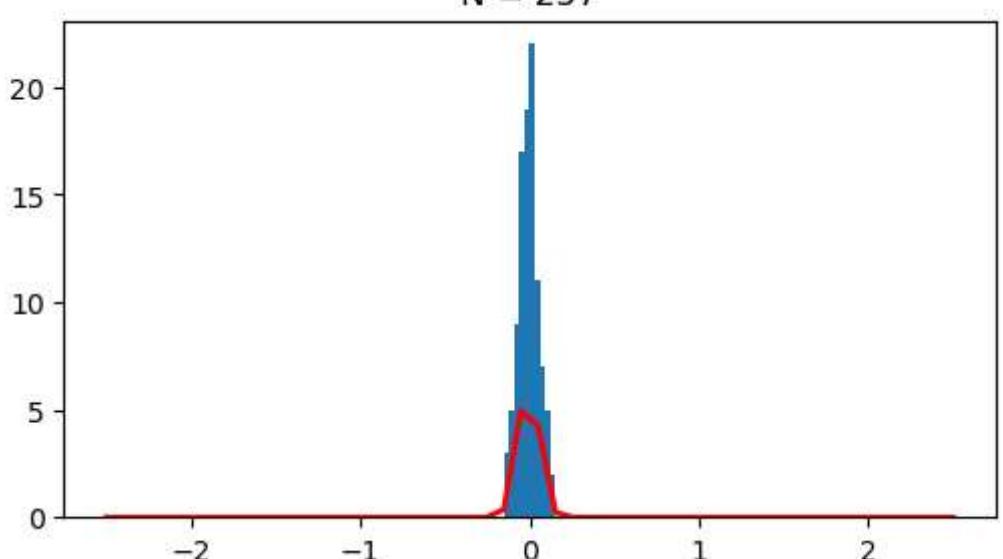


N = 257

Média = -0.006024147806021872

Variância = 0.0037711156541010257

N = 257

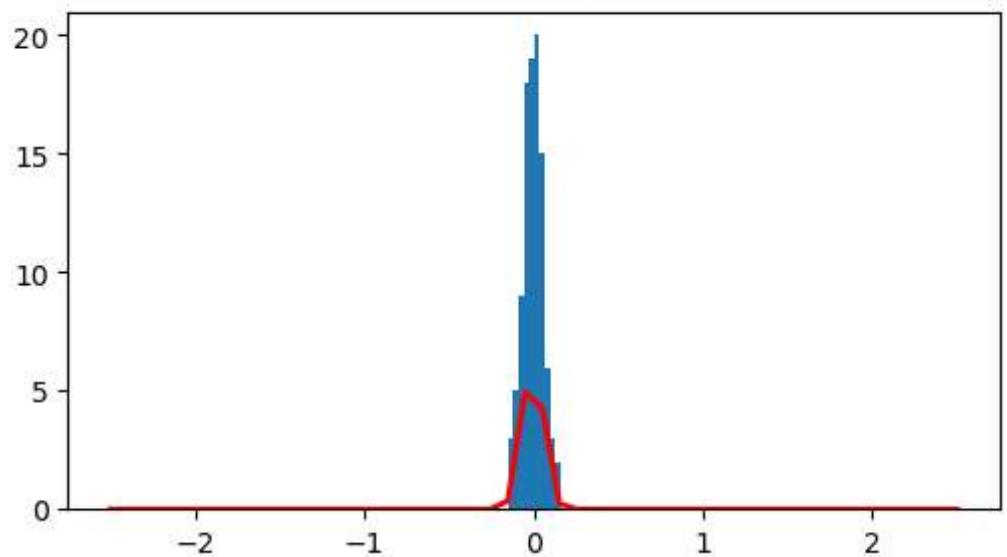


N = 258

Média = -0.0054144007076796265

Variância = 0.0037610363126185753

N = 258

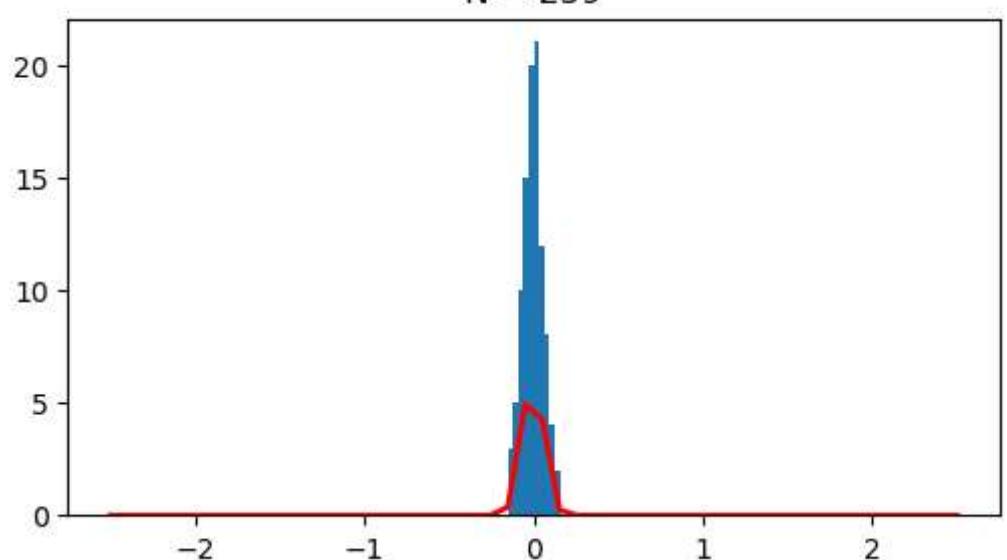


N = 259

Média = -0.005473464026363152

Variância = 0.0038150512008873396

N = 259

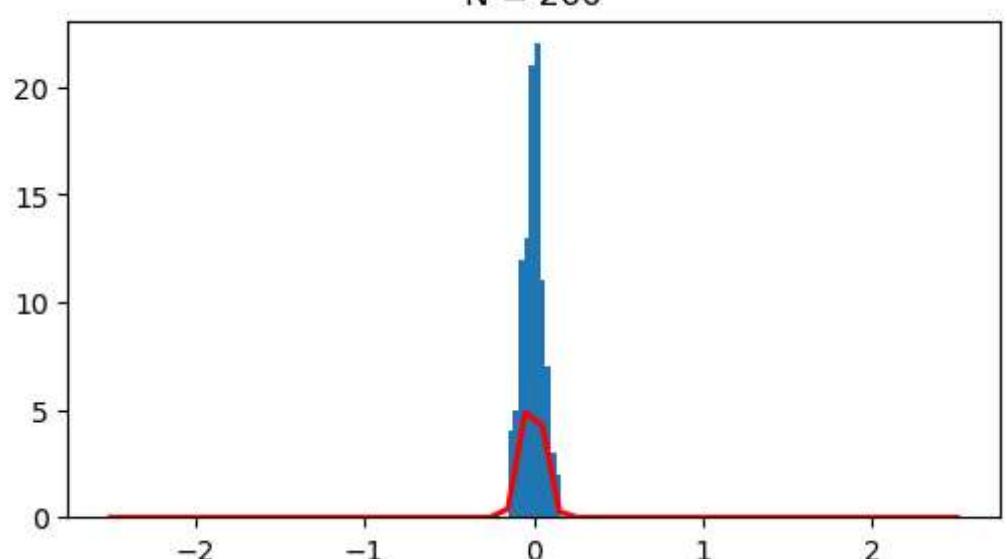


N = 260

Média = -0.005111321465052658

Variância = 0.00393099797565075

N = 260

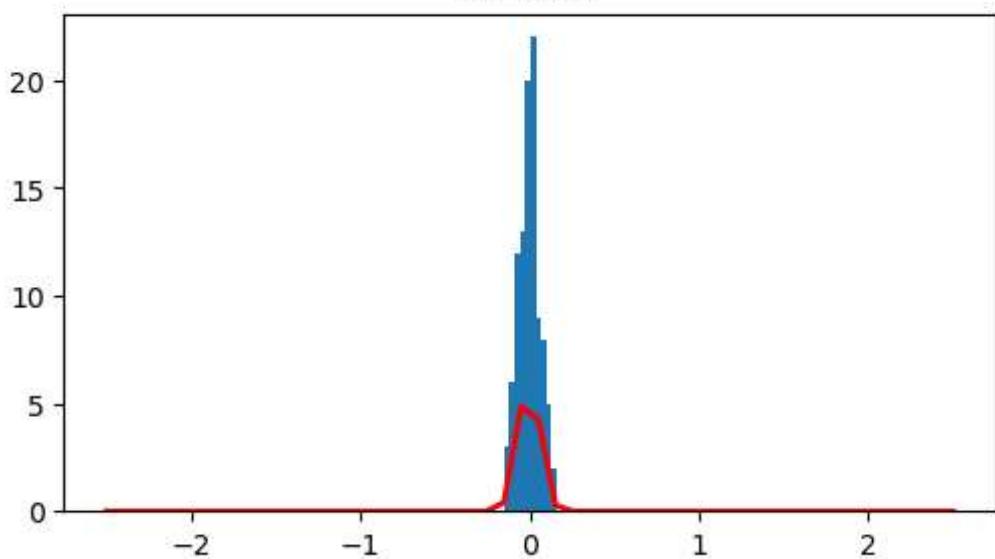


N = 261

Média = -0.005094994825695146

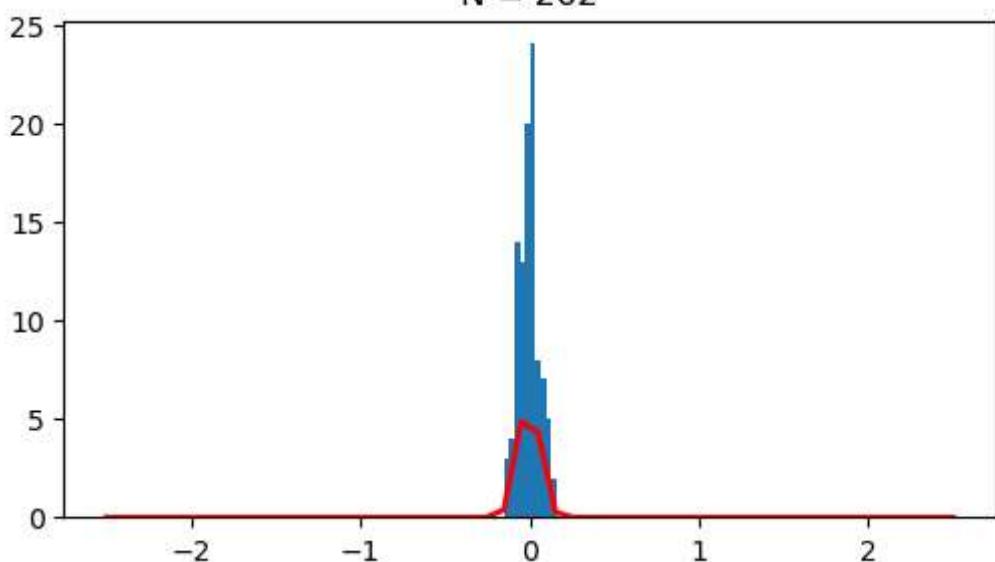
Variância = 0.003973793598317598

N = 261



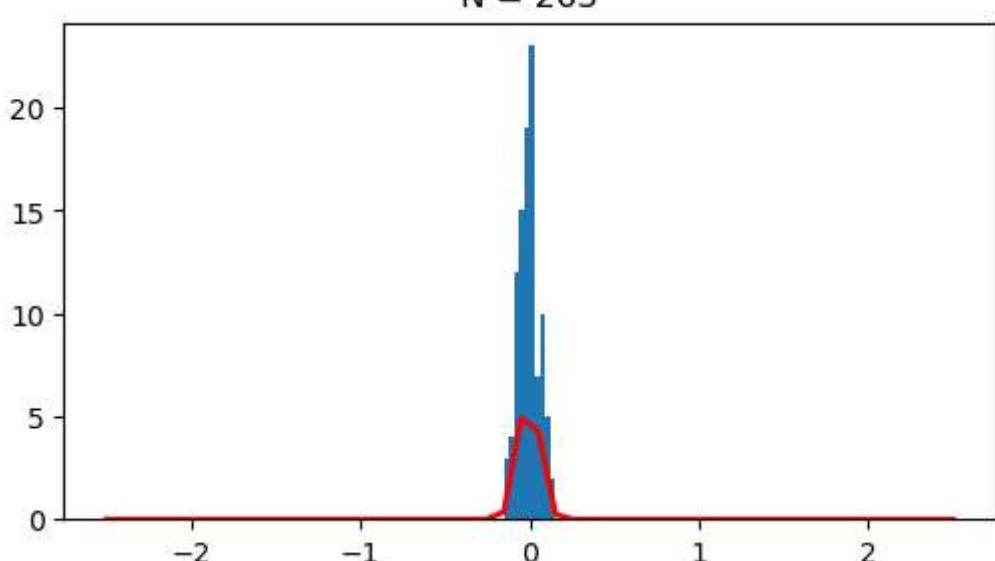
N = 262 Média = -0.00472543493512123 Variância = 0.00391208013626414

N = 262



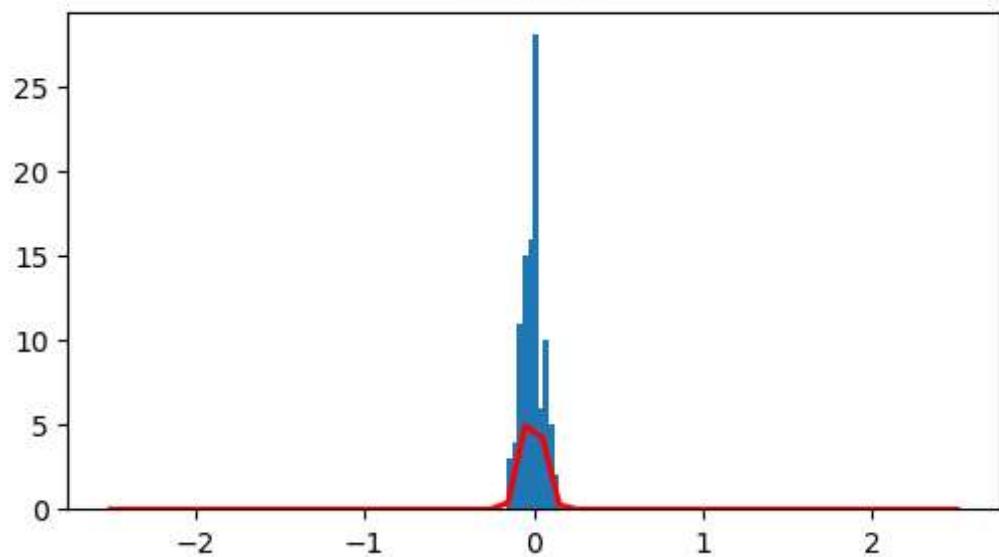
N = 263 Média = -0.0051296290014700265 Variância = 0.0038088709608218134

N = 263



N = 264 Média = -0.005505893175442992 Variância = 0.0038473070933721077

N = 264

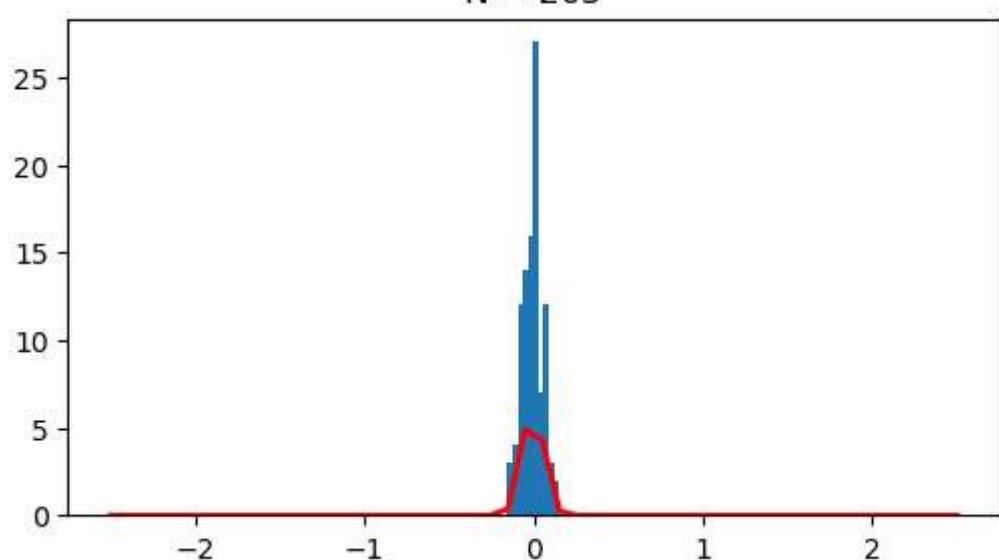


N = 265

Média = -0.0051388670651322885

Variância = 0.003821985391054671

N = 265

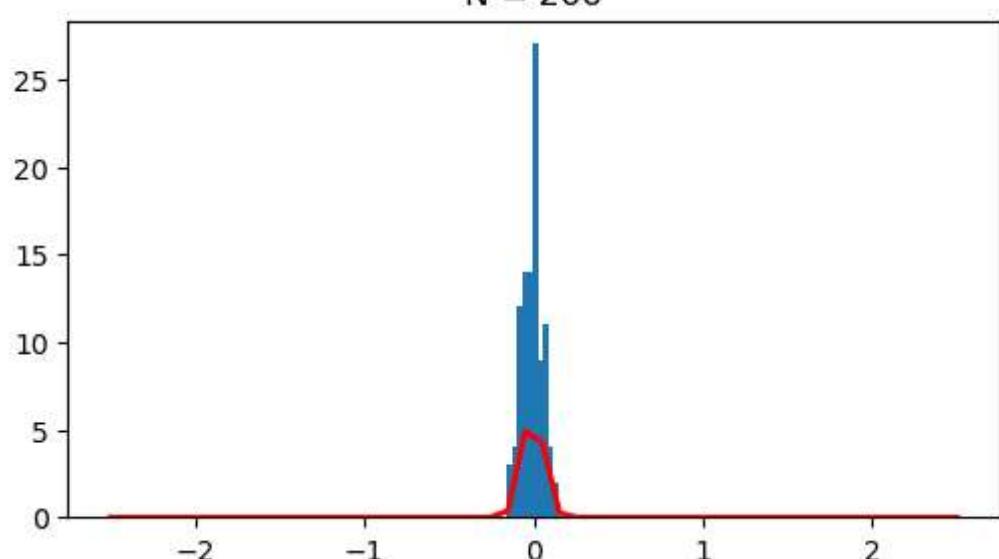


N = 266

Média = -0.005346445155089914

Variância = 0.0038275870651292656

N = 266

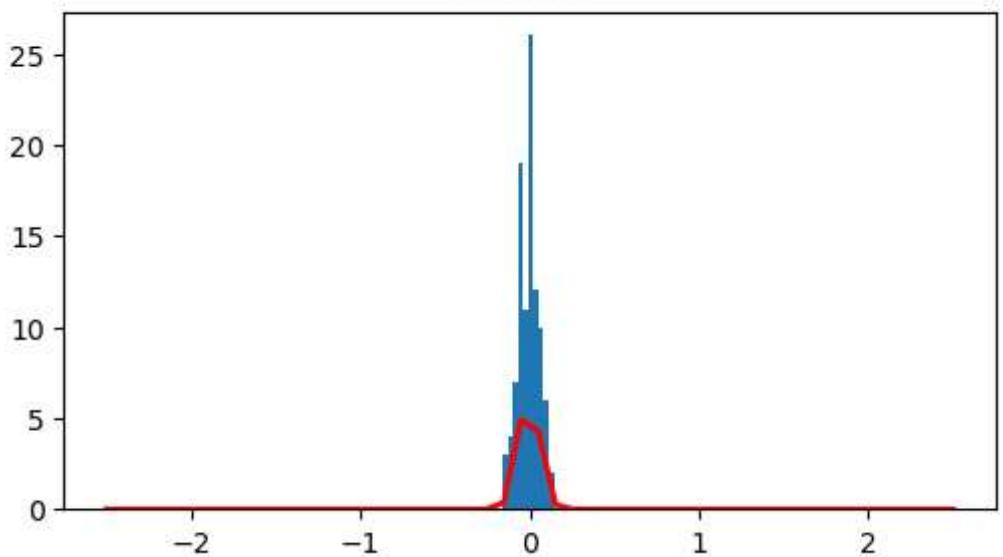


N = 267

Média = -0.005269227823706113

Variância = 0.003812078454642736

N = 267

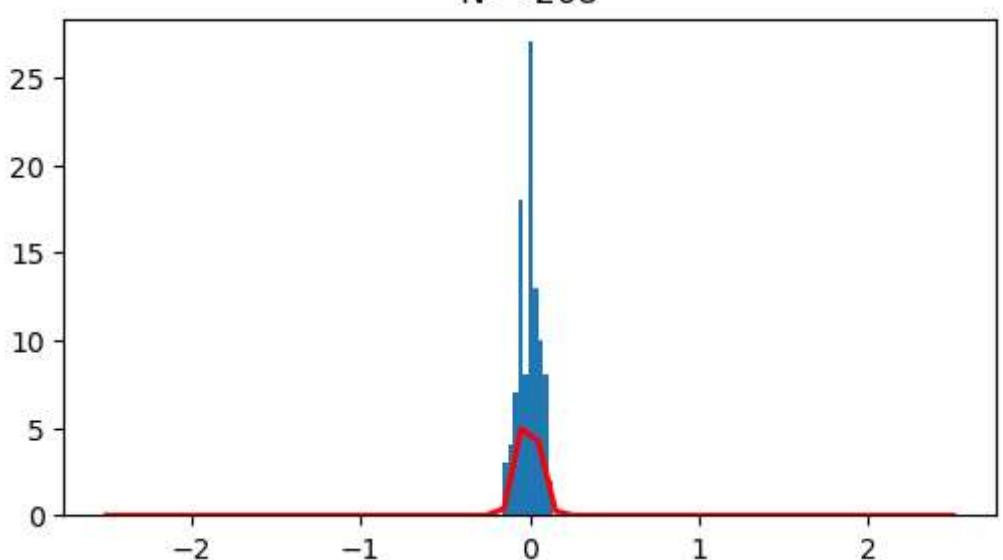


N = 268

Média = -0.005792151314265293

Variância = 0.0038389780283850546

N = 268

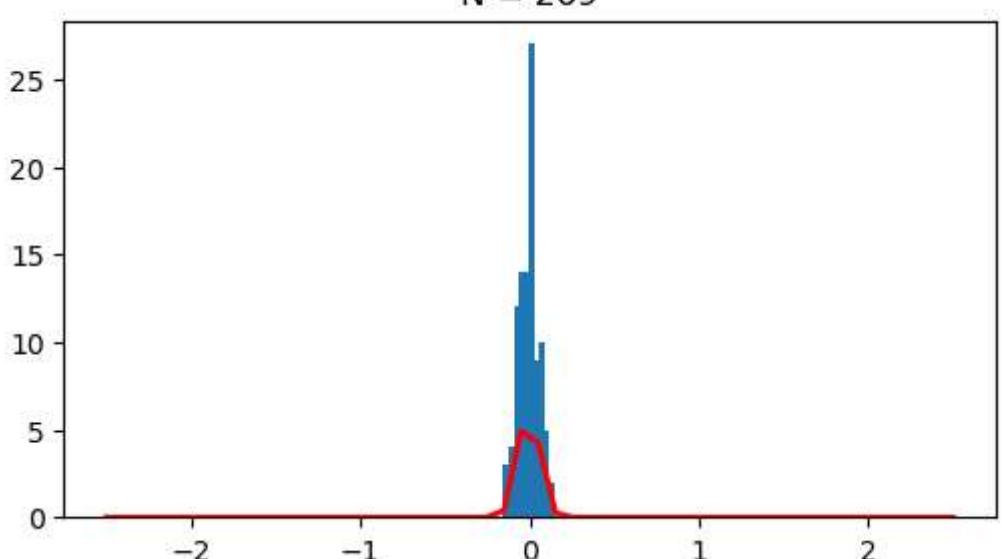


N = 269

Média = -0.005760249836946161

Variância = 0.0038665903937836342

N = 269

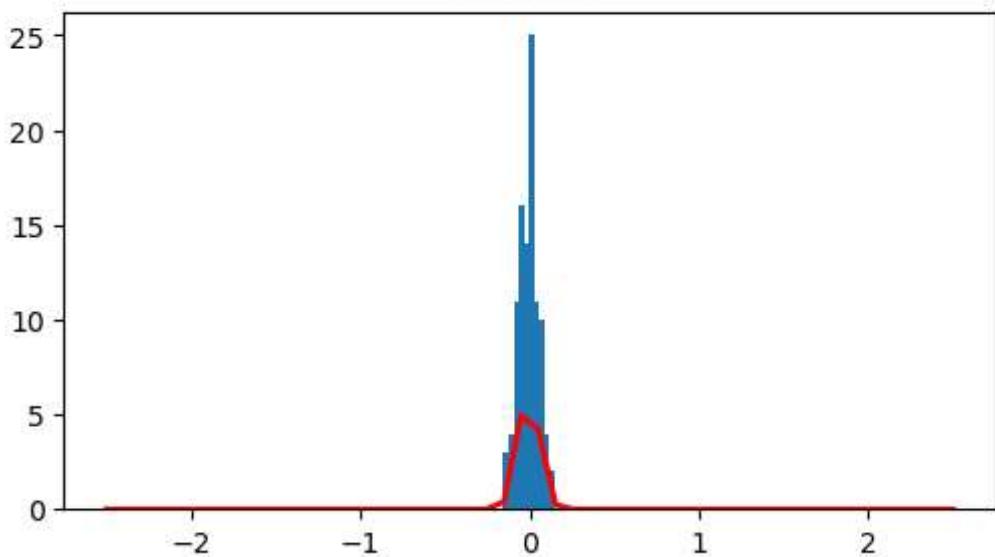


N = 270

Média = -0.006102563716187892

Variância = 0.0038514131197747753

N = 270

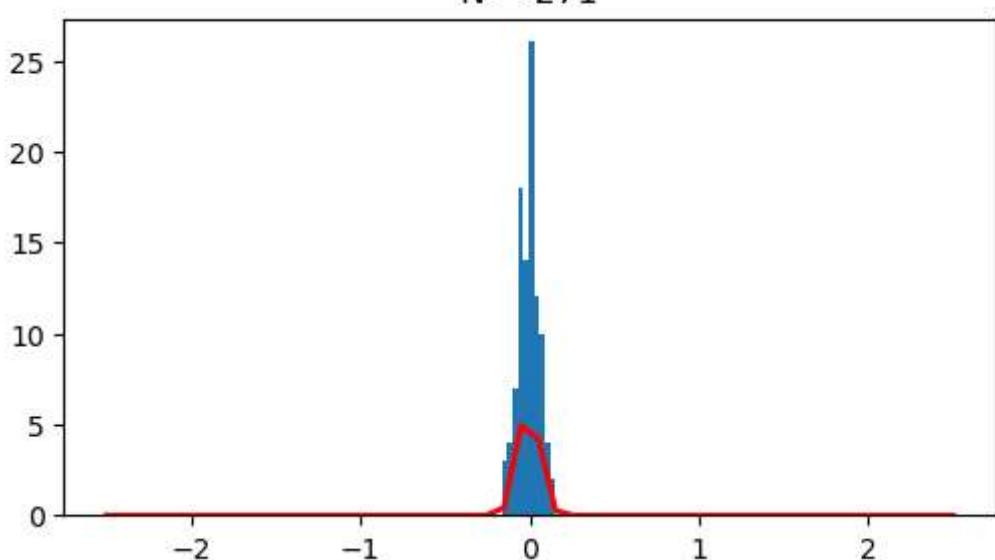


N = 271

Média = -0.006155240786342026

Variância = 0.003950749819365602

N = 271

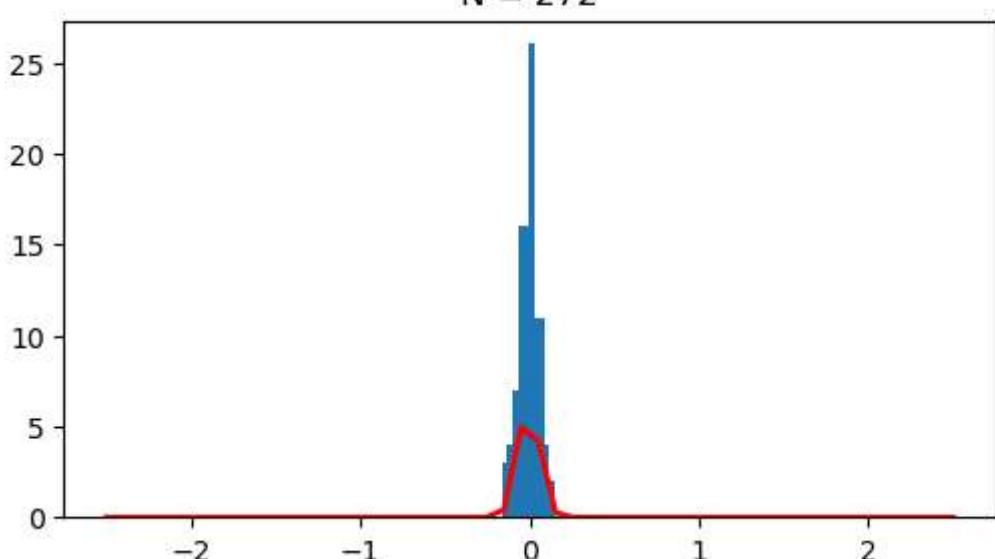


N = 272

Média = -0.00639562652244484

Variância = 0.003950775040940325

N = 272

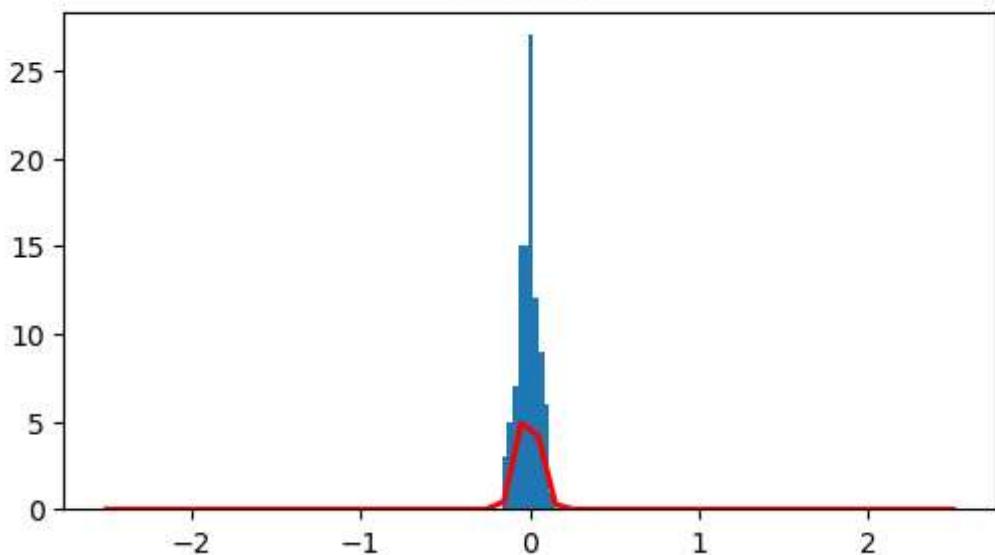


N = 273

Média = -0.006431920385371073

Variância = 0.004029054255986372

N = 273

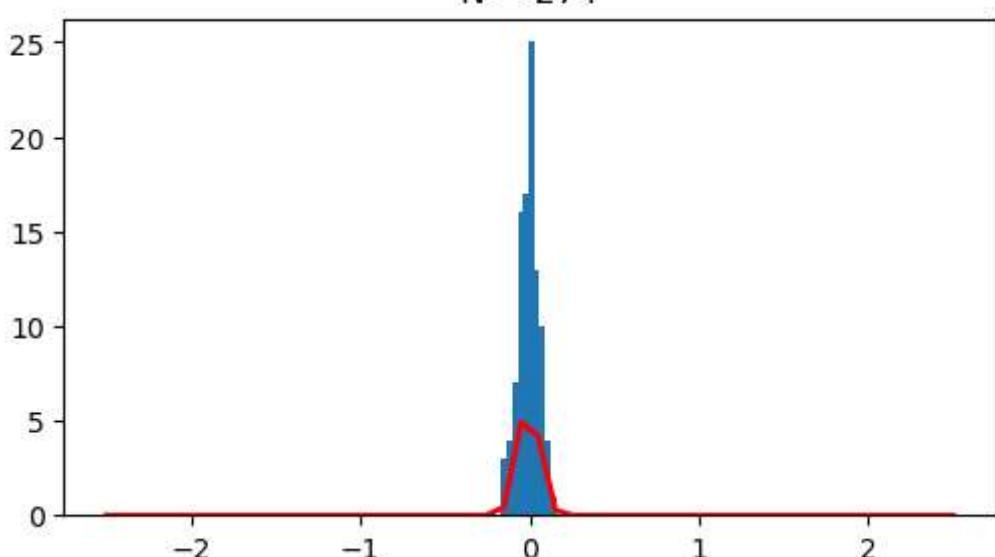


N = 274

Média = -0.006397940826536668

Variância = 0.004014551819888269

N = 274

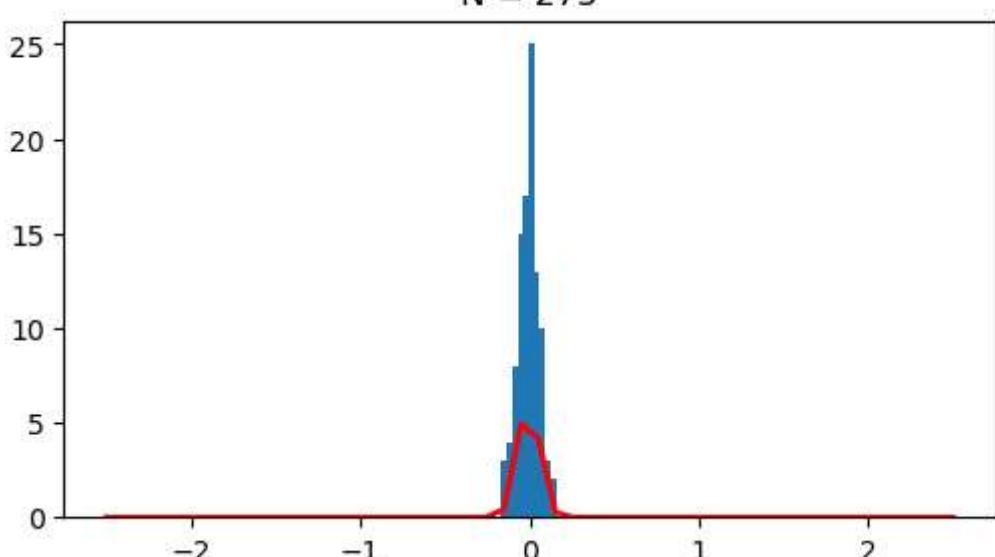


N = 275

Média = -0.006611303538754394

Variância = 0.003988252026825409

N = 275

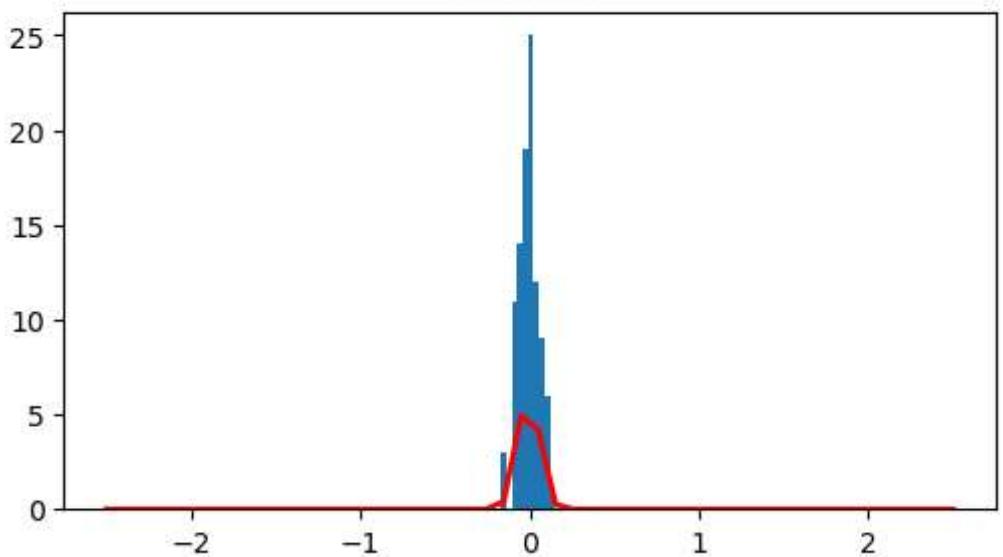


N = 276

Média = -0.006331223417102226

Variância = 0.003948057160492276

N = 276

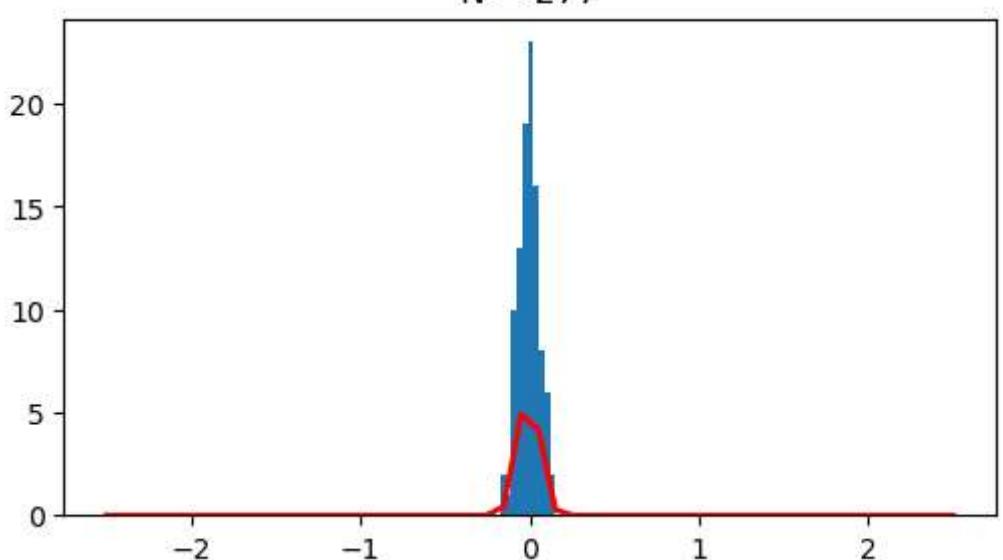


N = 277

Média = -0.0063019515013338885

Variância = 0.004018873251617359

N = 277

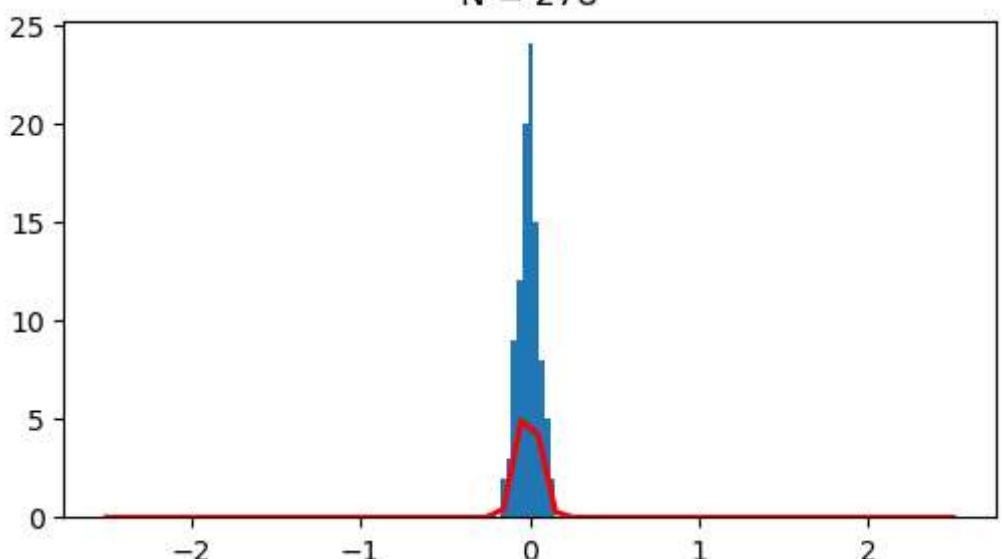


N = 278

Média = -0.006335202303609769

Variância = 0.004043042981570053

N = 278

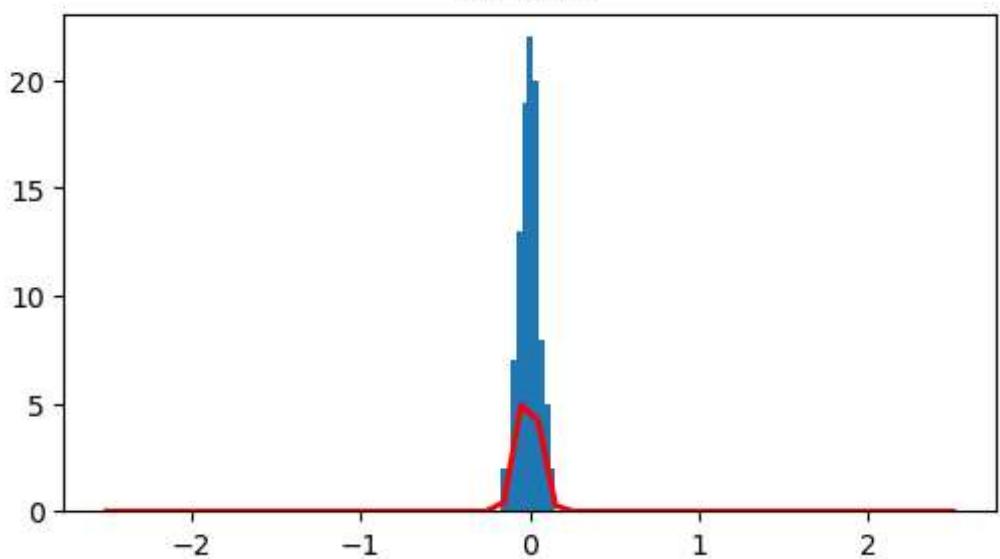


N = 279

Média = -0.0063613286567260575

Variância = 0.003980430608580734

N = 279

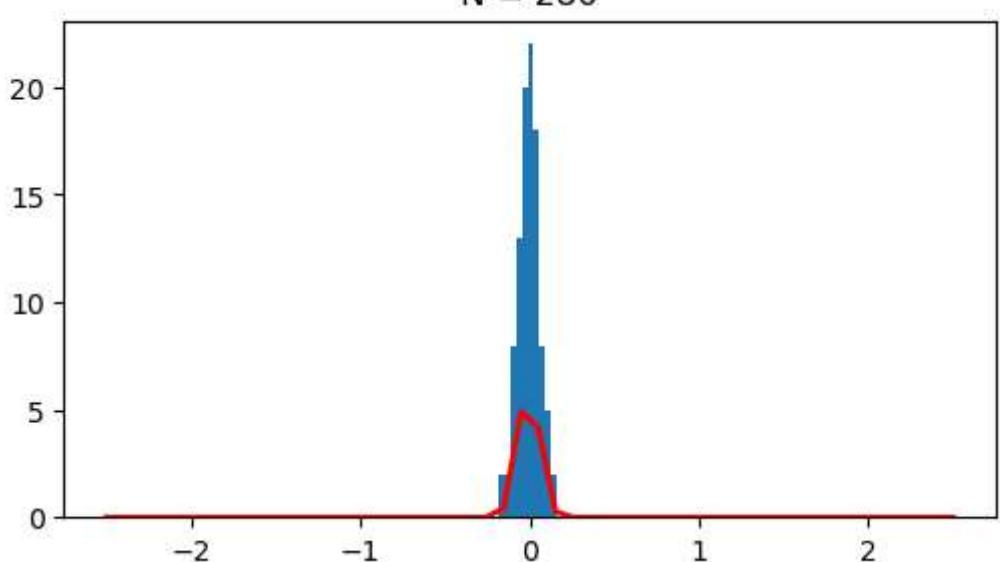


N = 280

Média = -0.006571563958728176

Variância = 0.004052114710999023

N = 280

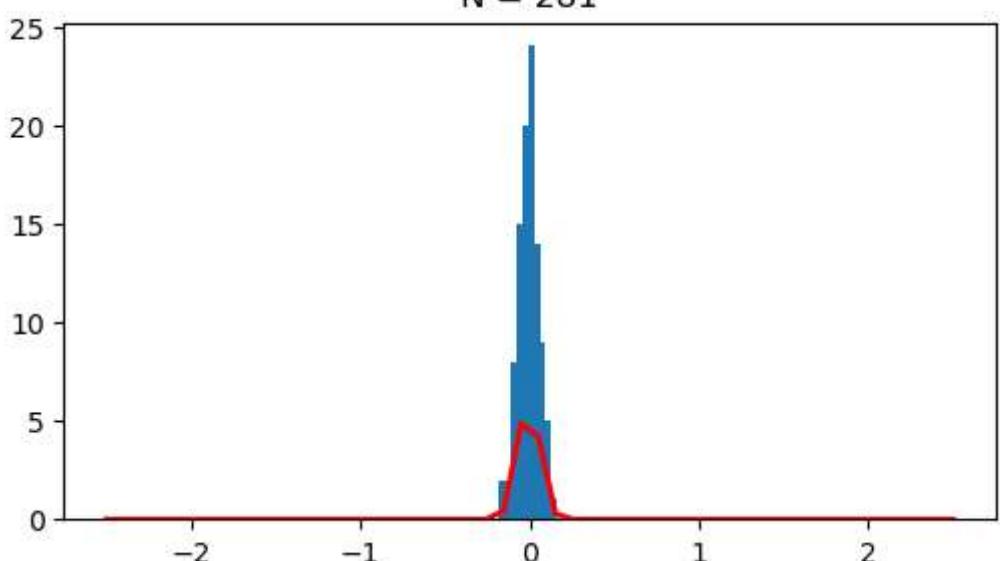


N = 281

Média = -0.0058246830614158305

Variância = 0.004093866906076793

N = 281

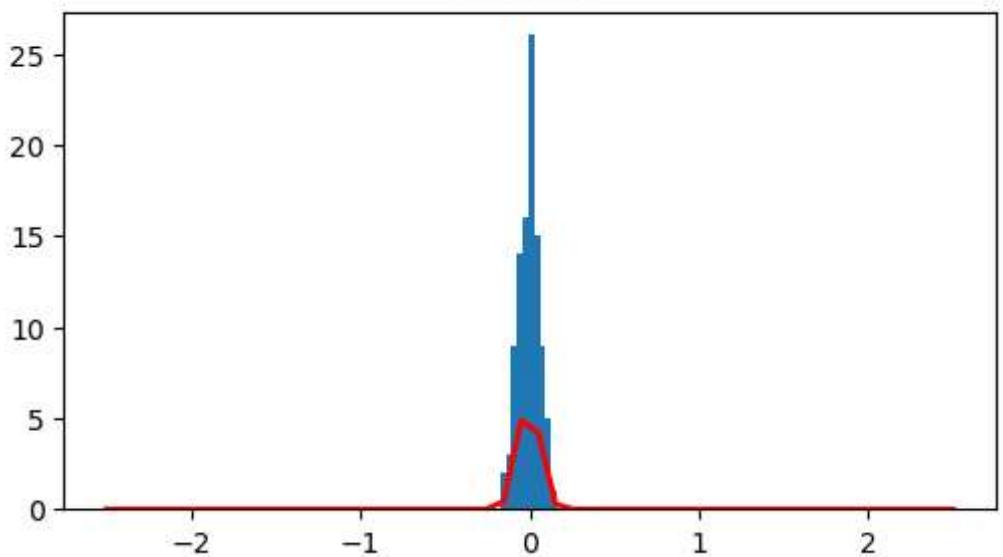


N = 282

Média = -0.0057086589543464605

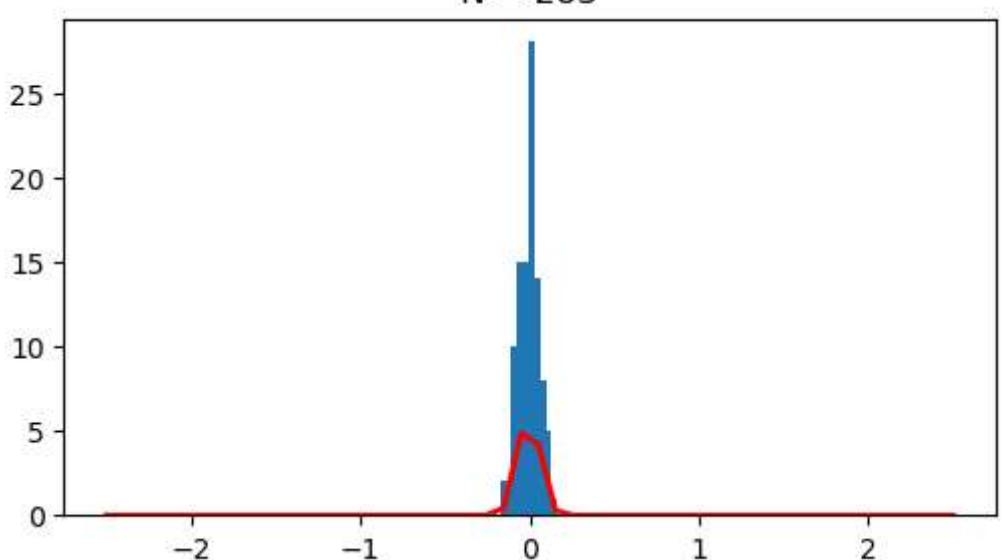
Variância = 0.004060103951071769

N = 282



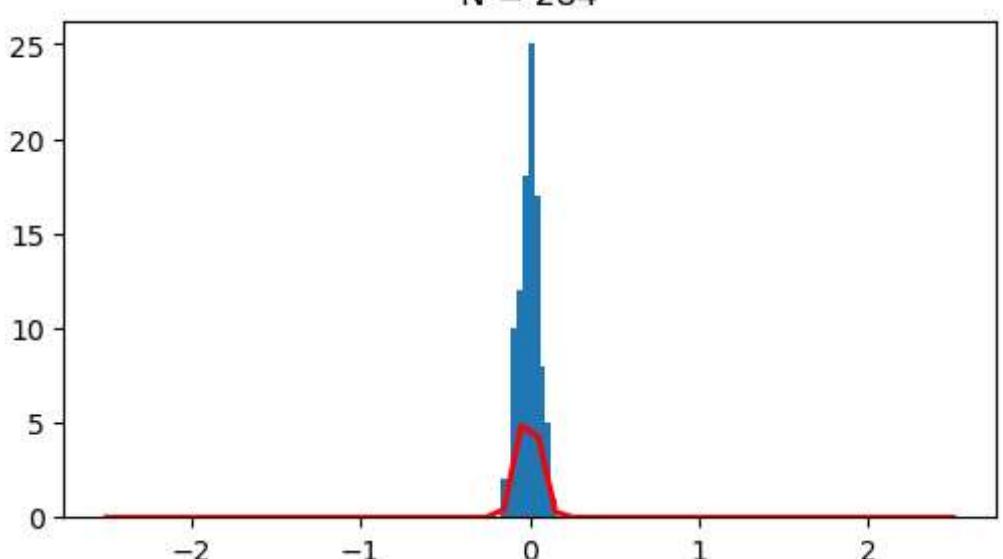
N = 283 Média = -0.00576833114436607 Variância = 0.004091048290136408

N = 283



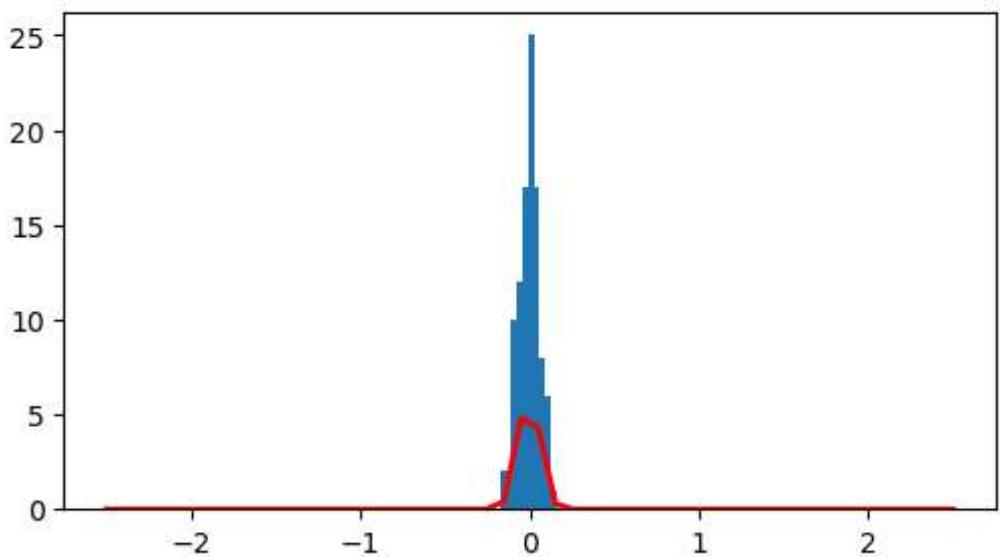
N = 284 Média = -0.00505691333056102 Variância = 0.004036125287643309

N = 284



N = 285 Média = -0.004423290204524472 Variância = 0.004042871801505081

N = 285

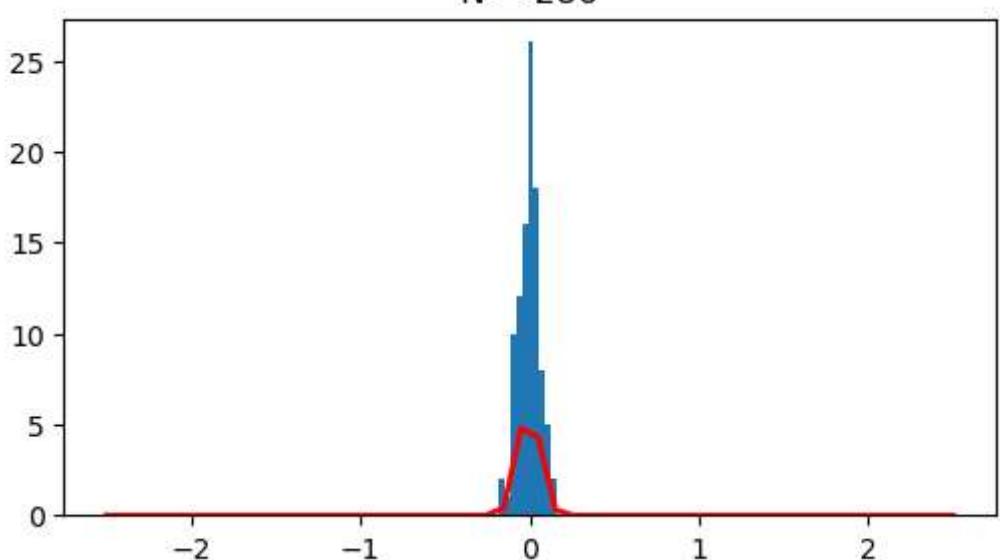


N = 286

Média = -0.004612227220347995

Variância = 0.004096725187861789

N = 286

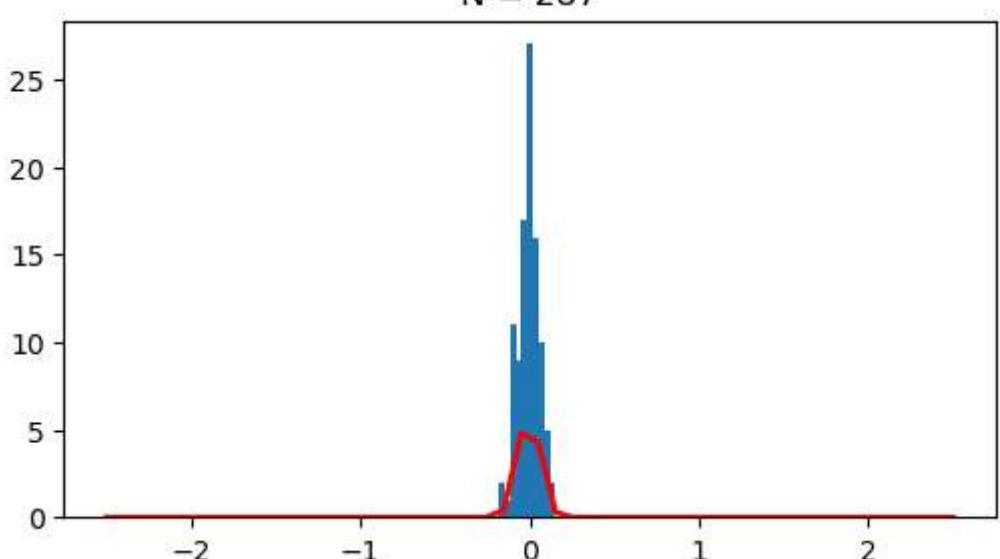


N = 287

Média = -0.004879304516922962

Variância = 0.0040568253247405235

N = 287

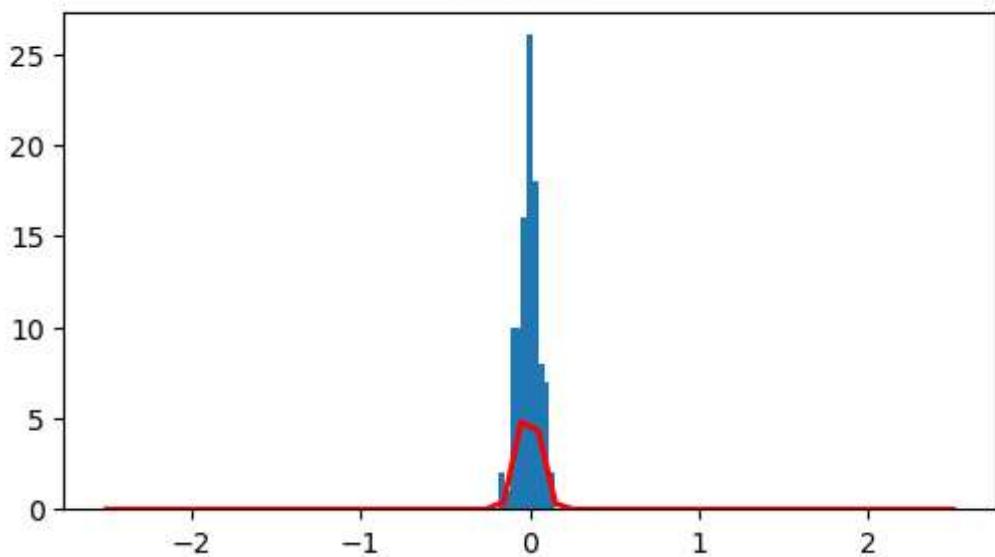


N = 288

Média = -0.004352877285408336

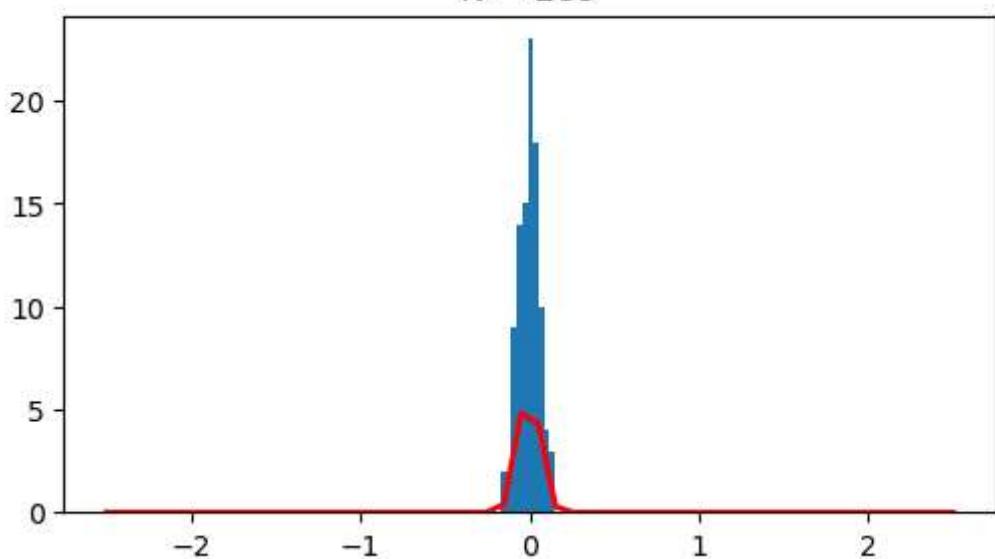
Variância = 0.004079200698215556

N = 288



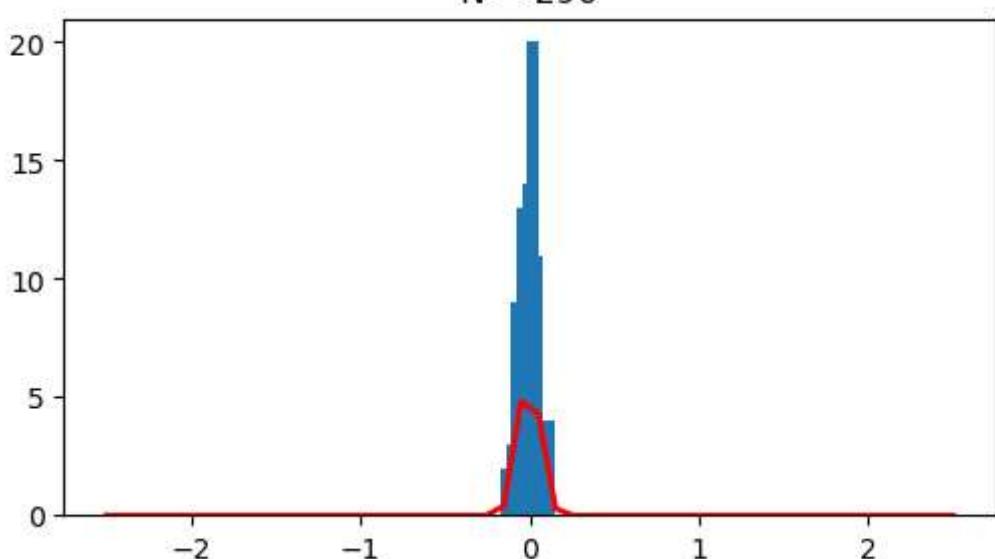
N = 289 Média = -0.004324687011672304 Variância = 0.003964435797214394

N = 289



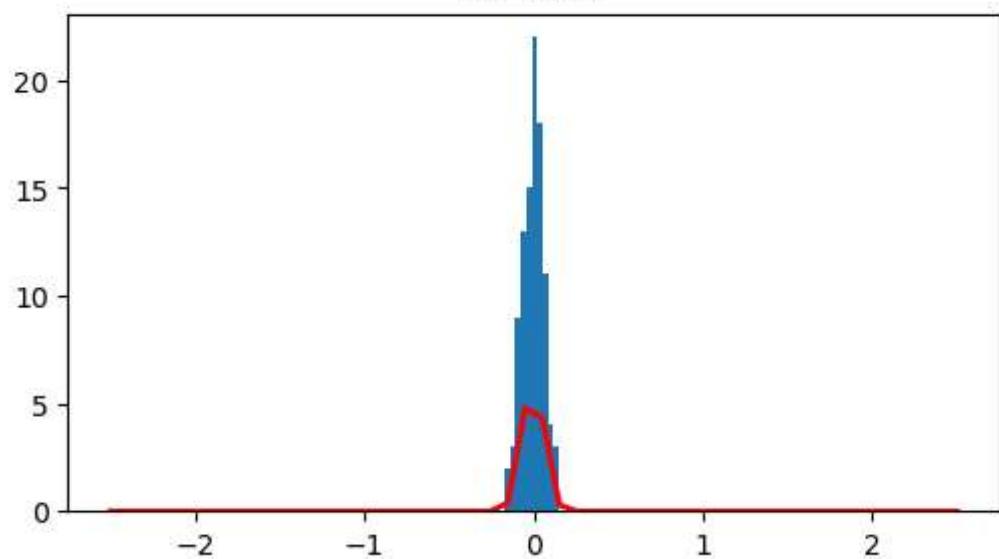
N = 290 Média = -0.004367379346944344 Variância = 0.003990837906248481

N = 290



N = 291 Média = -0.003984433710528357 Variância = 0.003972963292995575

N = 291

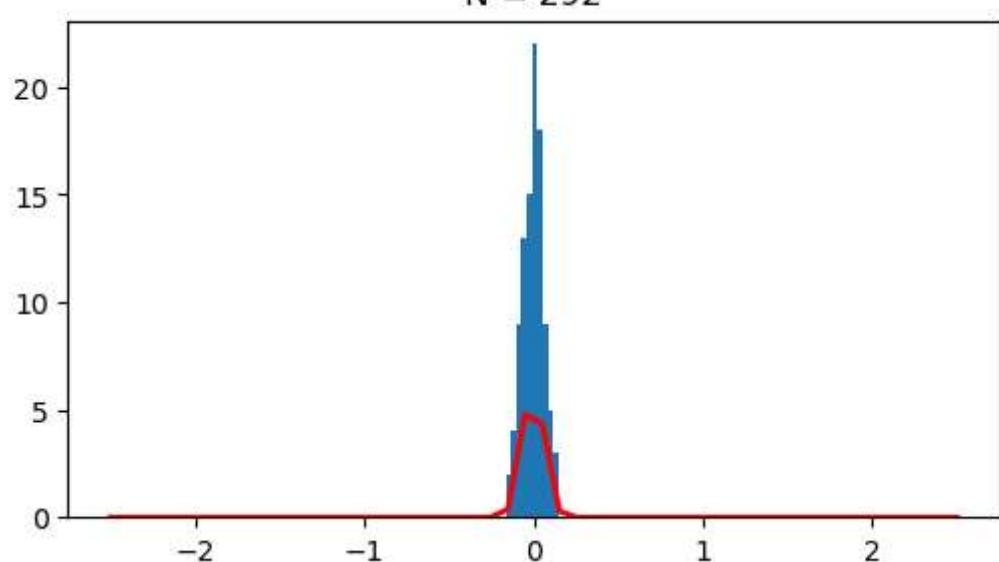


N = 292

Média = -0.0037015989247135583

Variância = 0.003941373532704058

N = 292

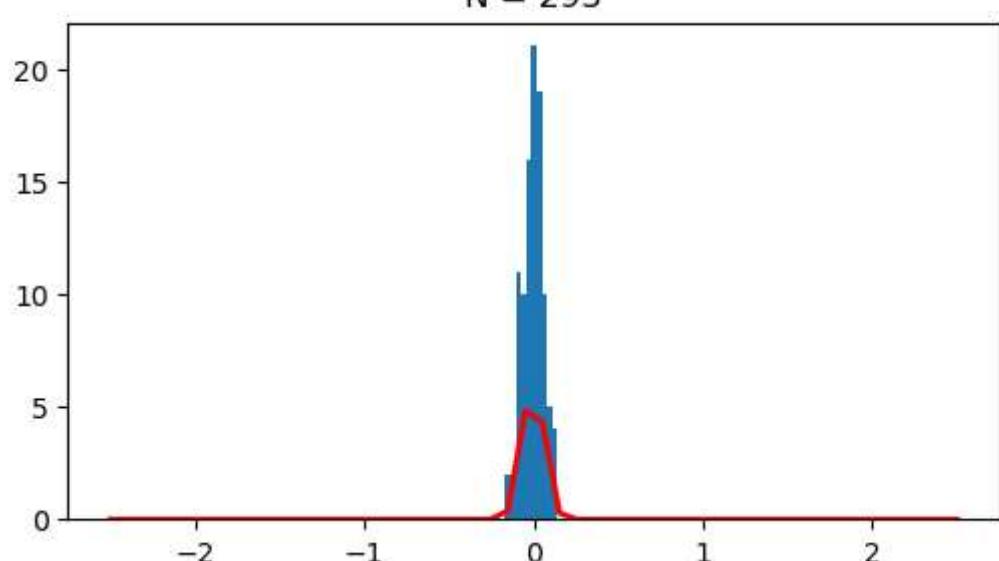


N = 293

Média = -0.004068618500319808

Variância = 0.003928742213035772

N = 293

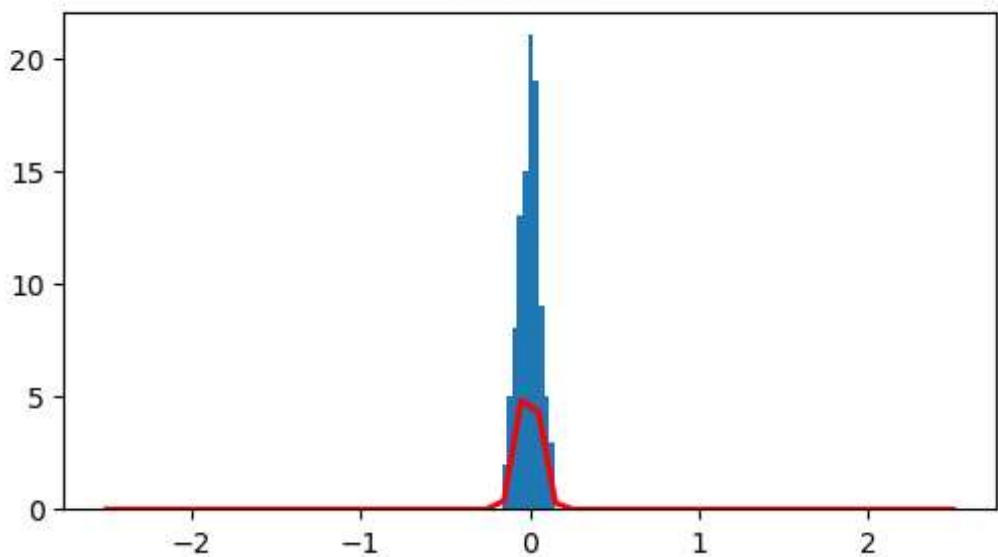


N = 294

Média = -0.00390378740395155

Variância = 0.003917452444126037

N = 294

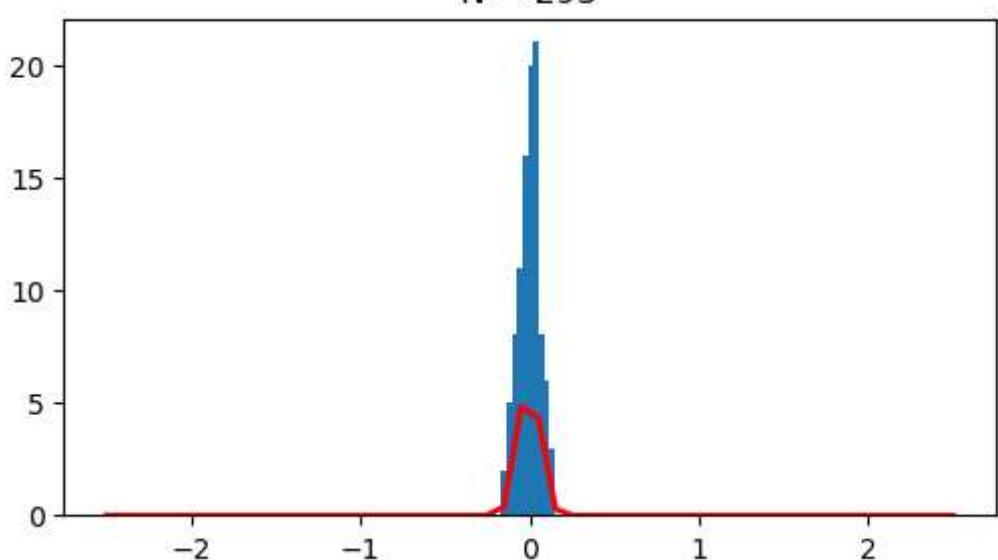


N = 295

Média = -0.003899786399479142

Variância = 0.003923536856506636

N = 295

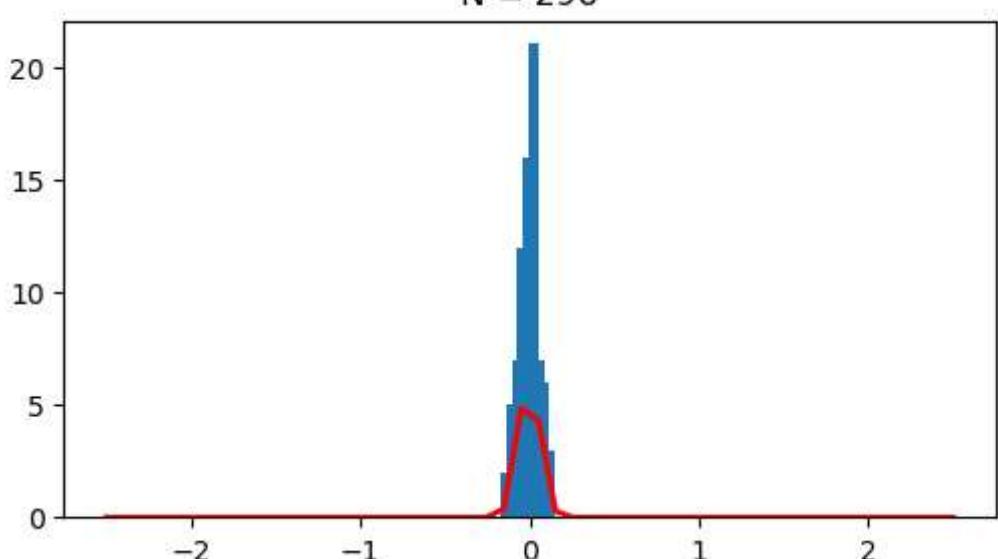


N = 296

Média = -0.0042092616710677775

Variância = 0.003934296052429788

N = 296

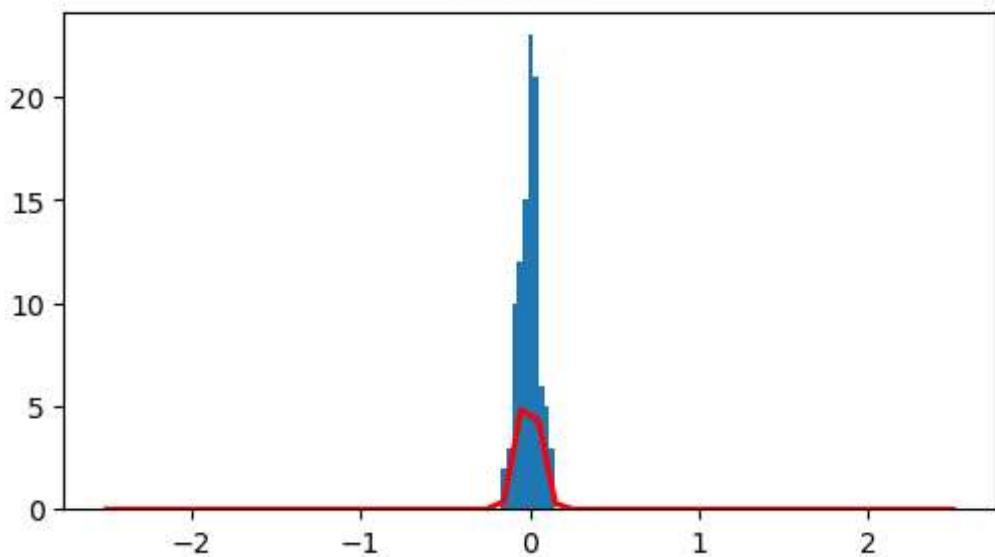


N = 297

Média = -0.00419427292654835

Variância = 0.0039225221377313674

N = 297

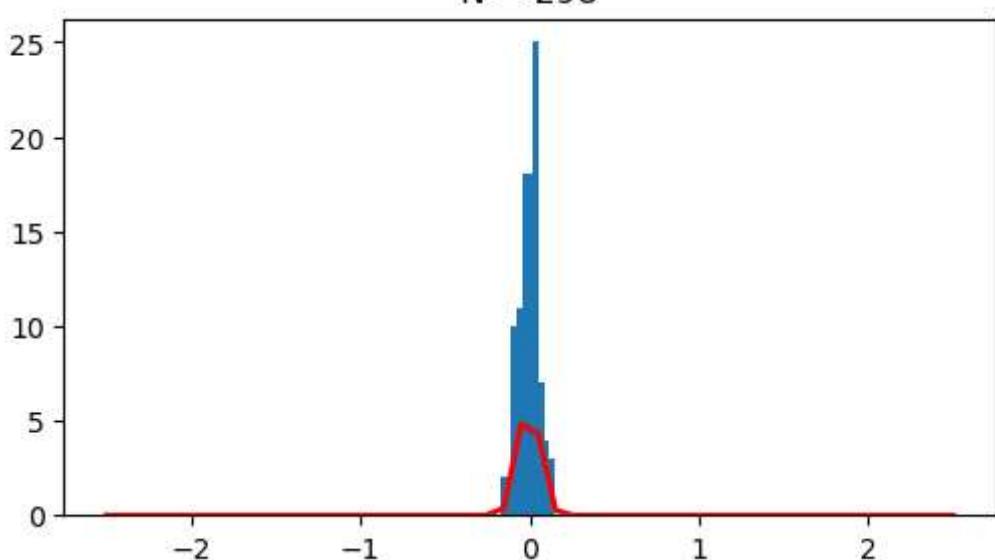


N = 298

Média = -0.004491907250235648

Variância = 0.003939327406560499

N = 298

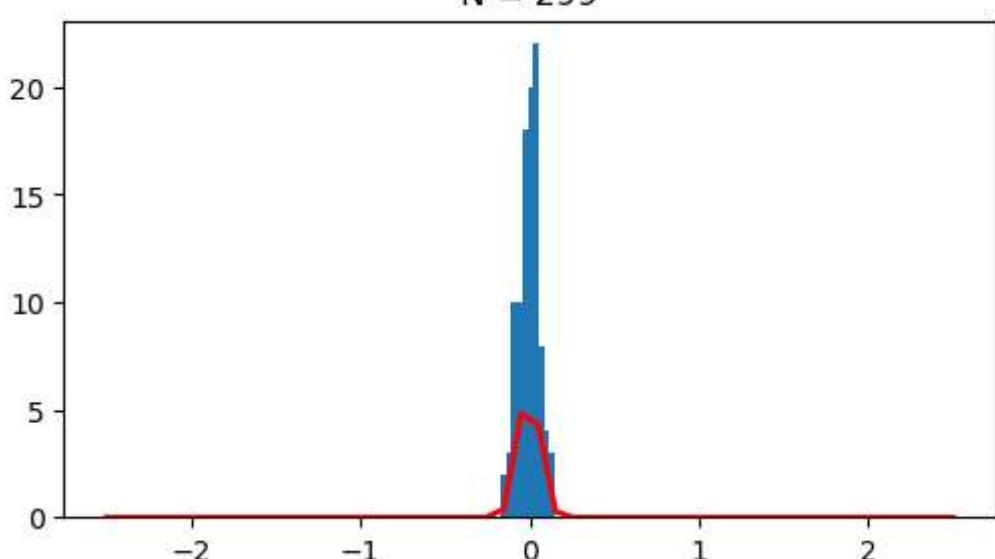


N = 299

Média = -0.004460333412343437

Variância = 0.003953742217017991

N = 299

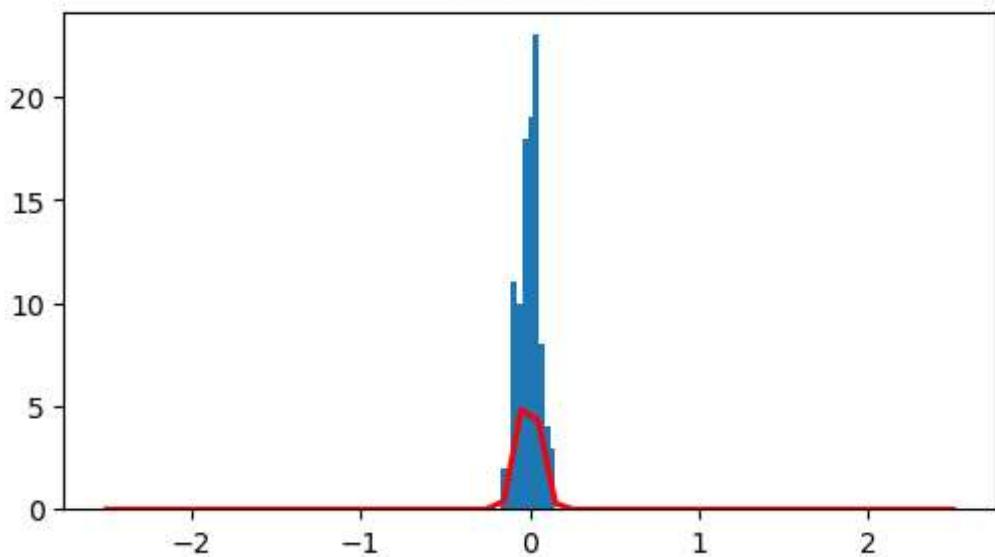


N = 300

Média = -0.0044285330135925794

Variância = 0.003972722805851163

N = 300

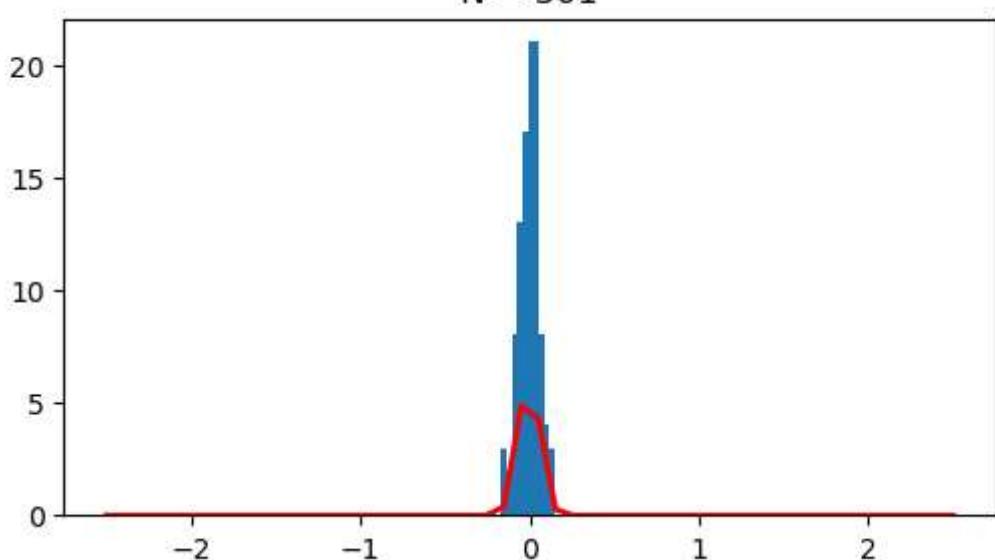


N = 301

Média = -0.004690448415237982

Variância = 0.003929868814327791

N = 301

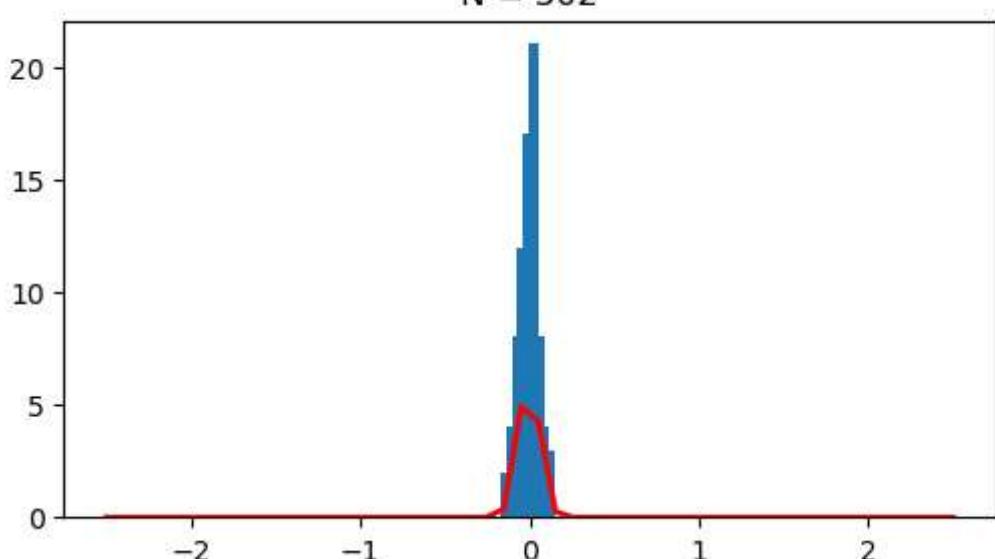


N = 302

Média = -0.005232764455273744

Variância = 0.003854180074608036

N = 302

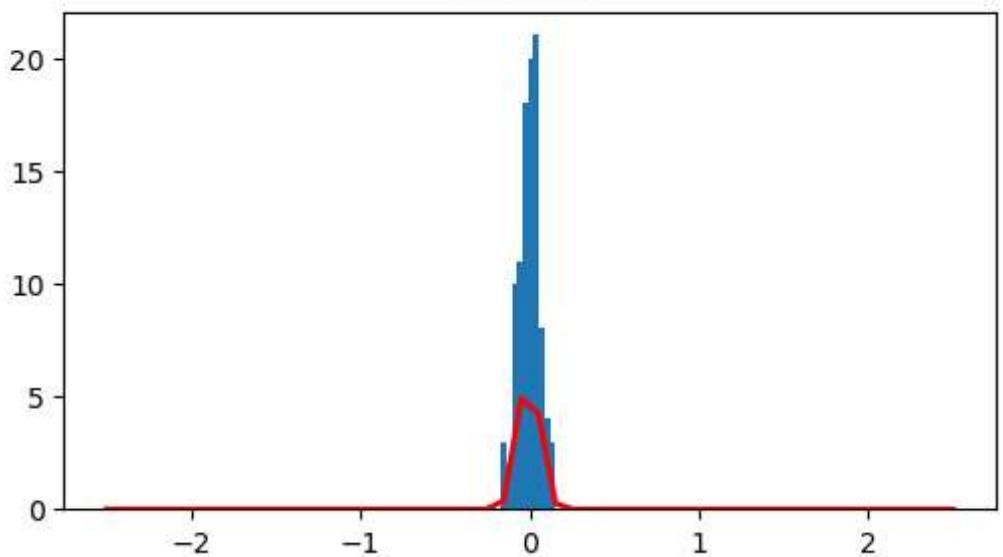


N = 303

Média = -0.005410073488291296

Variância = 0.0038840042540066446

N = 303

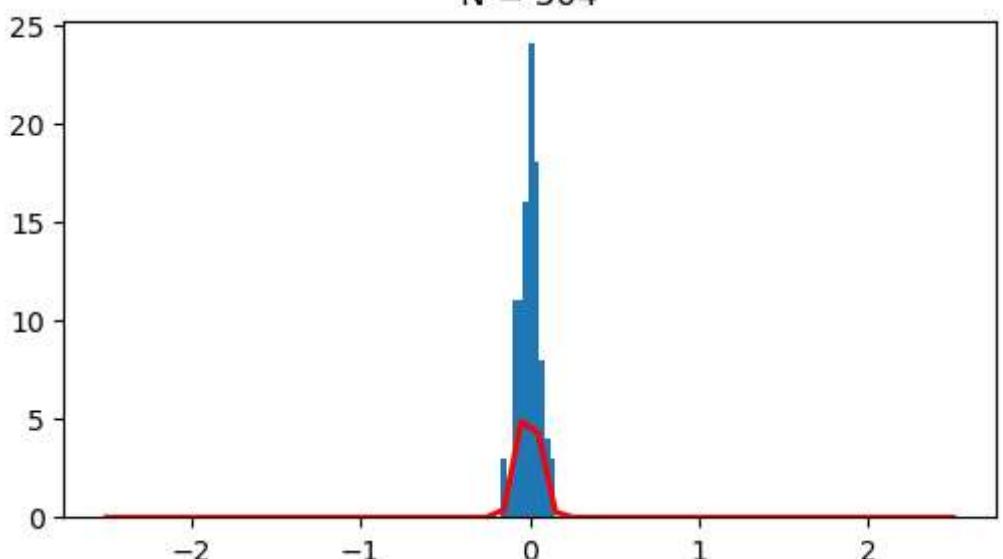


N = 304

Média = -0.004927208849334374

Variância = 0.003924642437022582

N = 304

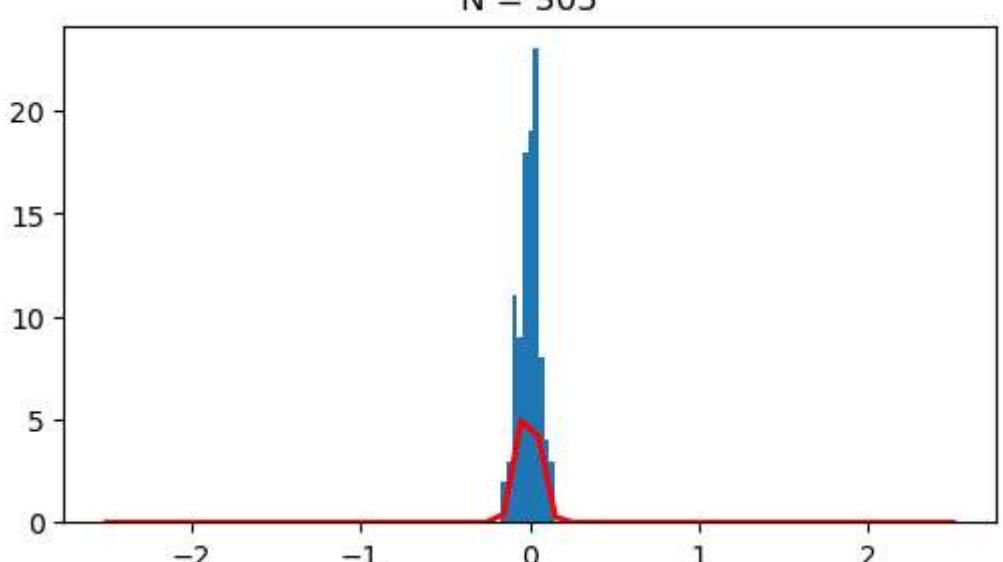


N = 305

Média = -0.006151340883369446

Variância = 0.003899143780311067

N = 305

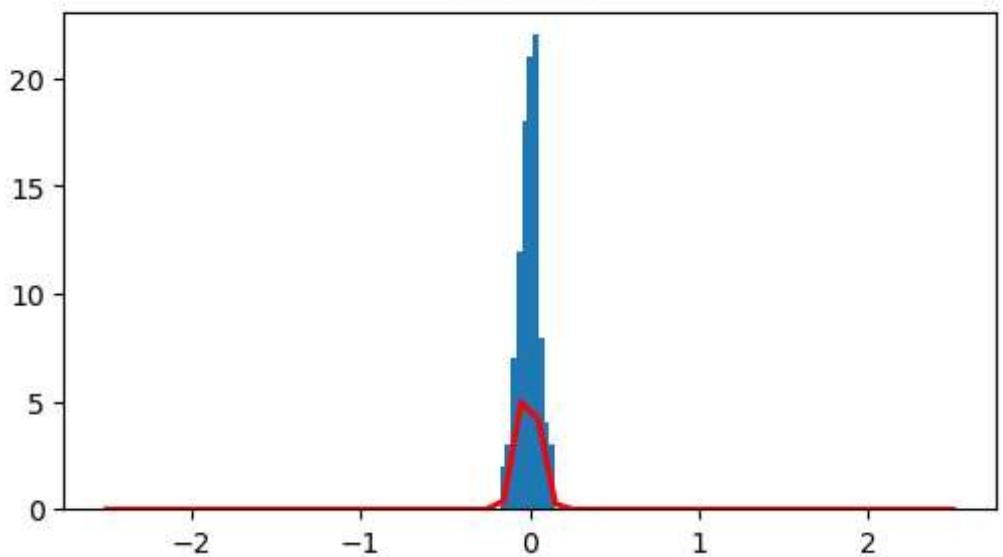


N = 306

Média = -0.006689173580313659

Variância = 0.0038581189737683735

N = 306

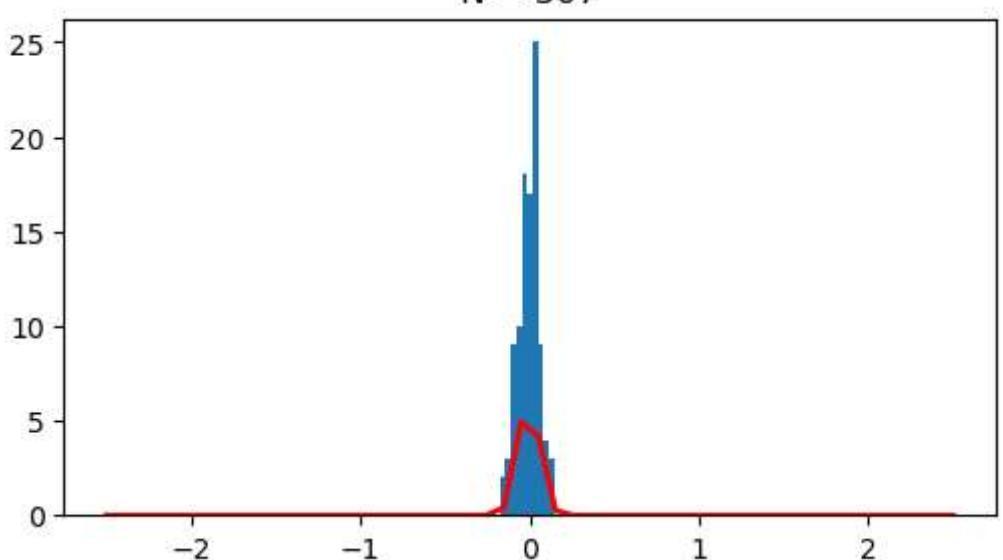


N = 307

Média = -0.006167895712696724

Variância = 0.00394543465794575

N = 307

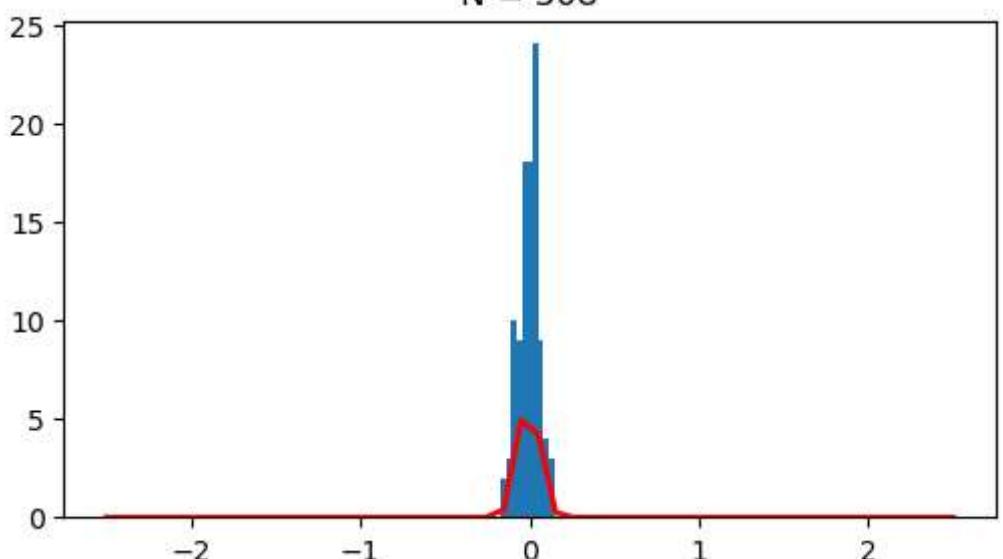


N = 308

Média = -0.006029963252394122

Variância = 0.00391012219764901

N = 308

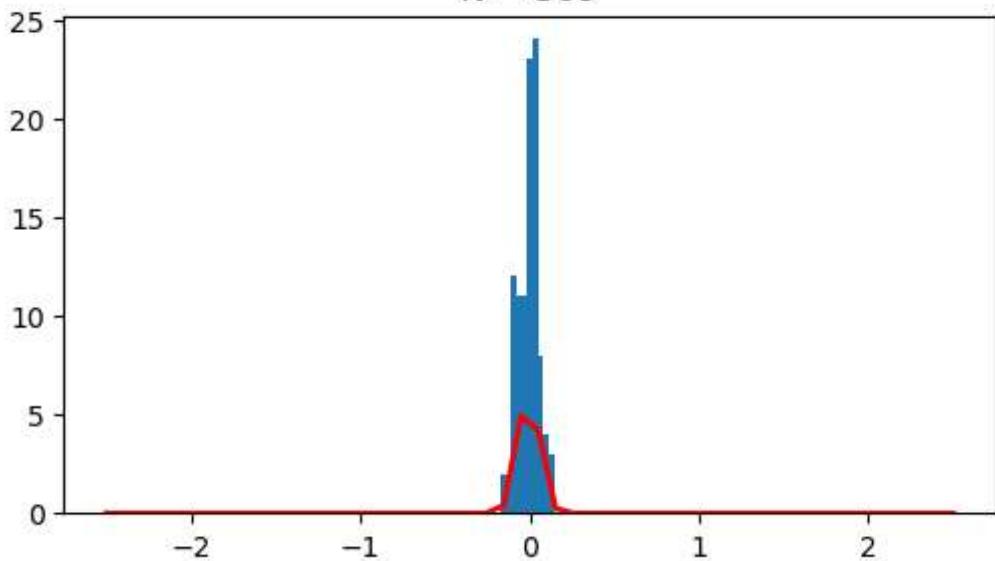


N = 309

Média = -0.006162511922376089

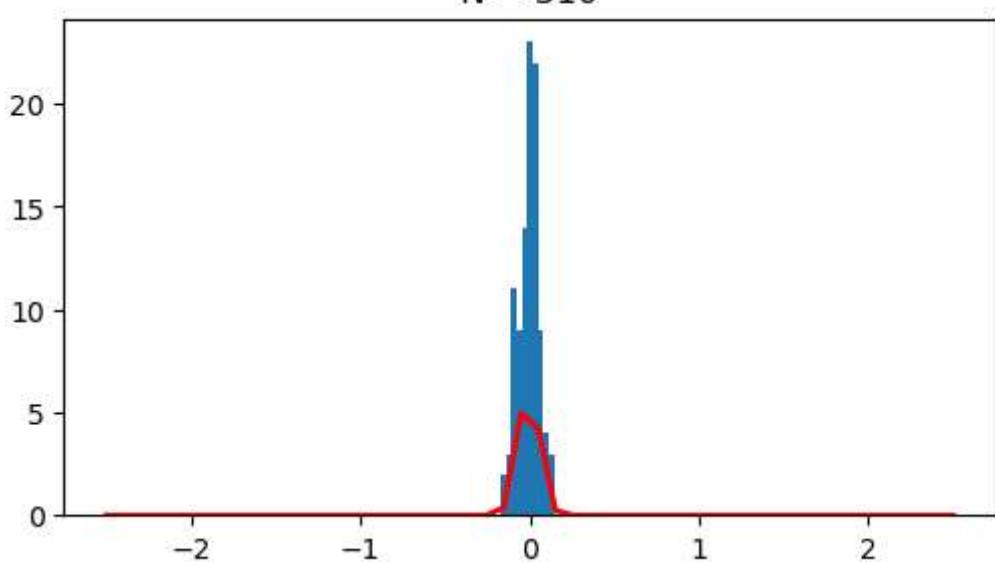
Variância = 0.0038947751483607517

N = 309



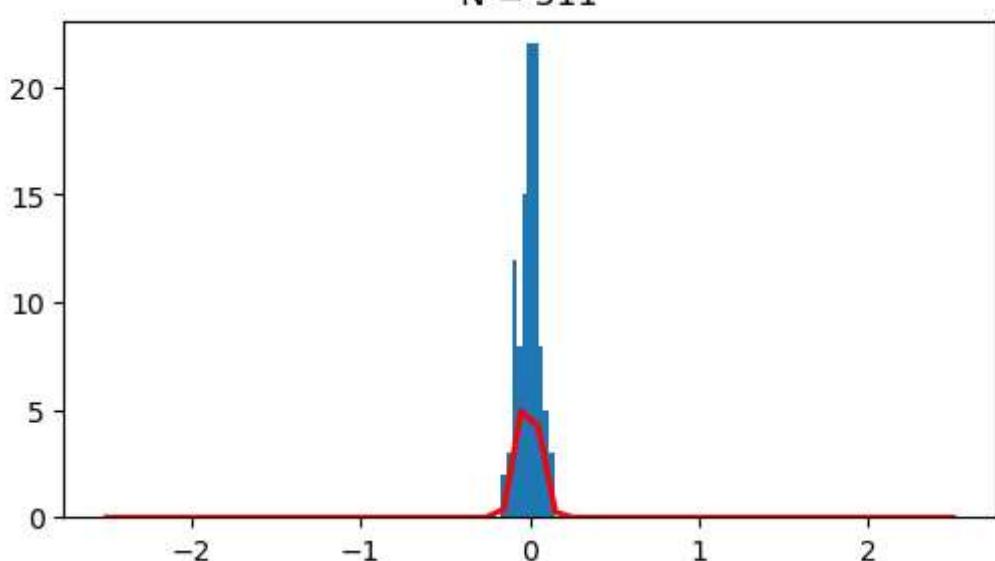
N = 310 Média = -0.006109835792674271 Variância = 0.00381865615618853

N = 310



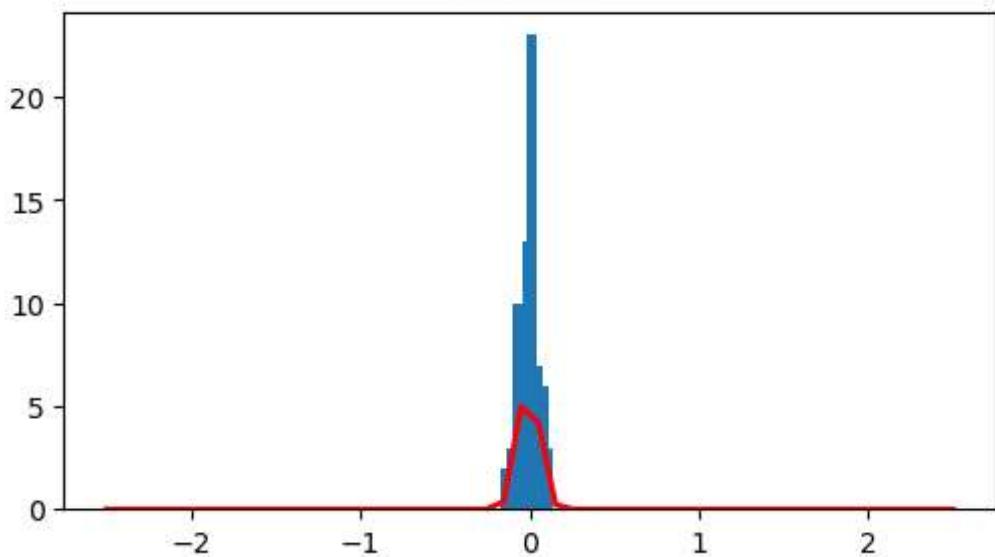
N = 311 Média = -0.006209971884773595 Variância = 0.0038344543605739276

N = 311



N = 312 Média = -0.006366056419638094 Variância = 0.0037814120938530565

N = 312

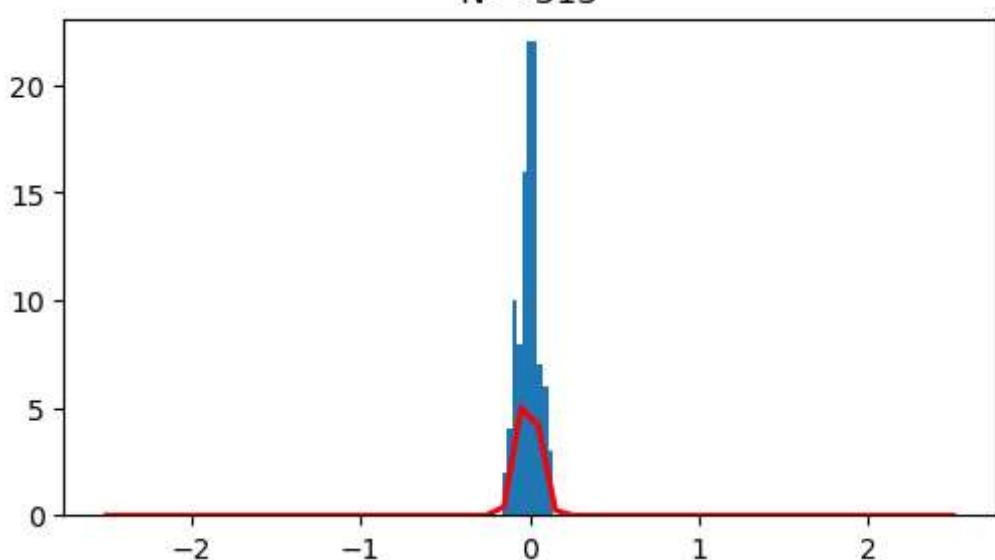


N = 313

Média = -0.006970155802211637

Variância = 0.003818638682051136

N = 313

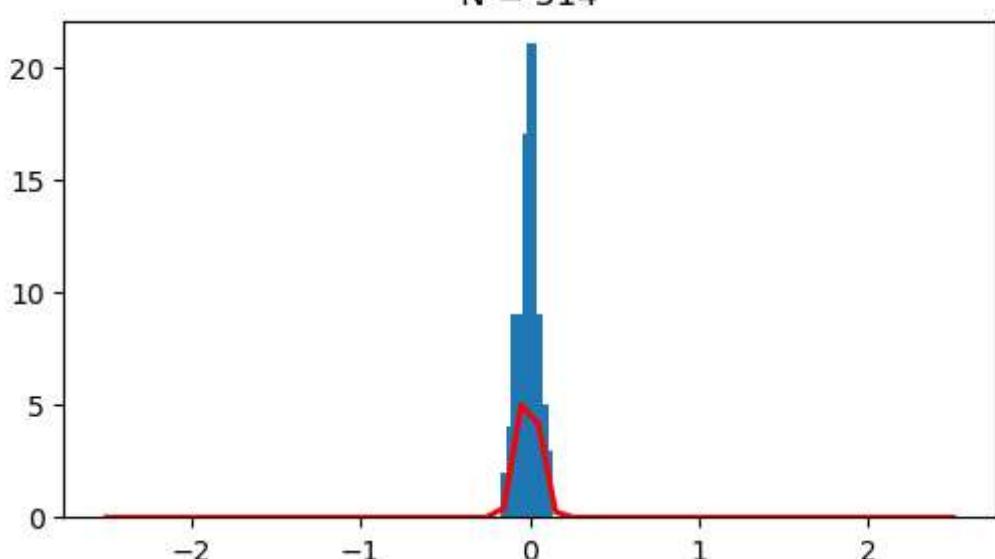


N = 314

Média = -0.006871032483338964

Variância = 0.003917794869516144

N = 314

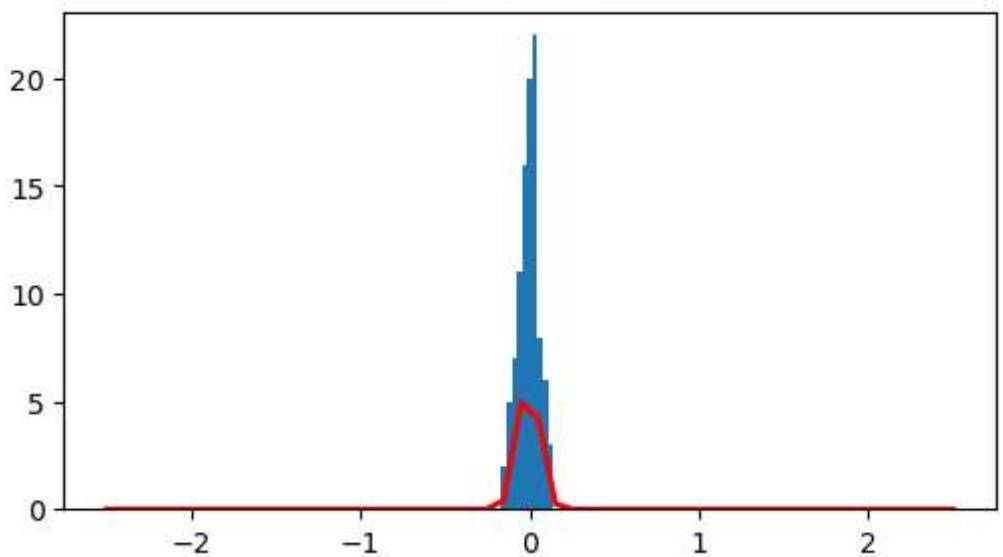


N = 315

Média = -0.0066202835397859575

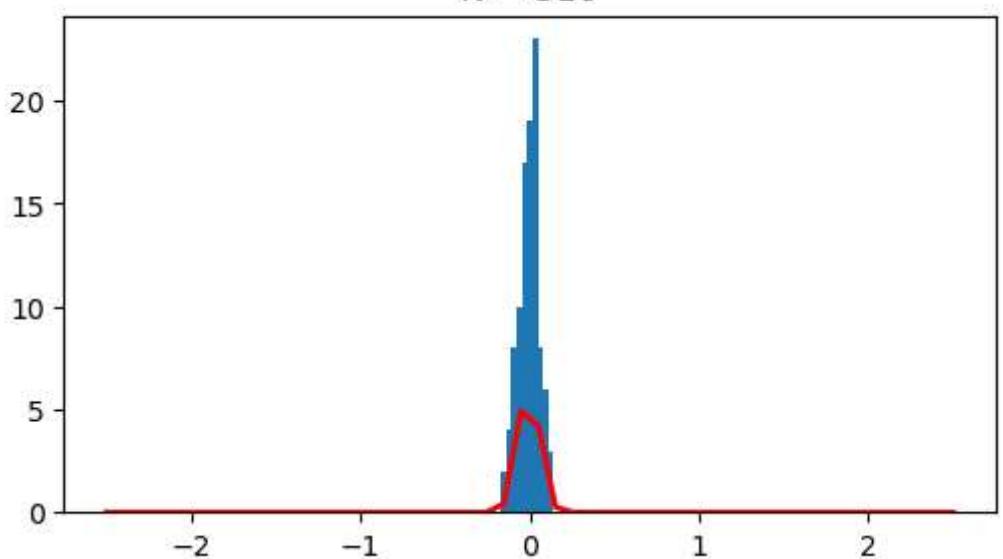
Variância = 0.003917251017694788

N = 315



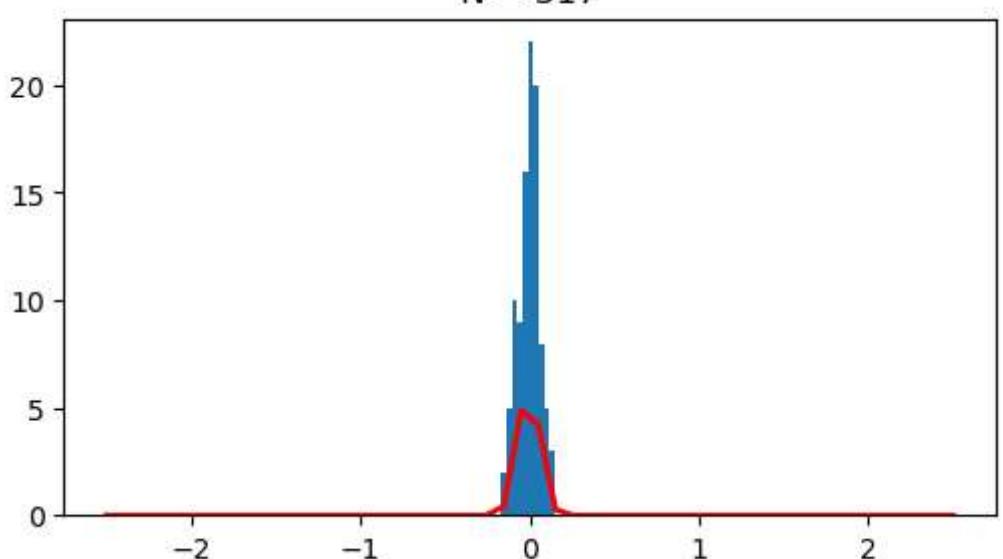
N = 316 Média = -0.0062445670263706924 Variância = 0.003958190771072261

N = 316



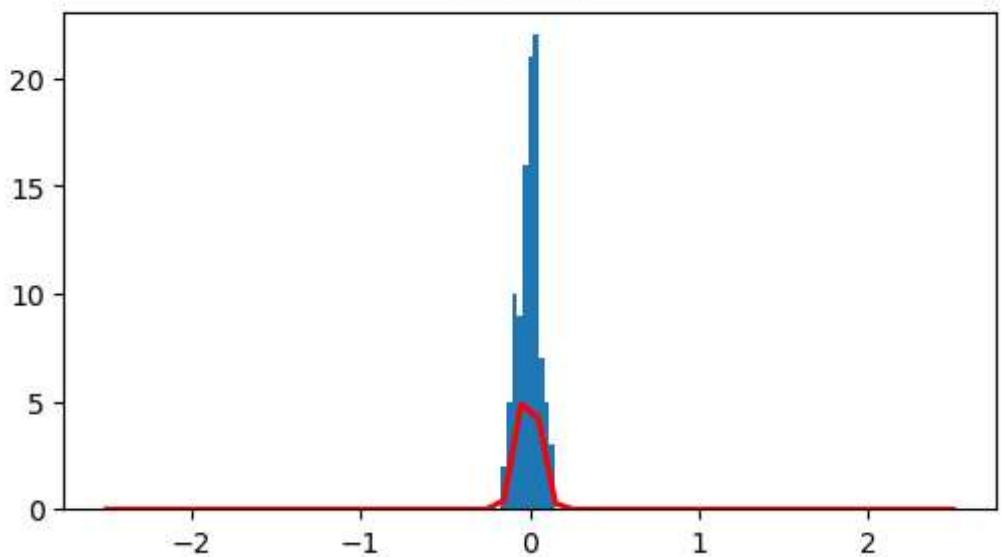
N = 317 Média = -0.0059329509200966 Variância = 0.004012206291479137

N = 317



N = 318 Média = -0.005756365251177696 Variância = 0.0039708958635040386

N = 318

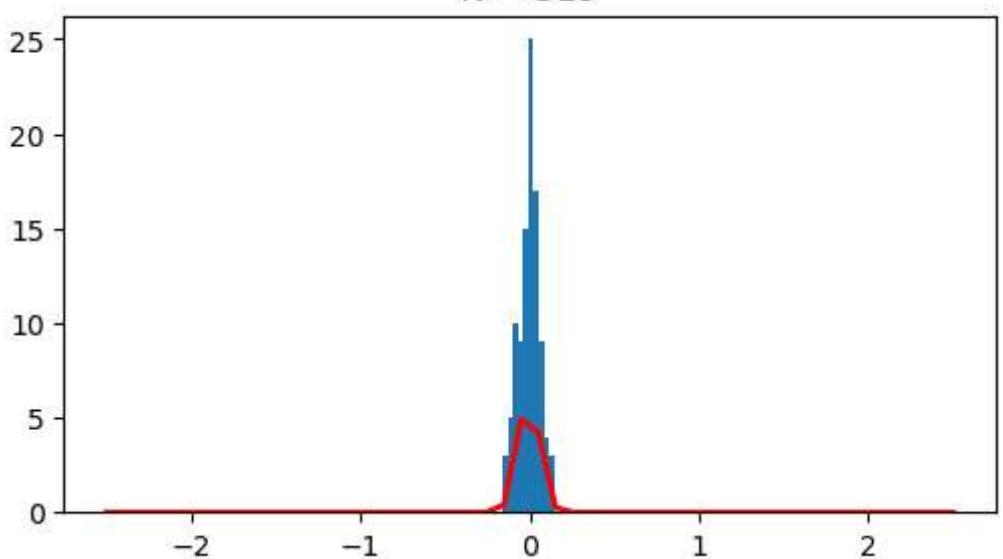


N = 319

Média = -0.0056951884399185195

Variância = 0.0038906764682079997

N = 319

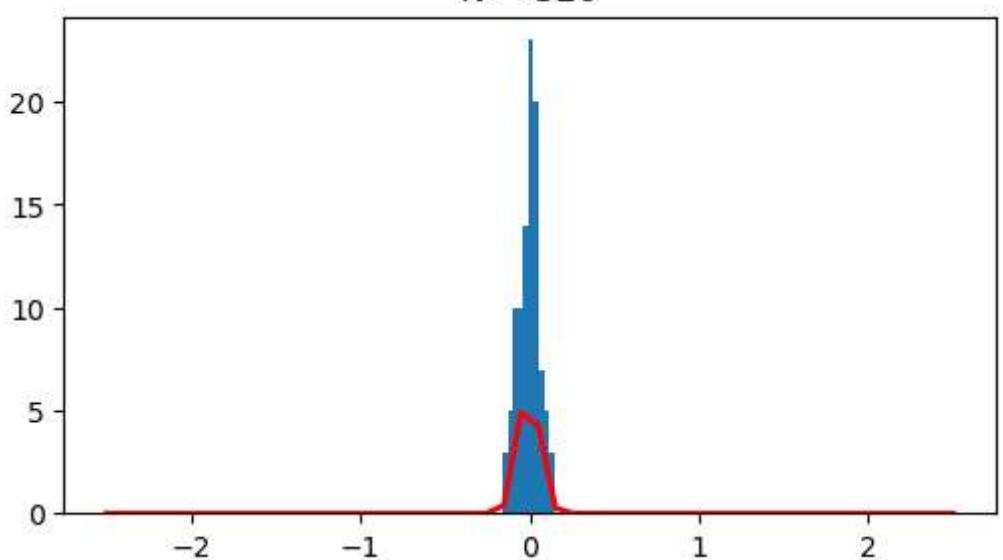


N = 320

Média = -0.005525723421152551

Variância = 0.0038934573751123317

N = 320

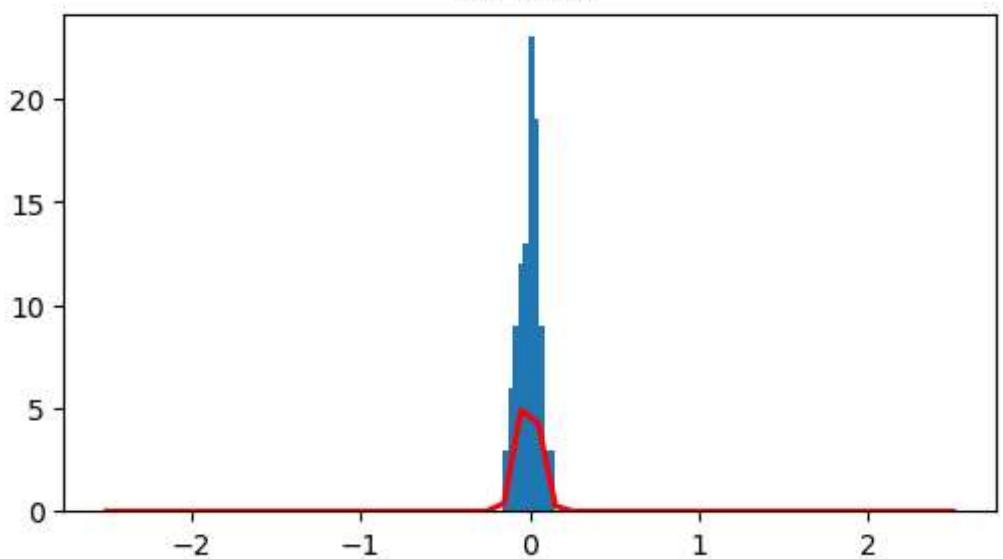


N = 321

Média = -0.005394961477361269

Variância = 0.0038500837753483895

N = 321

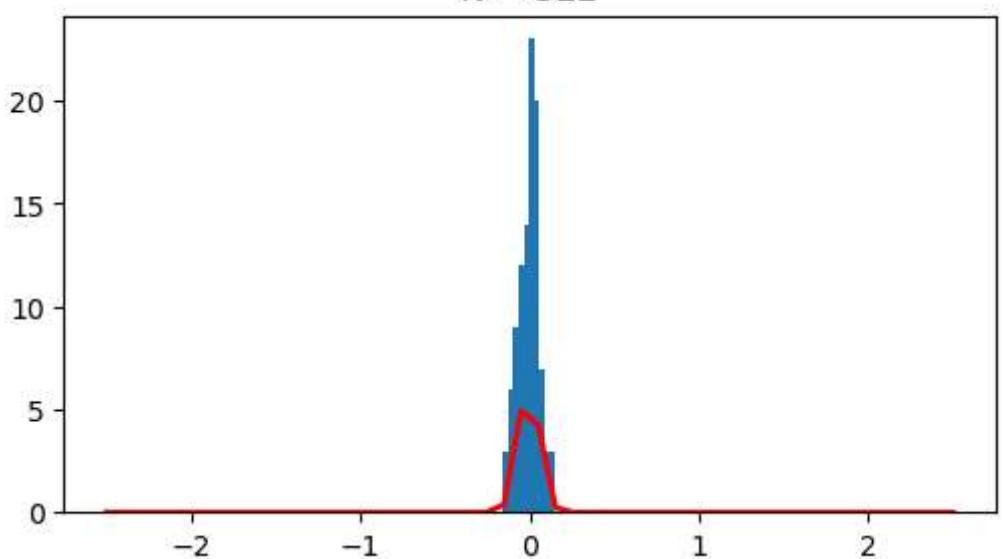


N = 322

Média = -0.0056860846230013164

Variância = 0.0038050749487384085

N = 322

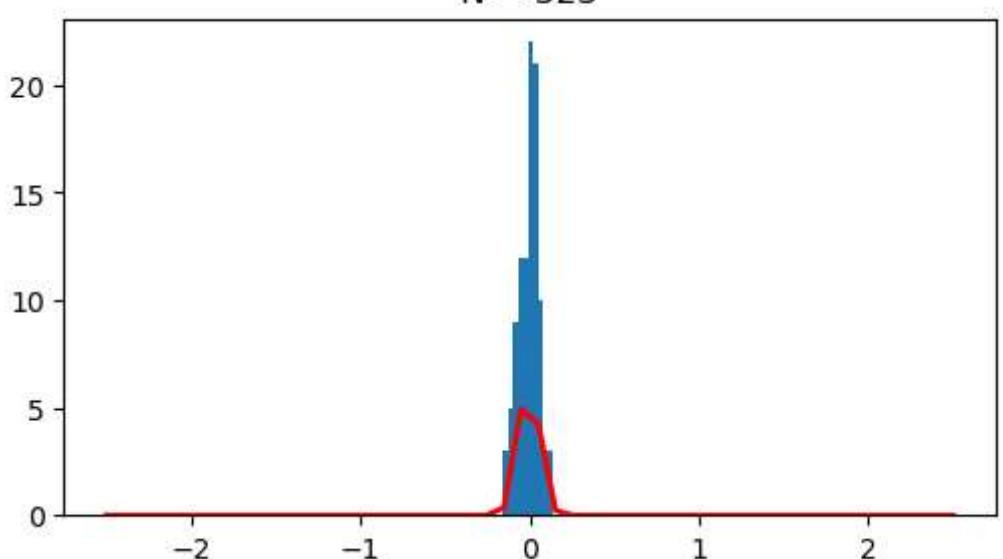


N = 323

Média = -0.005510155920721377

Variância = 0.0037526106692654434

N = 323

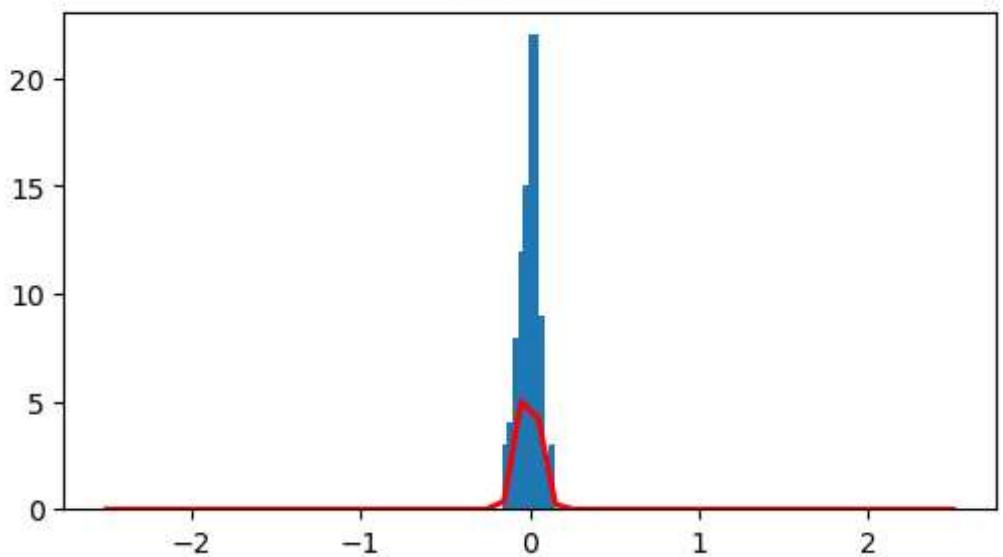


N = 324

Média = -0.00625769959065997

Variância = 0.00373563053113404

N = 324

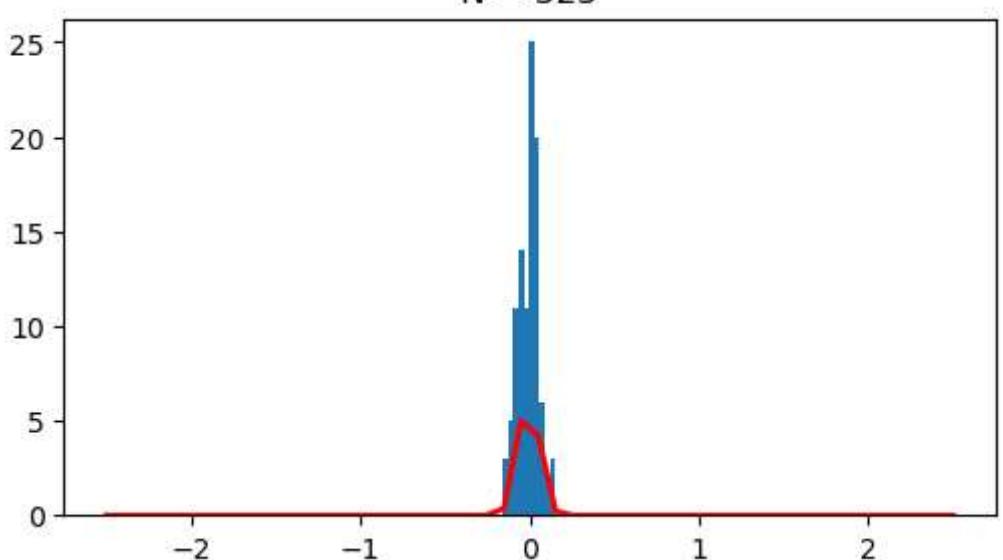


N = 325

Média = -0.006501021499681973

Variância = 0.0037243331310437638

N = 325

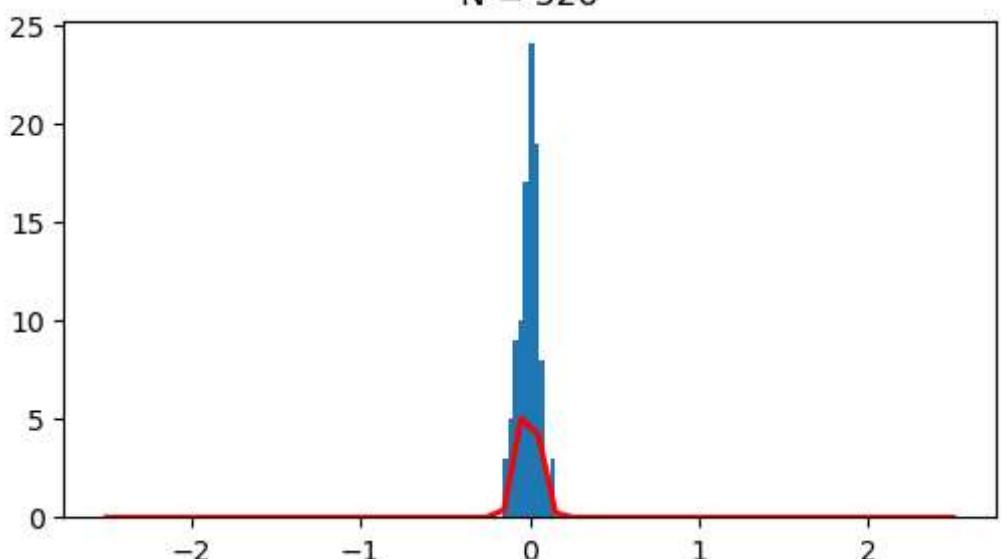


N = 326

Média = -0.006489916250160971

Variância = 0.0037531069479835514

N = 326

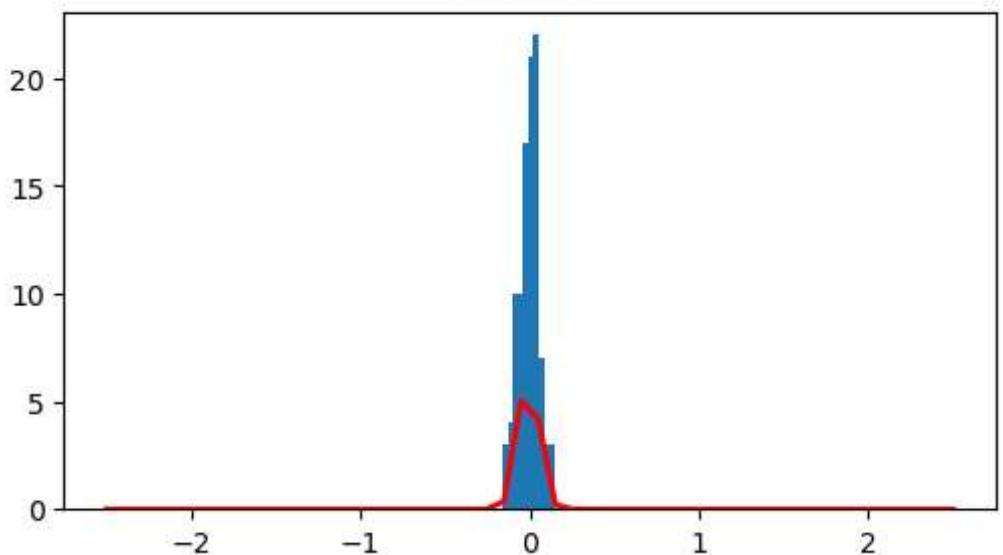


N = 327

Média = -0.00688999624612704

Variância = 0.003690007328032049

N = 327

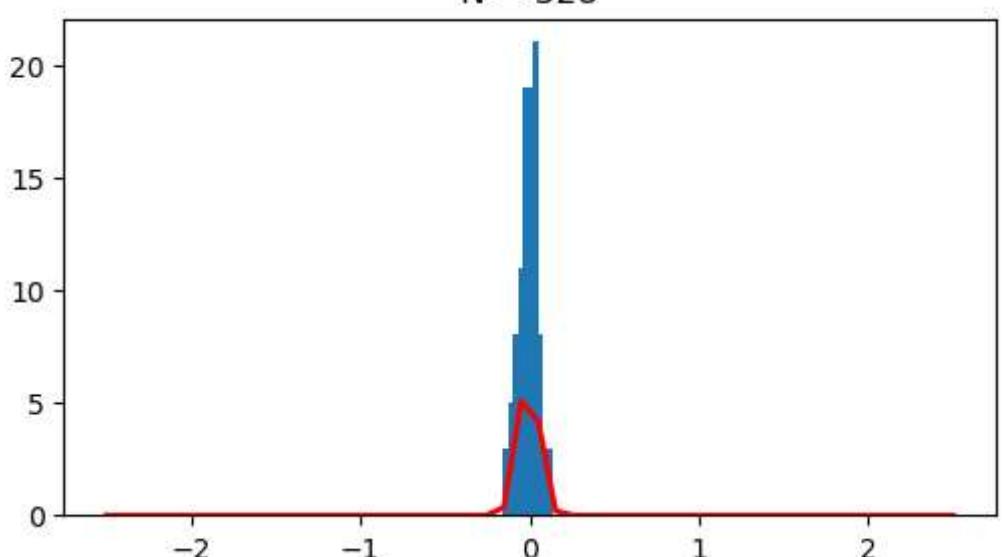


N = 328

Média = -0.006937527077038179

Variância = 0.0036627287821041723

N = 328

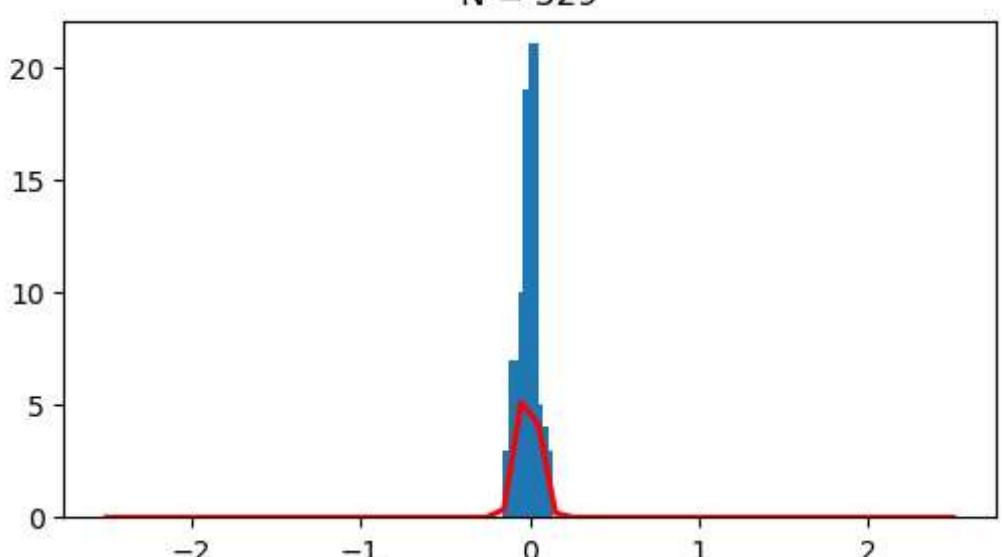


N = 329

Média = -0.0075133719604195326

Variância = 0.003630018388421564

N = 329

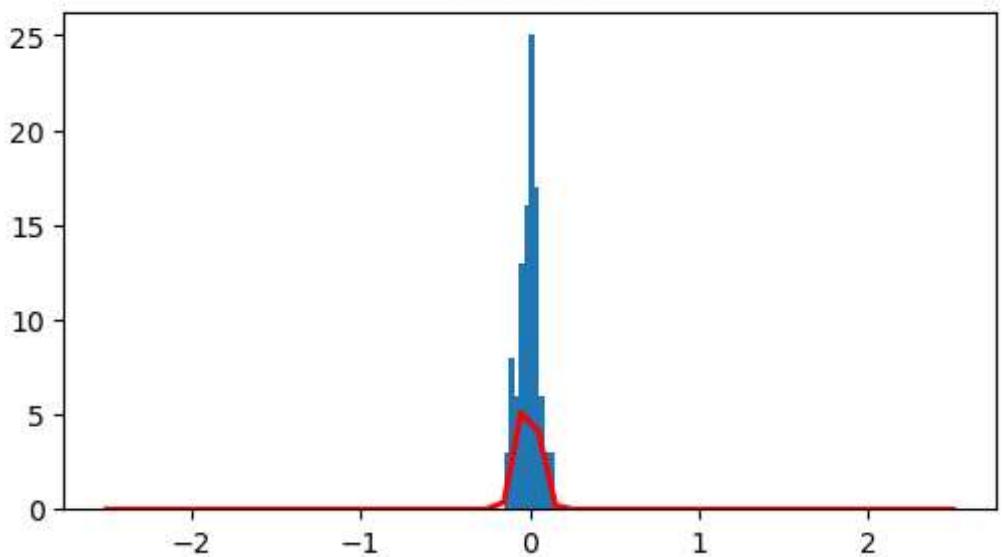


N = 330

Média = -0.007592770784526423

Variância = 0.003675921740370129

N = 330

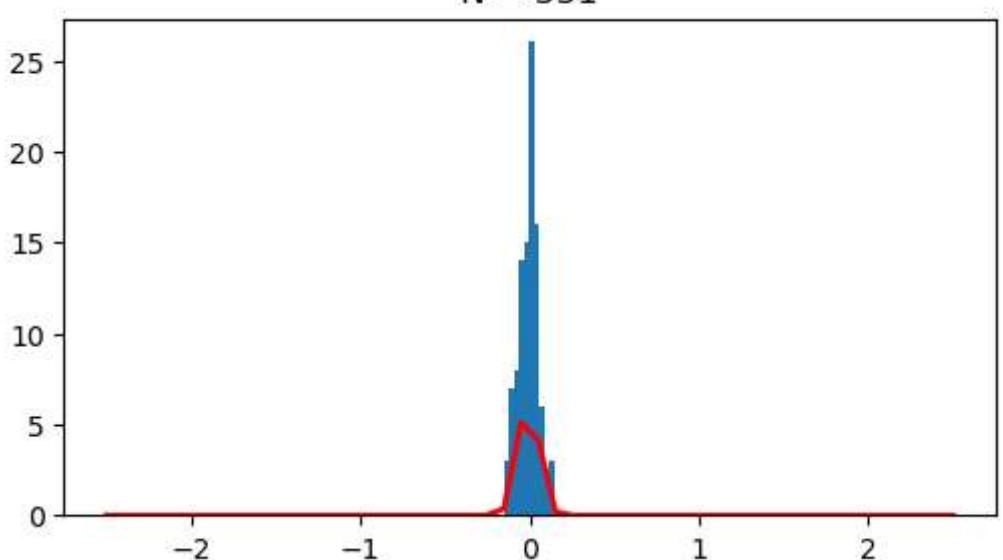


N = 331

Média = -0.007620536436170714

Variância = 0.0036533273858647855

N = 331

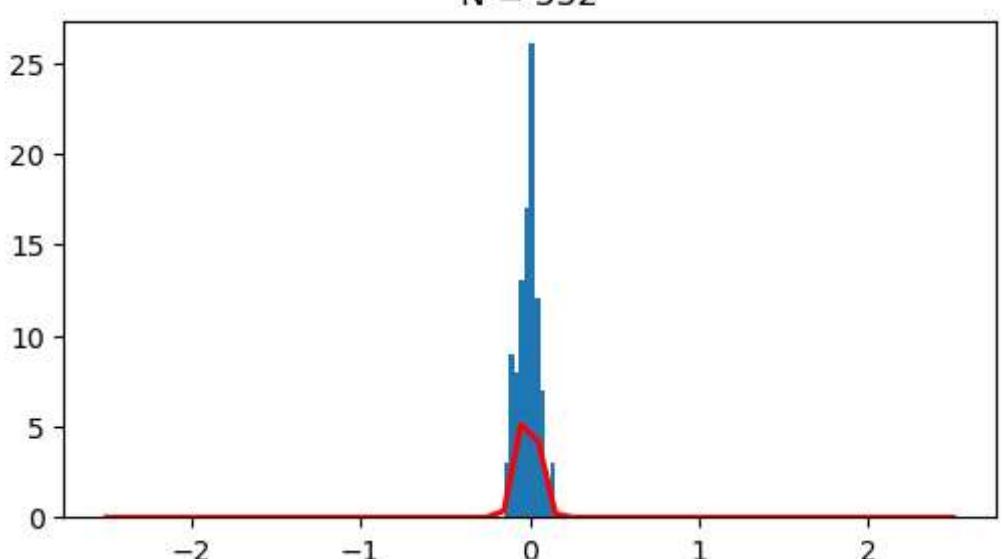


N = 332

Média = -0.00713280000014267

Variância = 0.0036235887031674566

N = 332

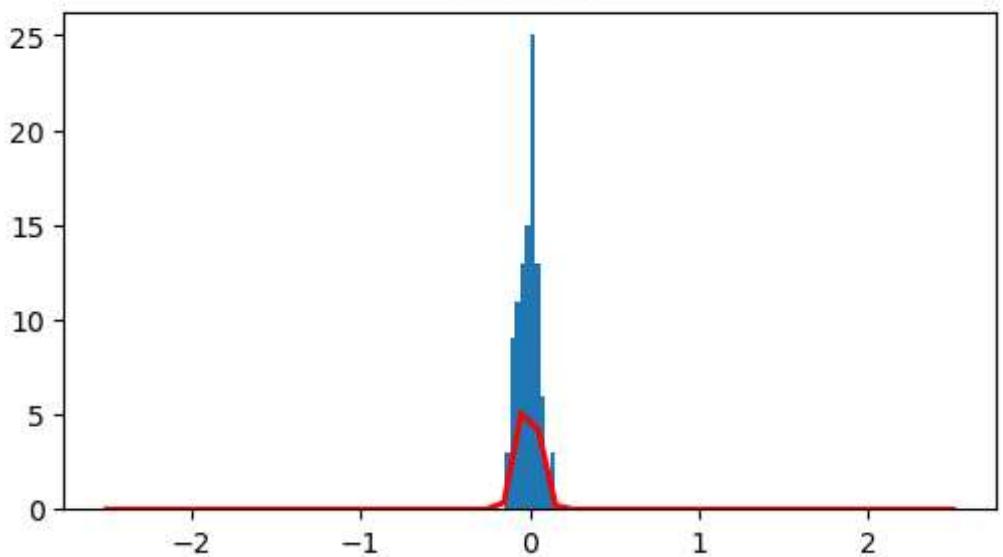


N = 333

Média = -0.006854780902411964

Variância = 0.0036223941198914567

N = 333

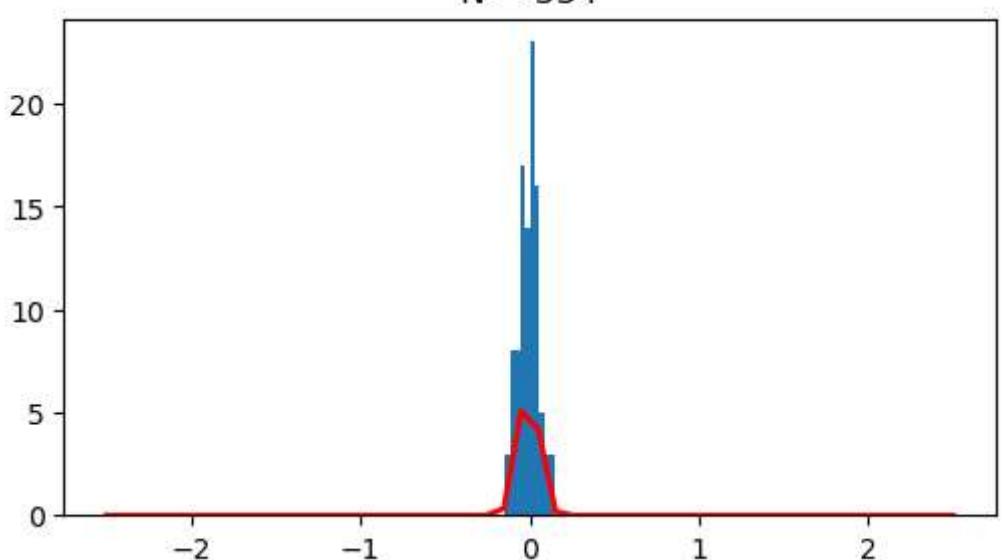


N = 334

Média = -0.006783202542619494

Variância = 0.0035831685684961038

N = 334

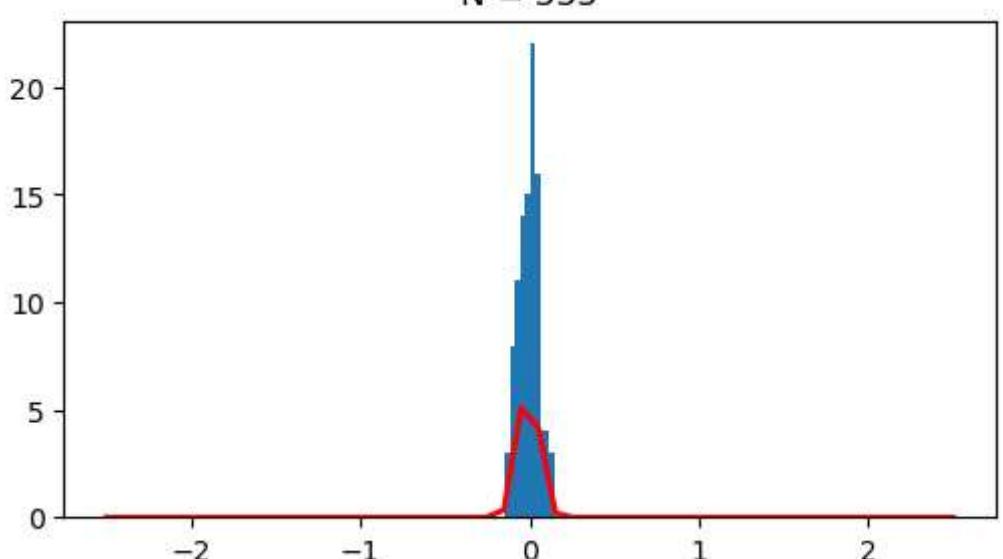


N = 335

Média = -0.006904405237979499

Variância = 0.0036104416190098827

N = 335

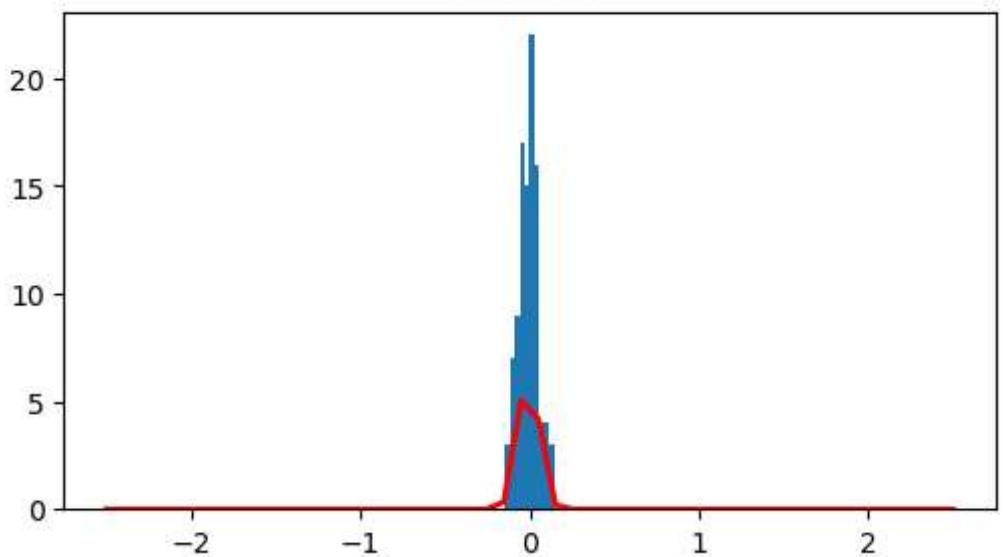


N = 336

Média = -0.006516294905358191

Variância = 0.003591850843133495

N = 336

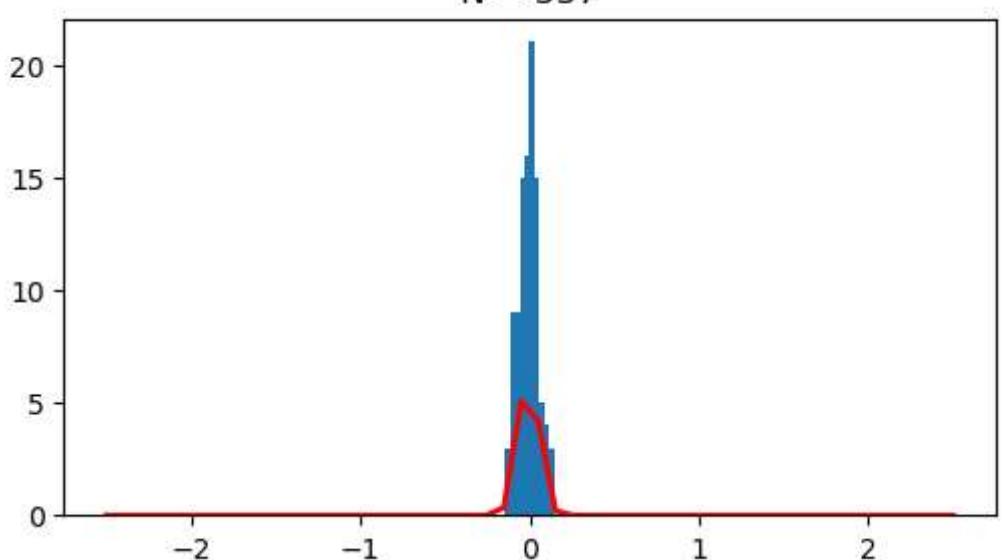


N = 337

Média = -0.006714005471085389

Variância = 0.0036245722013662635

N = 337

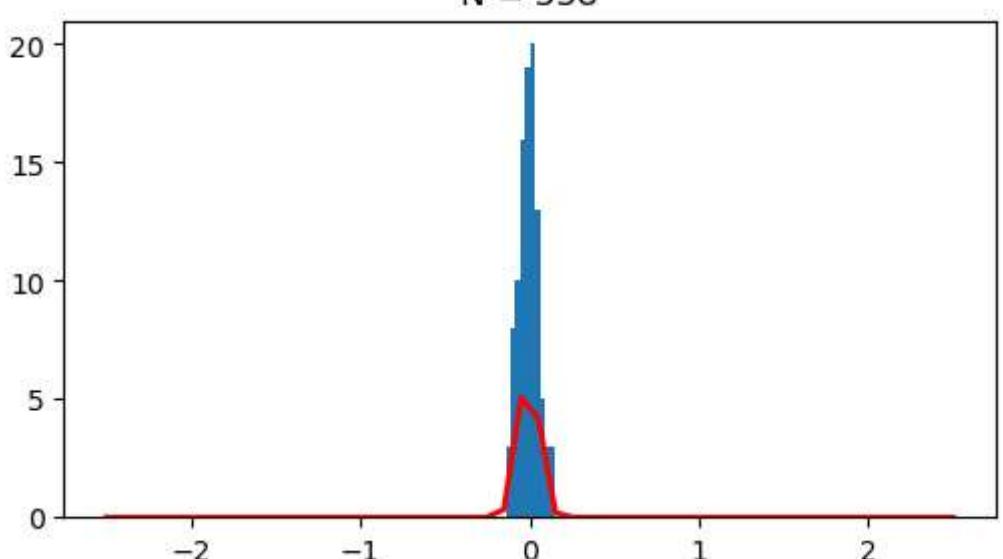


N = 338

Média = -0.006478740724283021

Variância = 0.003588530667095746

N = 338

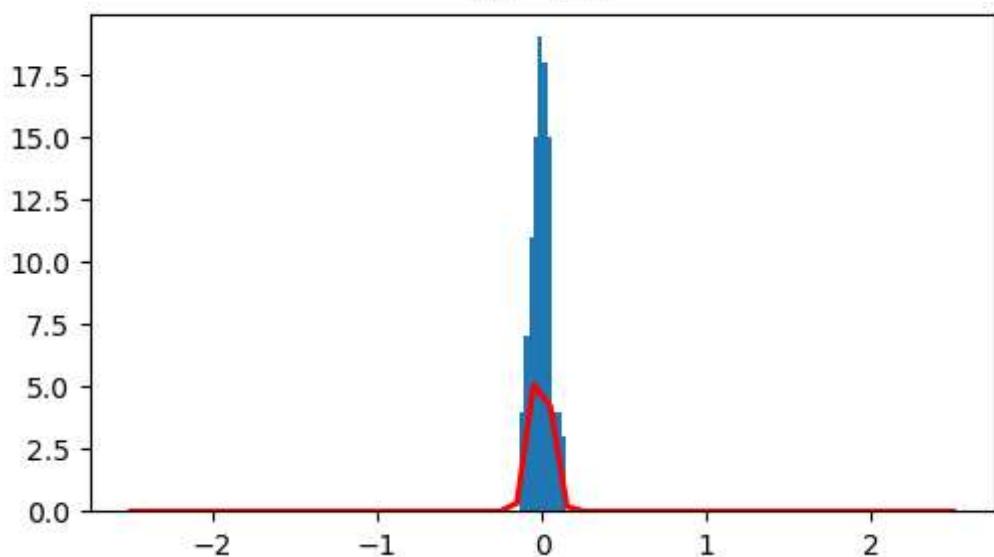


N = 339

Média = -0.006529990988281383

Variância = 0.0035360748266297674

N = 339

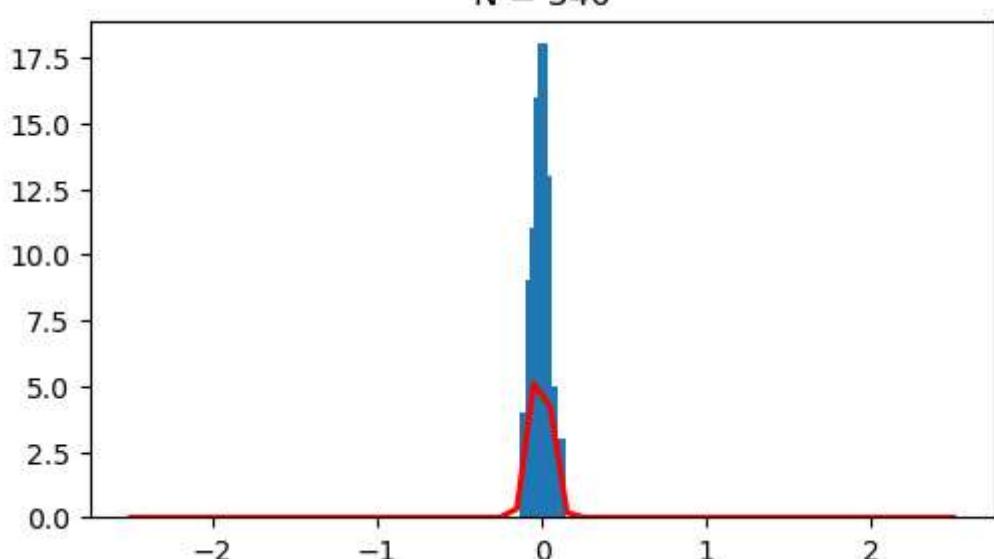


N = 340

Média = -0.006846532220111708

Variância = 0.0035233632031454287

N = 340

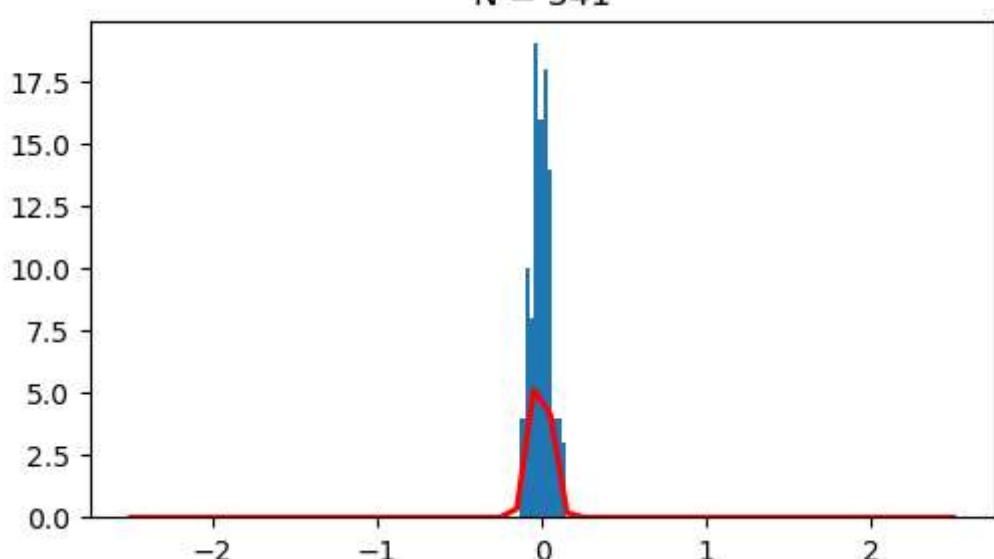


N = 341

Média = -0.0075643173303670186

Variância = 0.003559185996848225

N = 341

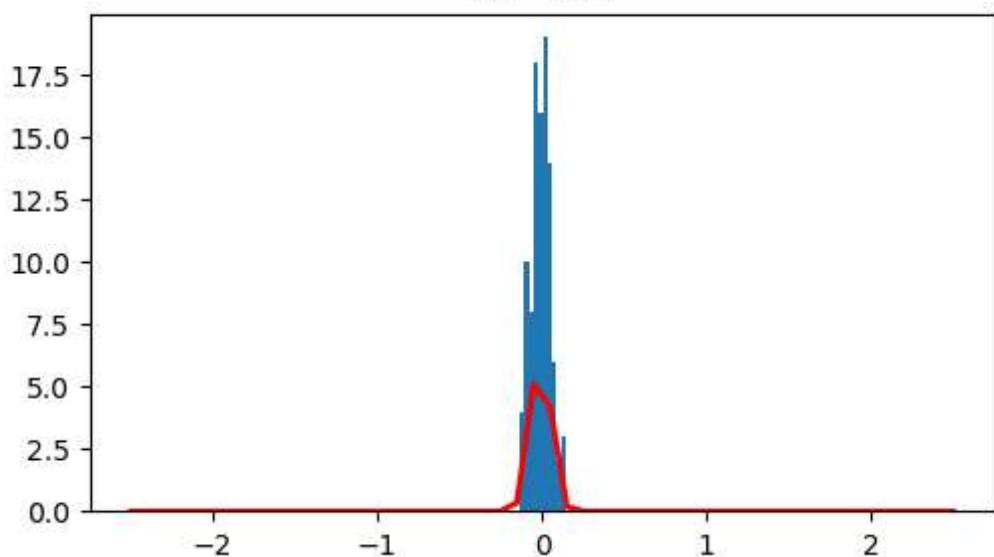


N = 342

Média = -0.00708994273454468

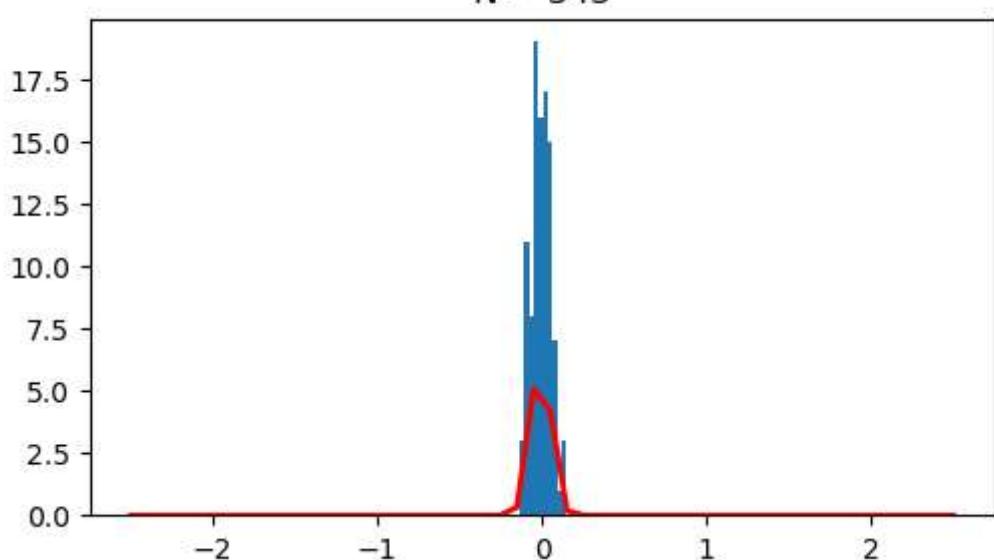
Variância = 0.003549674007629043

N = 342



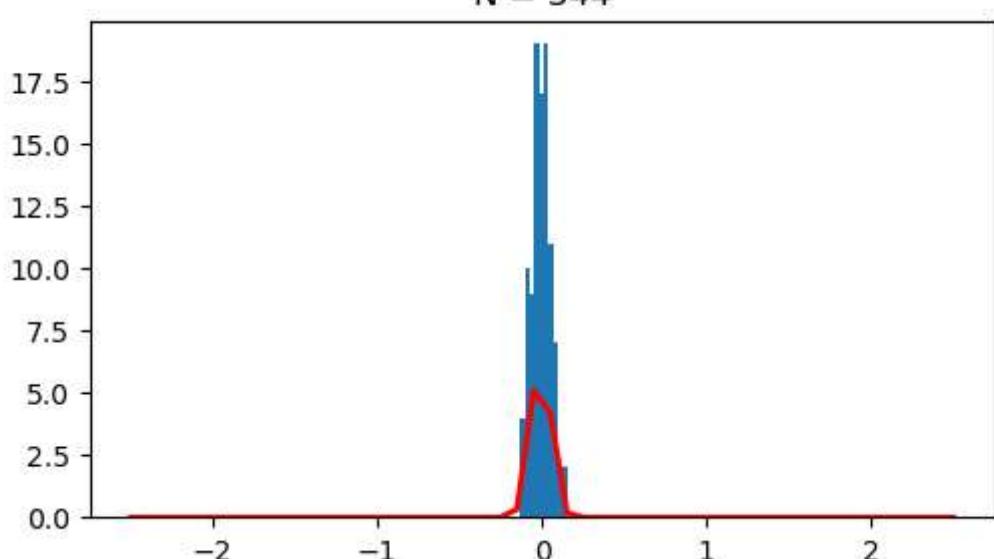
N = 343 Média = -0.00662256919992118 Variância = 0.0035293939229696196

N = 343



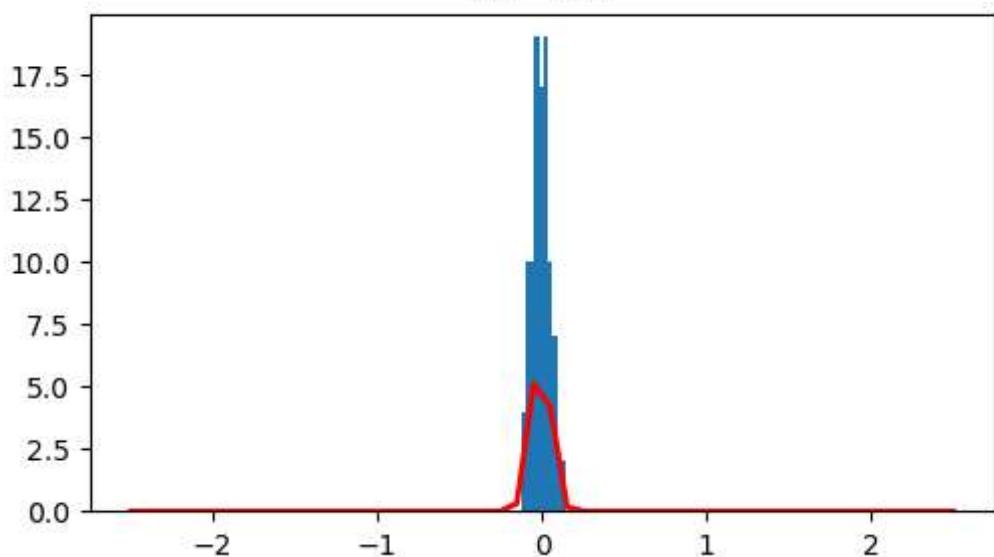
N = 344 Média = -0.006682603801535567 Variância = 0.0034995757045770347

N = 344



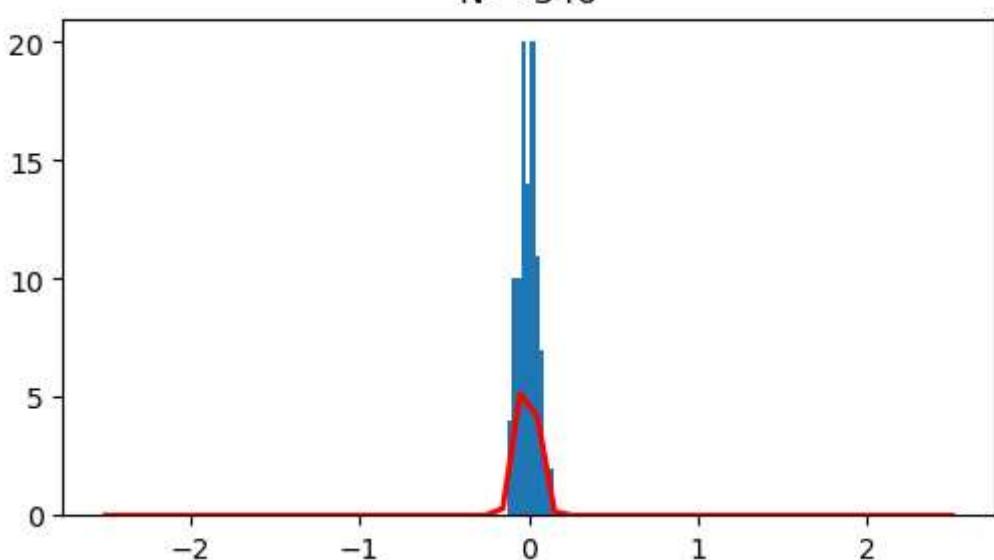
N = 345 Média = -0.006734537805209452 Variância = 0.003457883351567862

N = 345



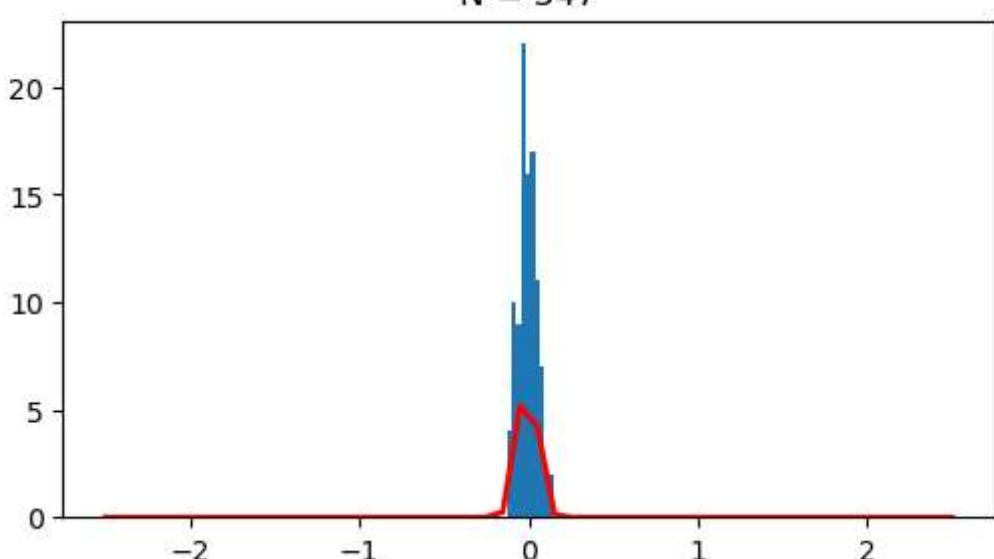
N = 346 Média = -0.006759770705131761 Variância = 0.003359771708871044

N = 346



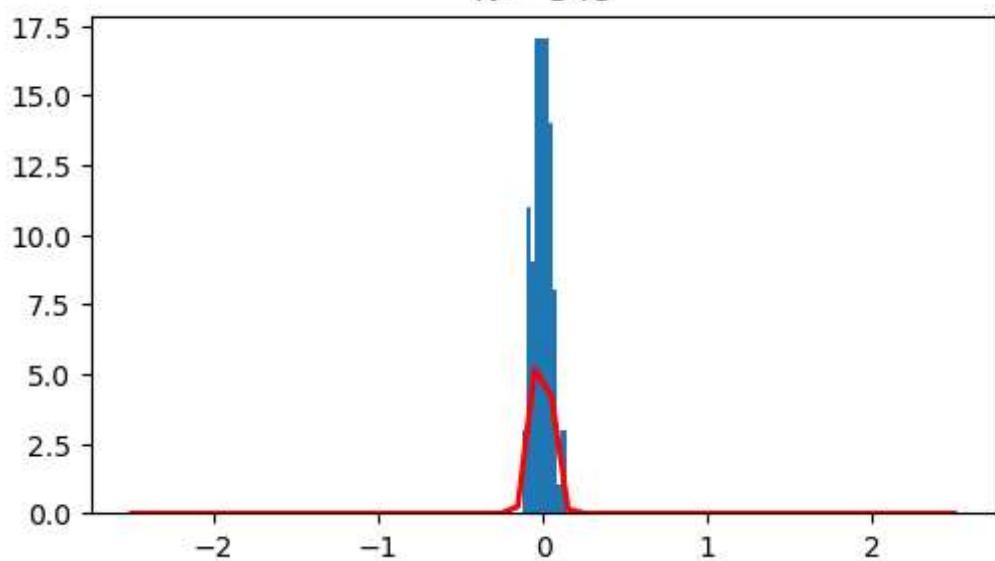
N = 347 Média = -0.006345094626761725 Variância = 0.003208259959150651

N = 347



N = 348 Média = -0.006246599240891571 Variância = 0.003184718131215546

N = 348

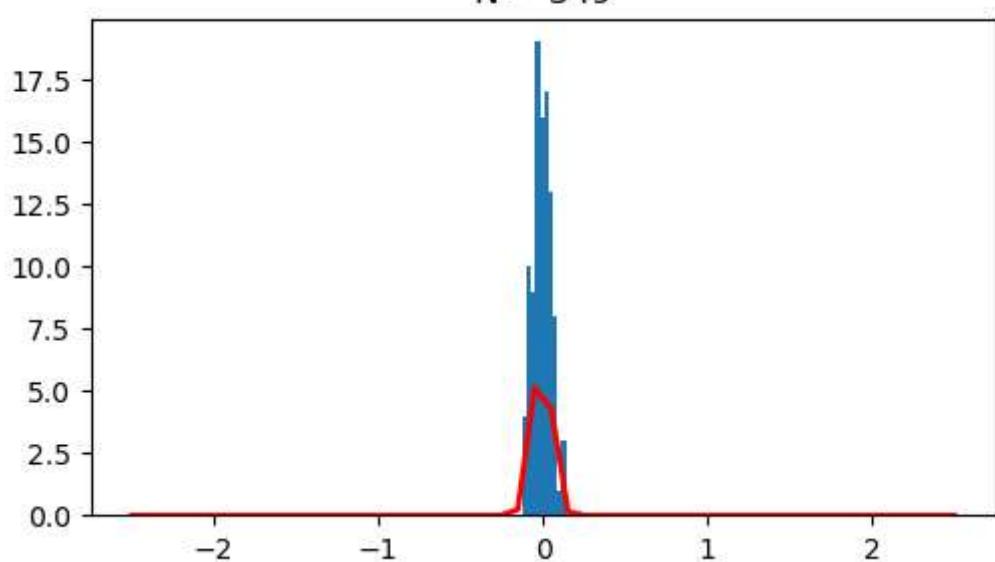


N = 349

Média = -0.005821510426292798

Variância = 0.0032009627614703624

N = 349

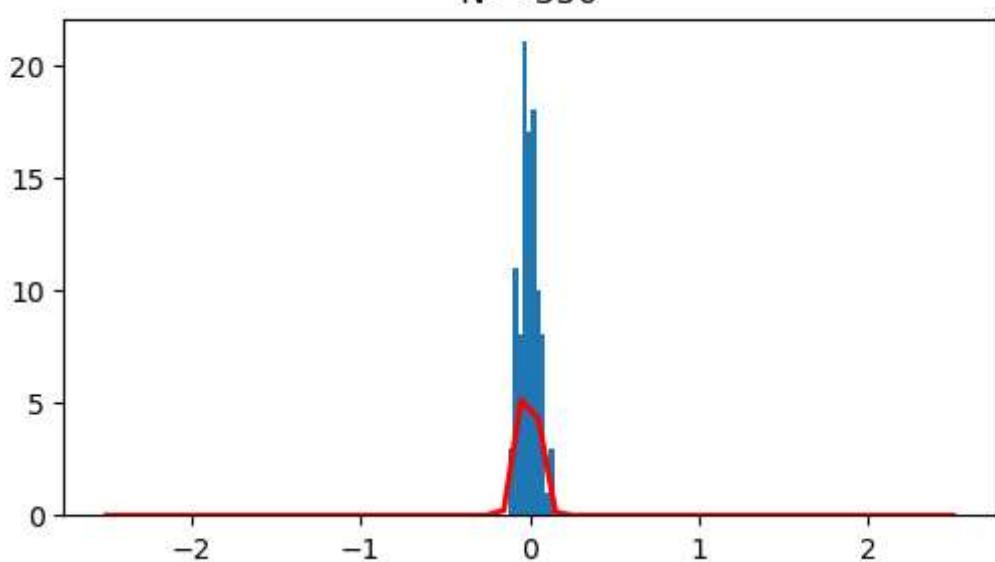


N = 350

Média = -0.005461011627284239

Variância = 0.0031406812659146056

N = 350

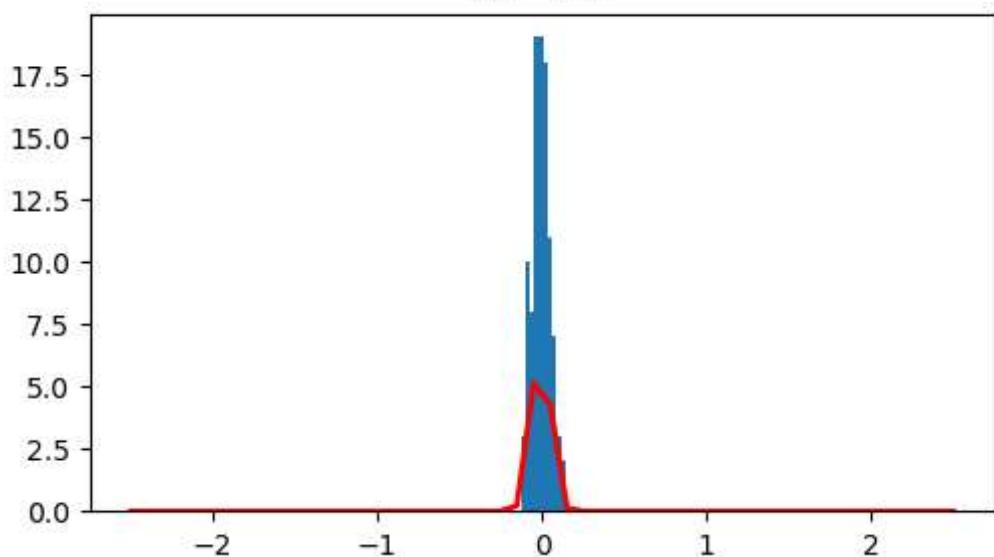


N = 351

Média = -0.005672642709989294

Variância = 0.0031262881633387493

N = 351

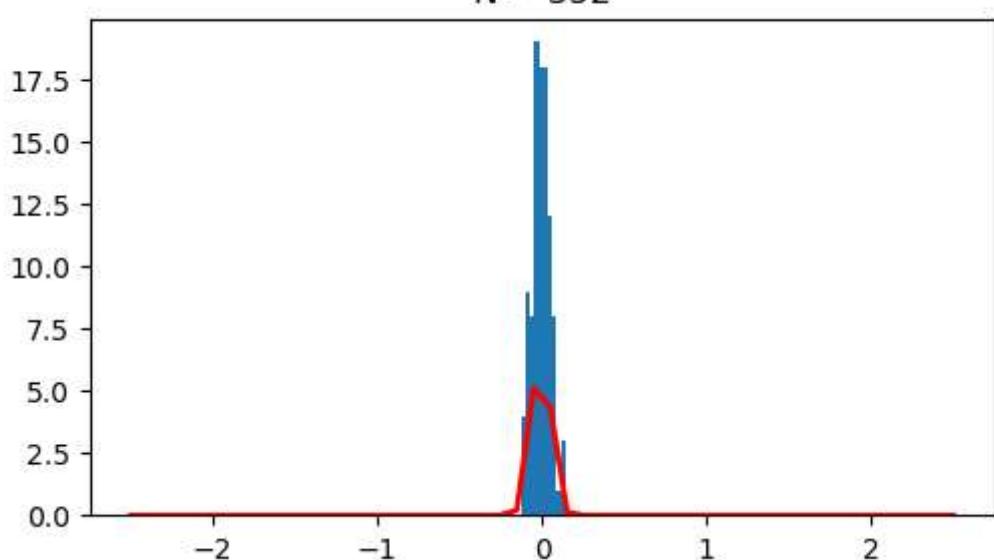


N = 352

Média = -0.005130292996902279

Variância = 0.0030943632945010526

N = 352

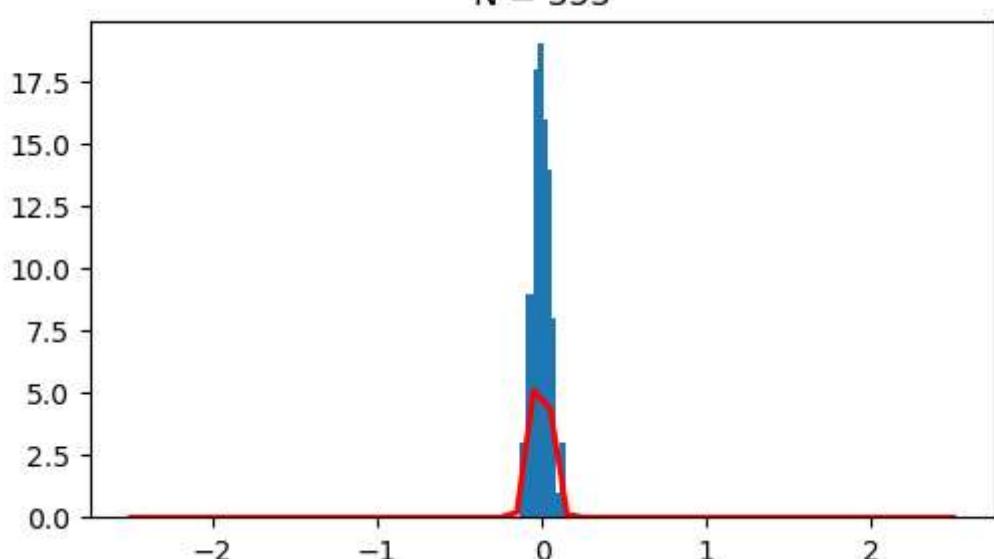


N = 353

Média = -0.004773672714166885

Variância = 0.0030398724863567065

N = 353

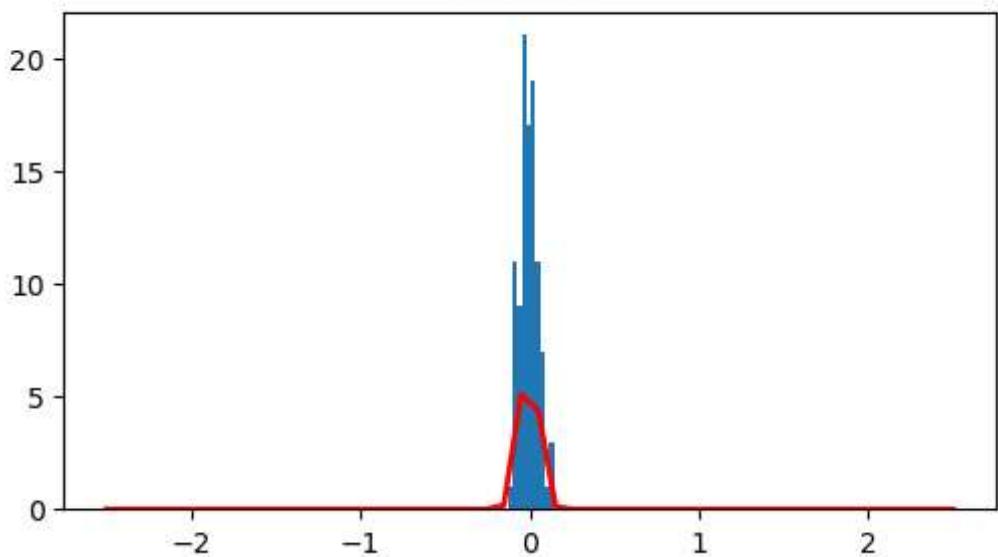


N = 354

Média = -0.004333218254681716

Variância = 0.0029587347190627284

N = 354

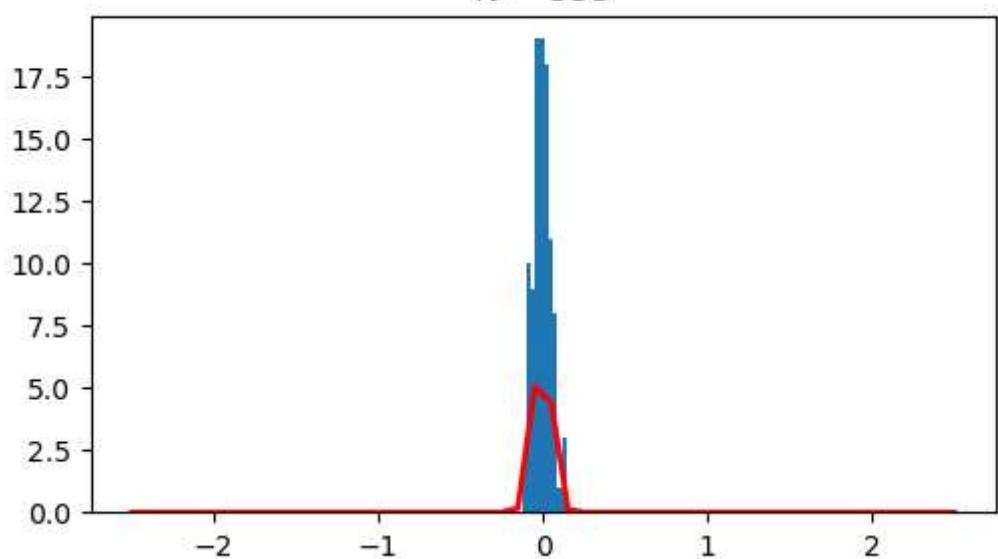


N = 355

Média = -0.003942615331238213

Variância = 0.0029208333711282395

N = 355

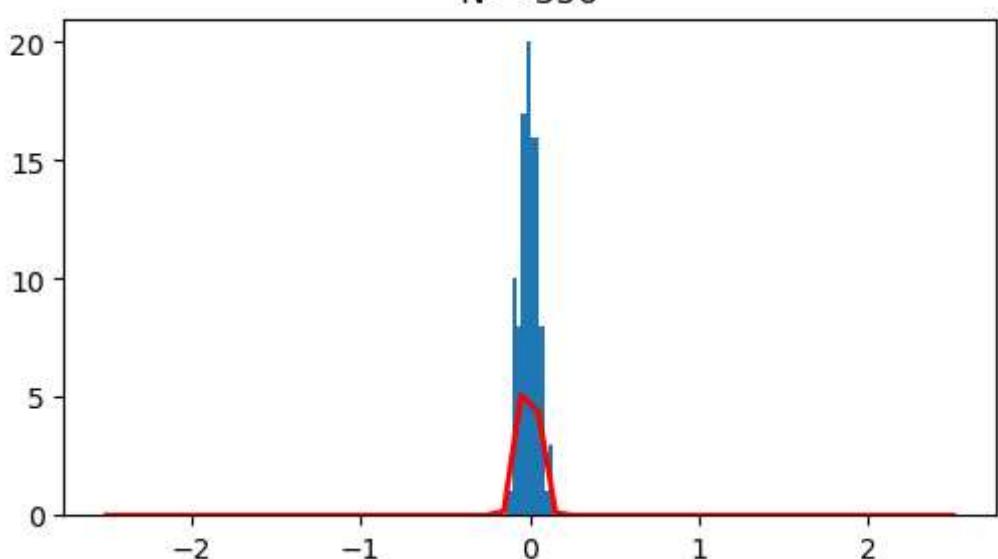


N = 356

Média = -0.004229499209431336

Variância = 0.002892419744863709

N = 356

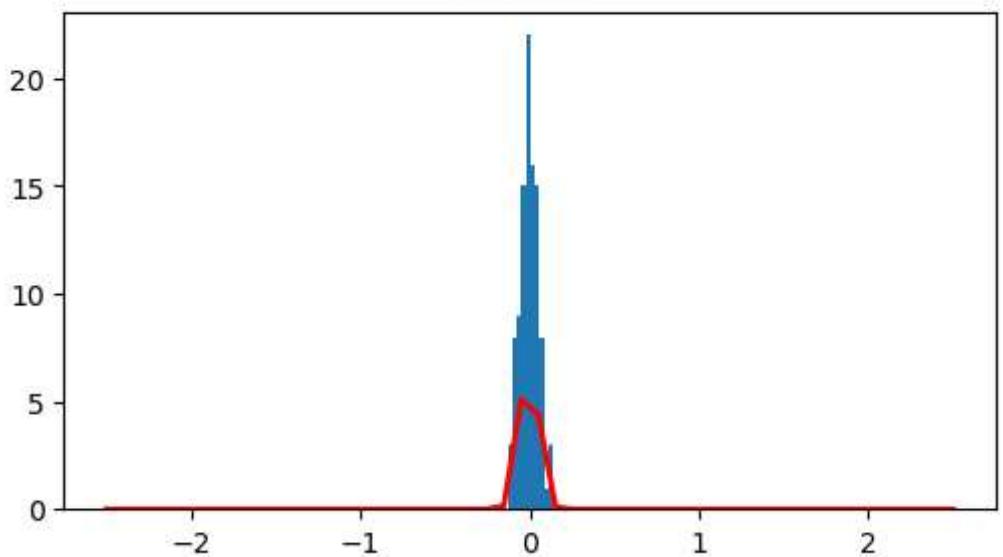


N = 357

Média = -0.004113157018604467

Variância = 0.0028563961778580484

N = 357

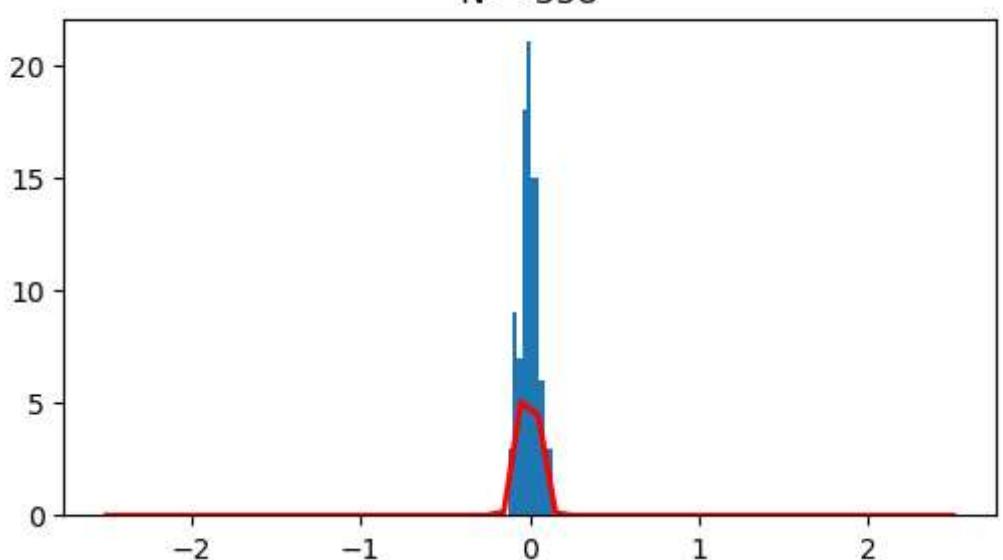


N = 358

Média = -0.0035791146202965073

Variância = 0.002873638424439593

N = 358

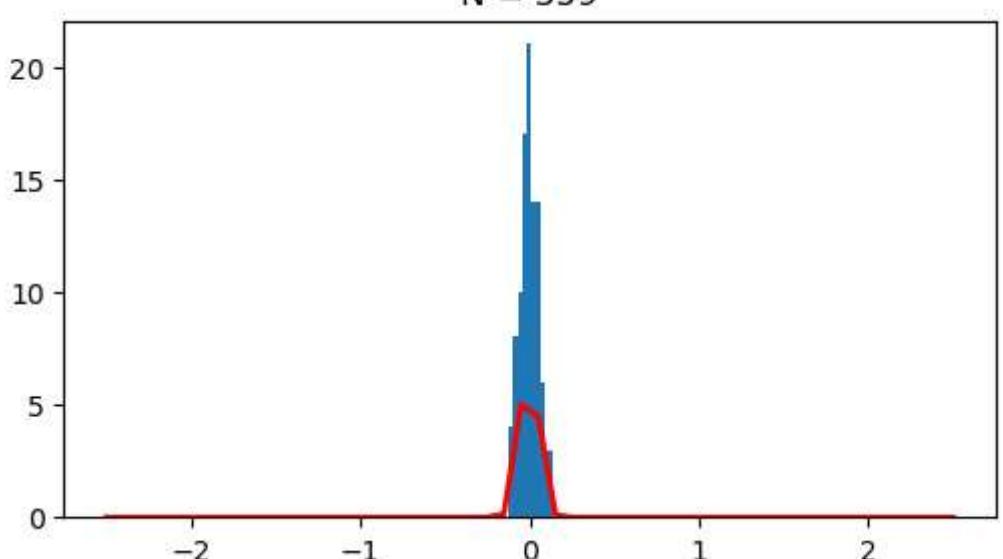


N = 359

Média = -0.0030510932973076806

Variância = 0.0028509968207358093

N = 359

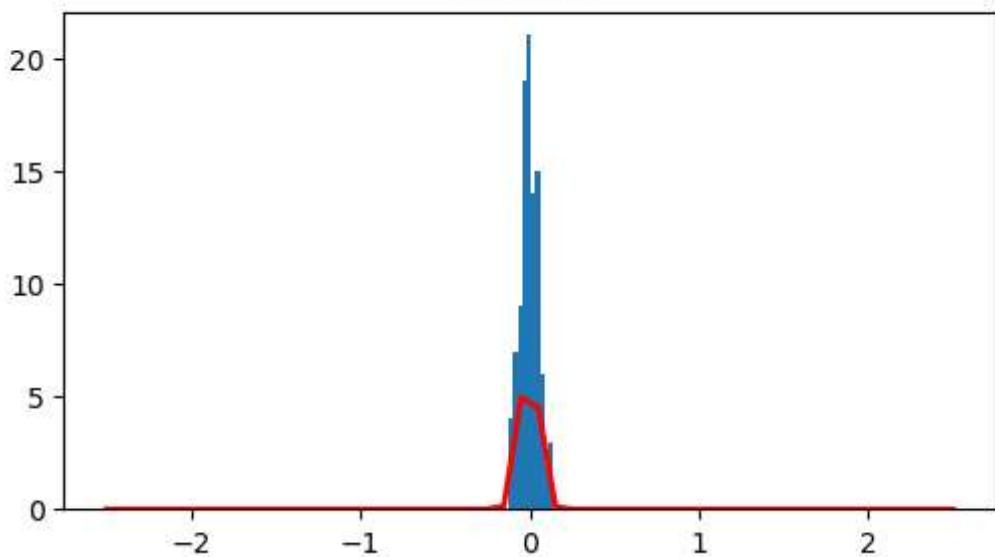


N = 360

Média = -0.0025591669092706677

Variância = 0.00283335224078666

N = 360

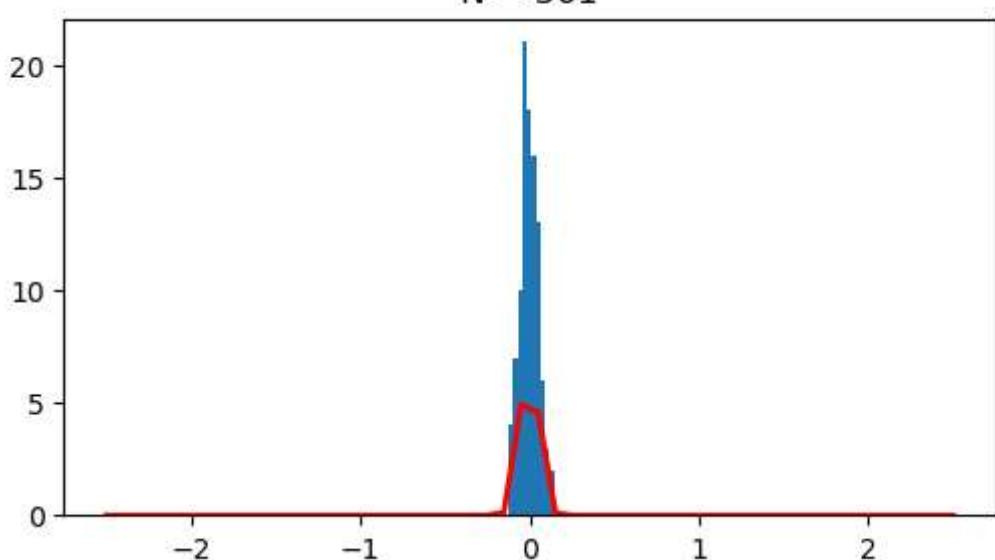


N = 361

Média = -0.002169339728713521

Variância = 0.0028042608898434475

N = 361

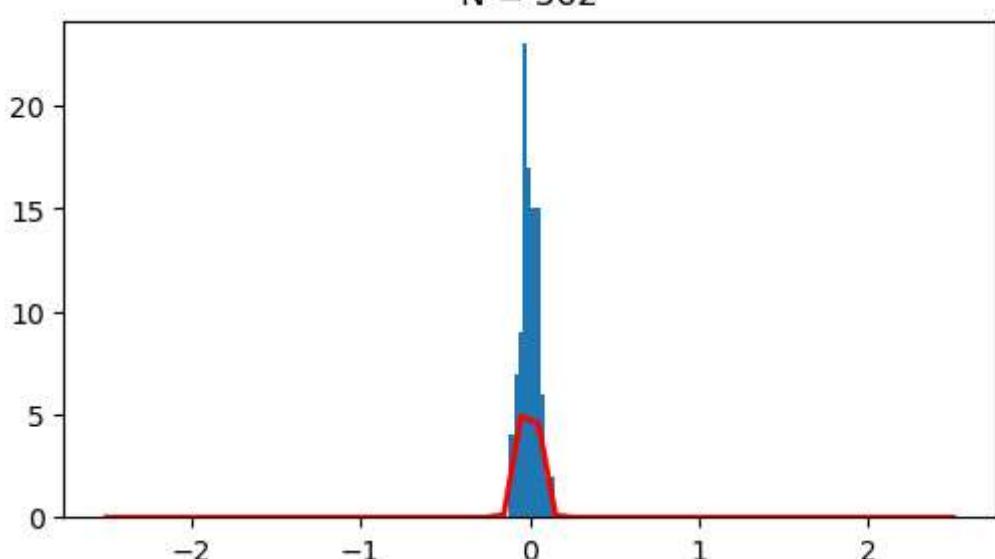


N = 362

Média = -0.001984043556119061

Variância = 0.002762083181203975

N = 362

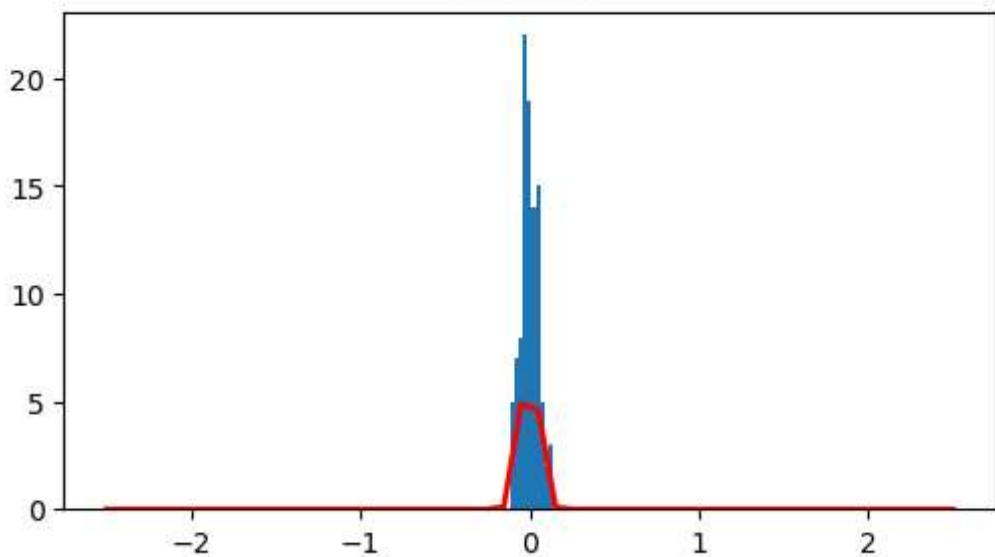


N = 363

Média = -0.0017954480841368464

Variância = 0.002704806634502239

N = 363

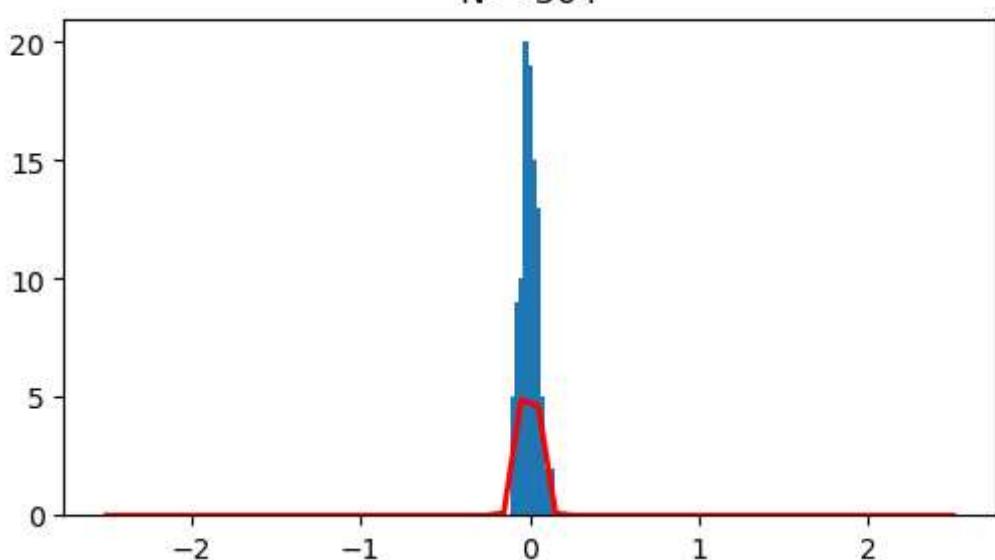


N = 364

Média = -0.001602572133985708

Variância = 0.002660585833914611

N = 364

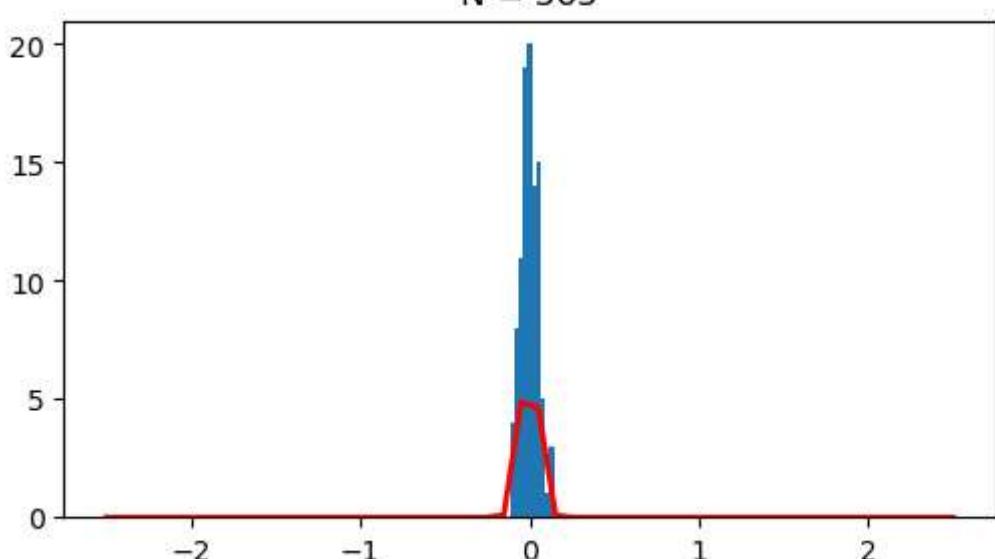


N = 365

Média = -0.0014786254480792433

Variância = 0.0026592893203119163

N = 365

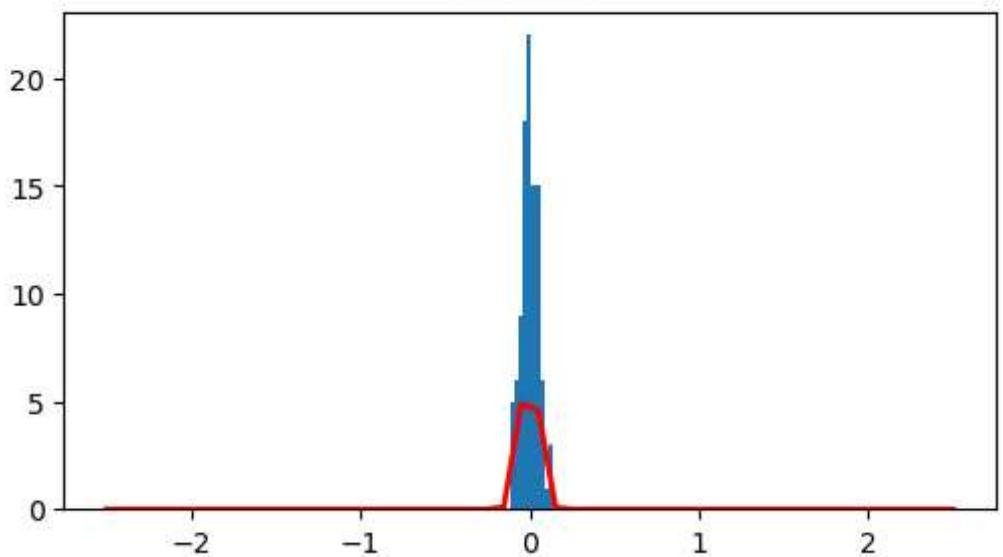


N = 366

Média = -0.0017038182671996881

Variância = 0.002611767917796582

N = 366

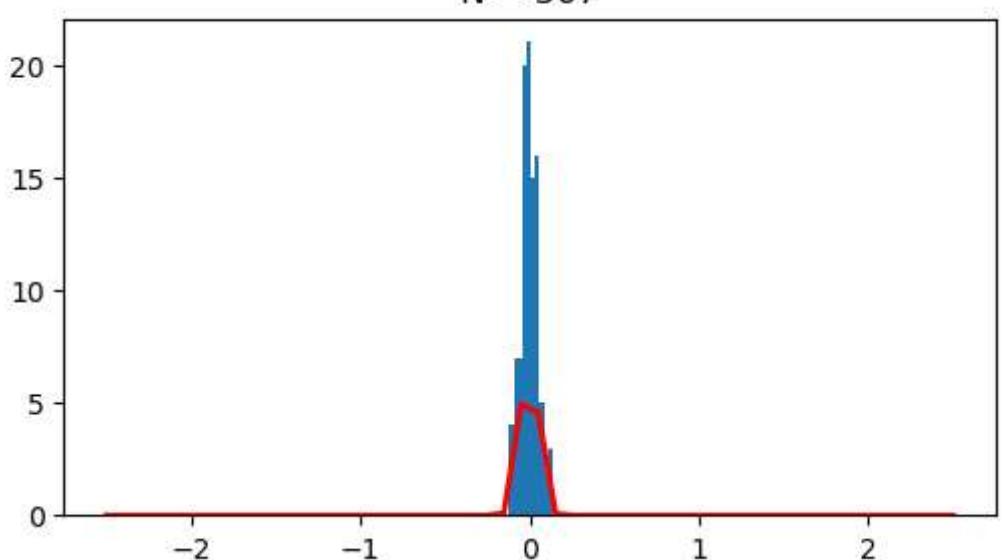


N = 367

Média = -0.0020295668558777203

Variância = 0.002579654160962638

N = 367

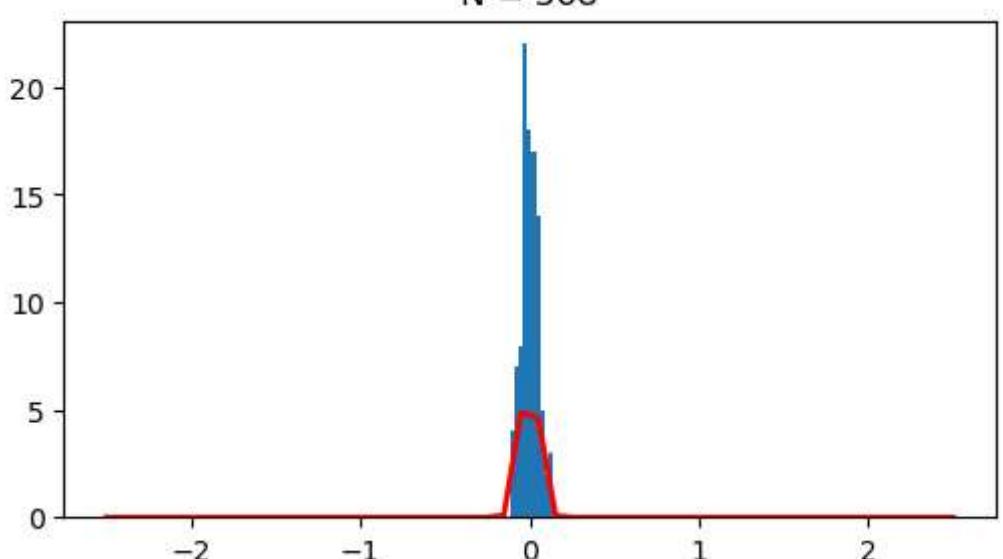


N = 368

Média = -0.0015686680291912625

Variância = 0.002598953841573664

N = 368

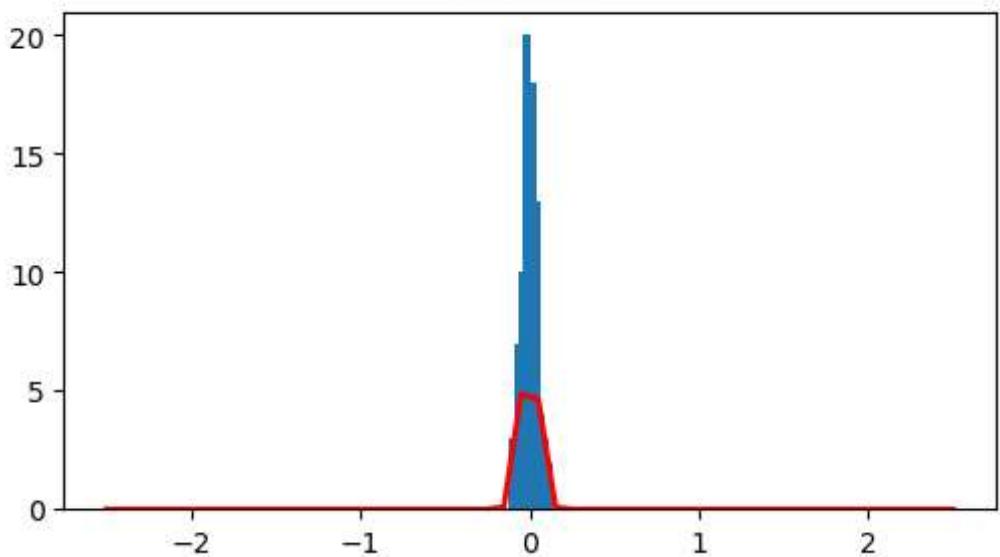


N = 369

Média = -0.0012466163088009235

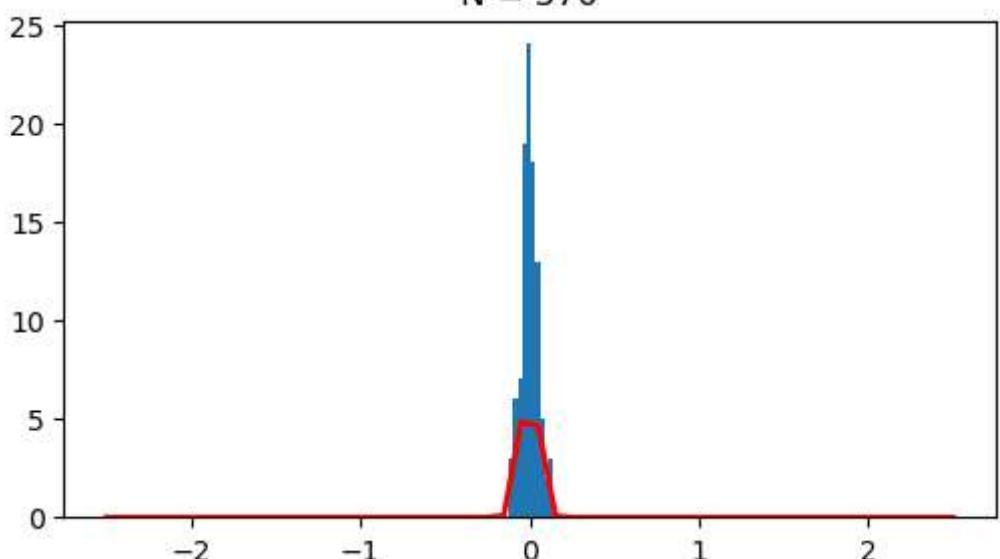
Variância = 0.0025875909765848484

N = 369



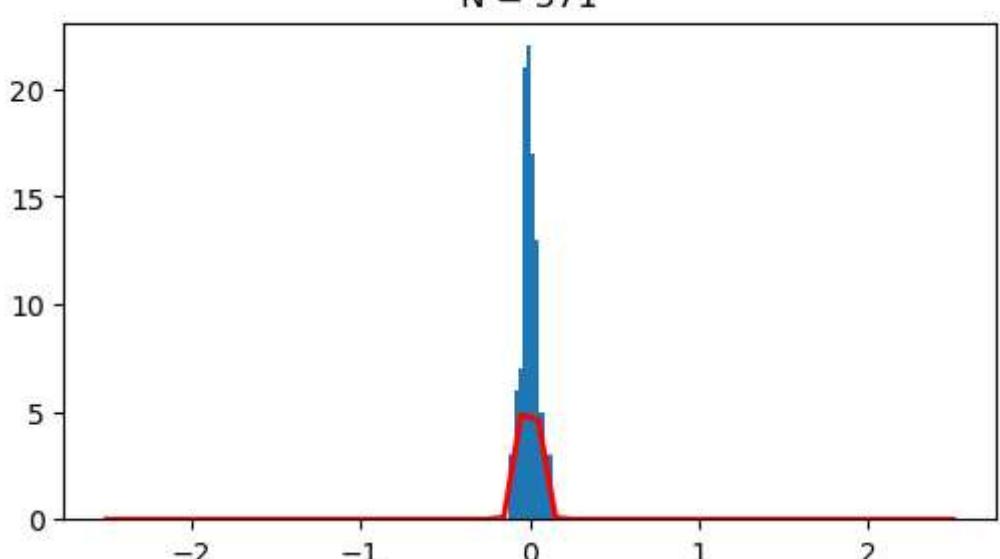
N = 370 Média = -0.0011608065467004984 Variância = 0.002543557532714161

N = 370



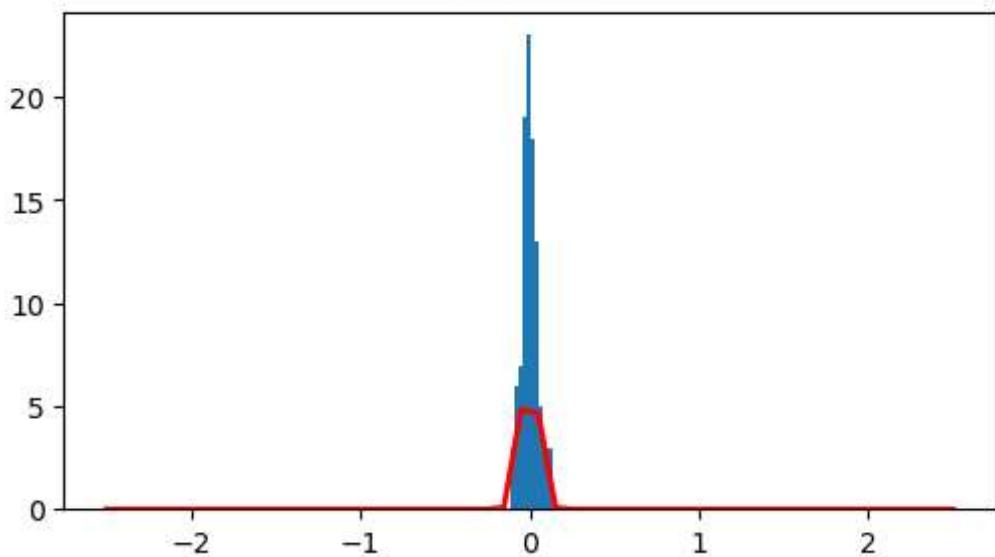
N = 371 Média = -0.0013262865601802326 Variância = 0.0025329603116031373

N = 371



N = 372 Média = -0.0010405727580975383 Variância = 0.0025134675071870486

N = 372

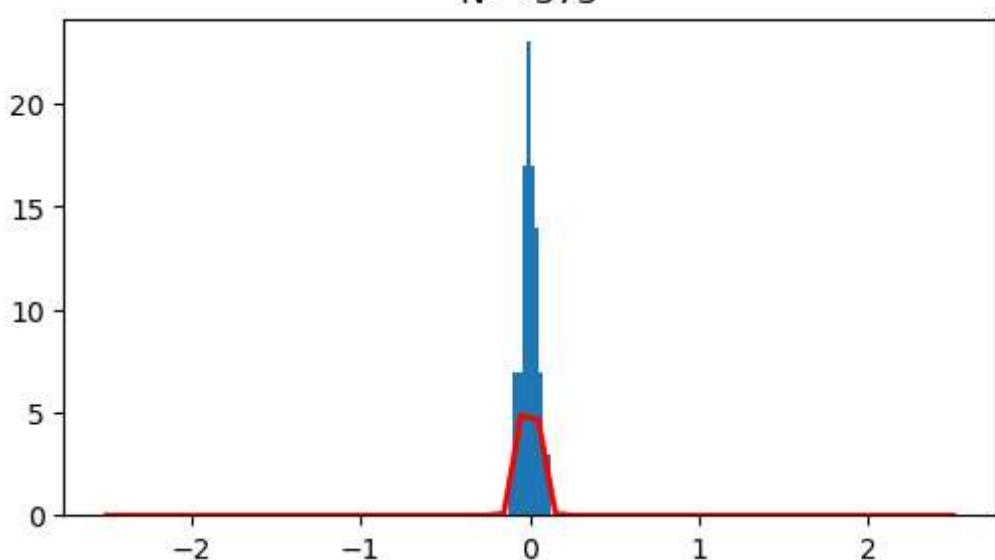


N = 373

Média = -0.0010789748410935448

Variância = 0.002500112817608066

N = 373

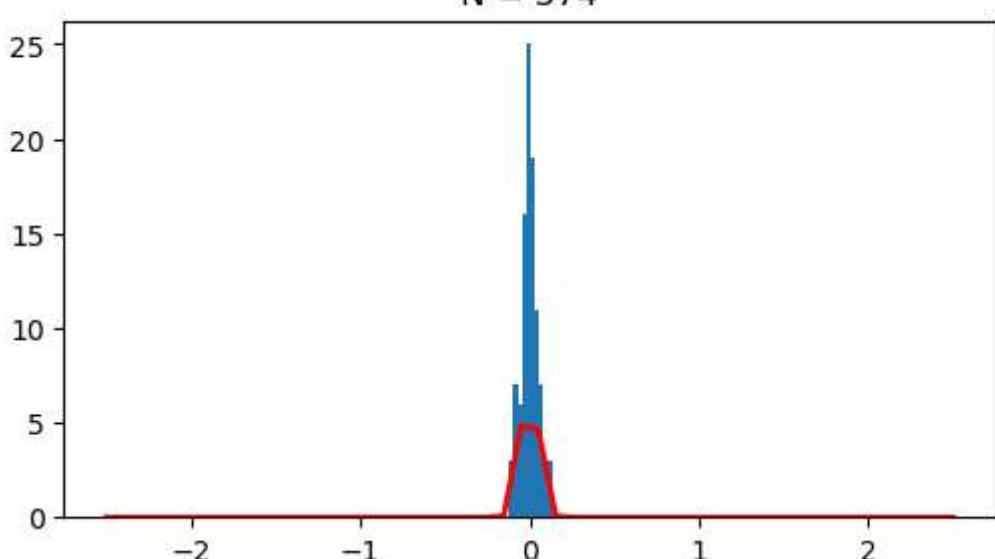


N = 374

Média = -0.0011198667548909377

Variância = 0.0025058908691657053

N = 374

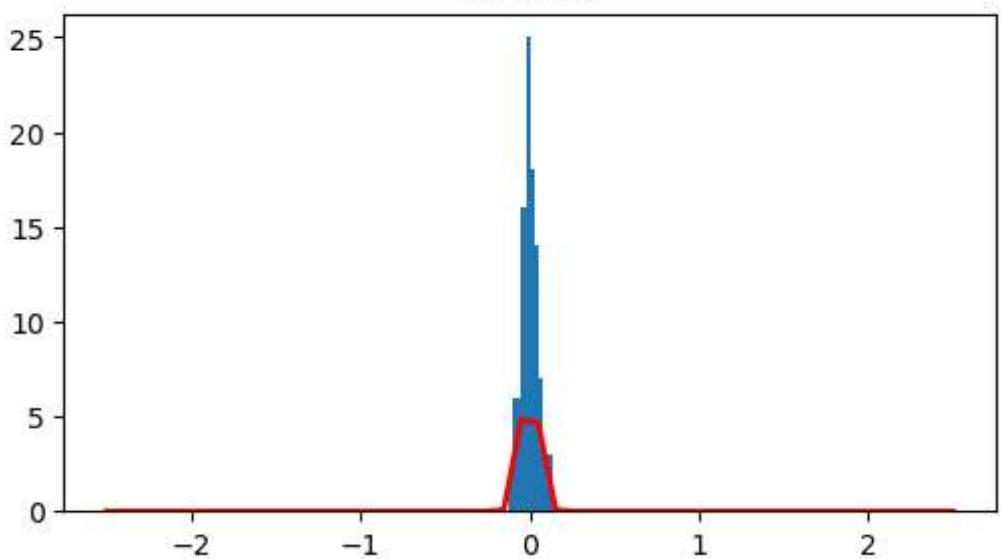


N = 375

Média = -0.0009399234582745242

Variância = 0.00248265465037891

N = 375

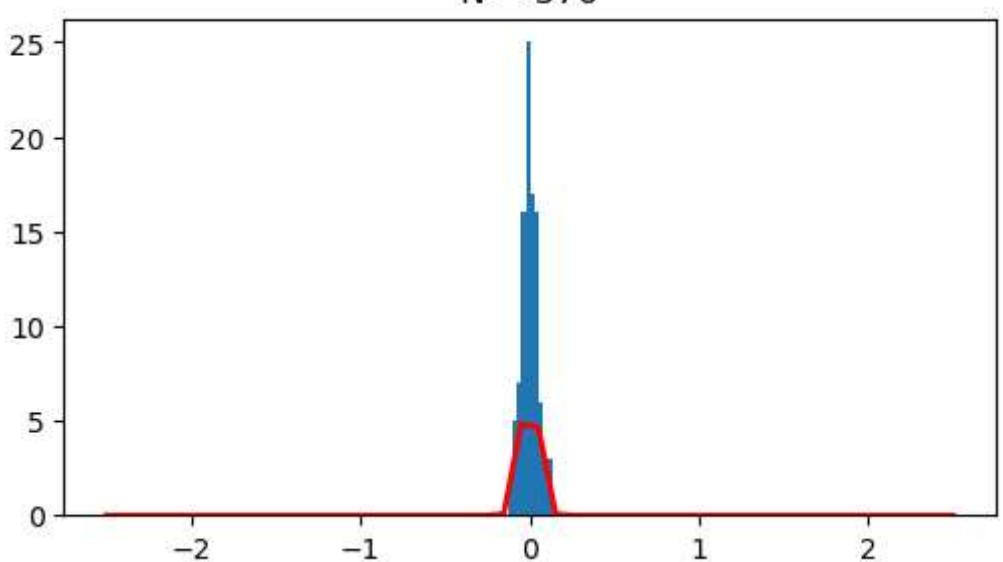


N = 376

Média = -0.0008758199426908242

Variância = 0.002463387722621145

N = 376

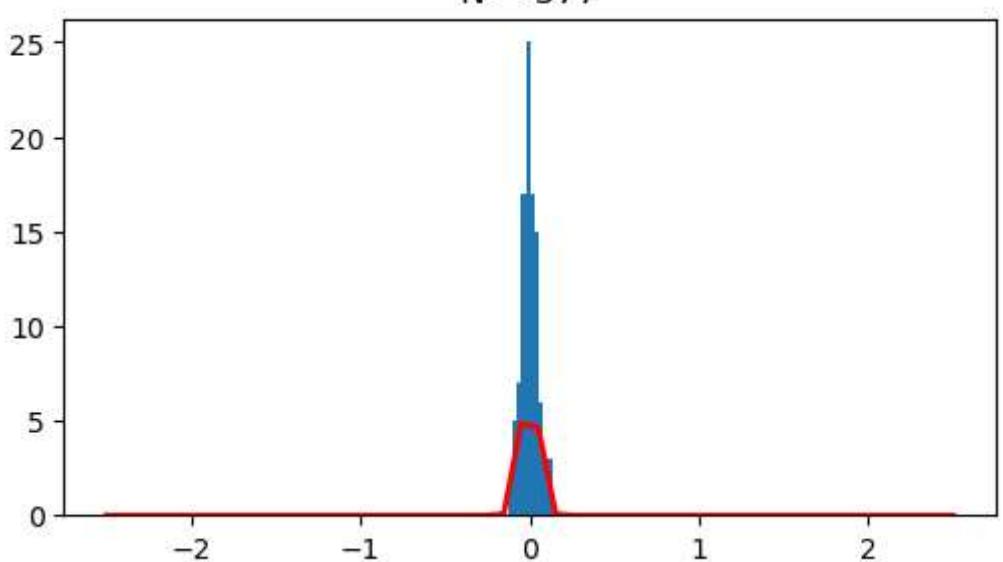


N = 377

Média = -0.0010952405447168711

Variância = 0.0024894115800090963

N = 377

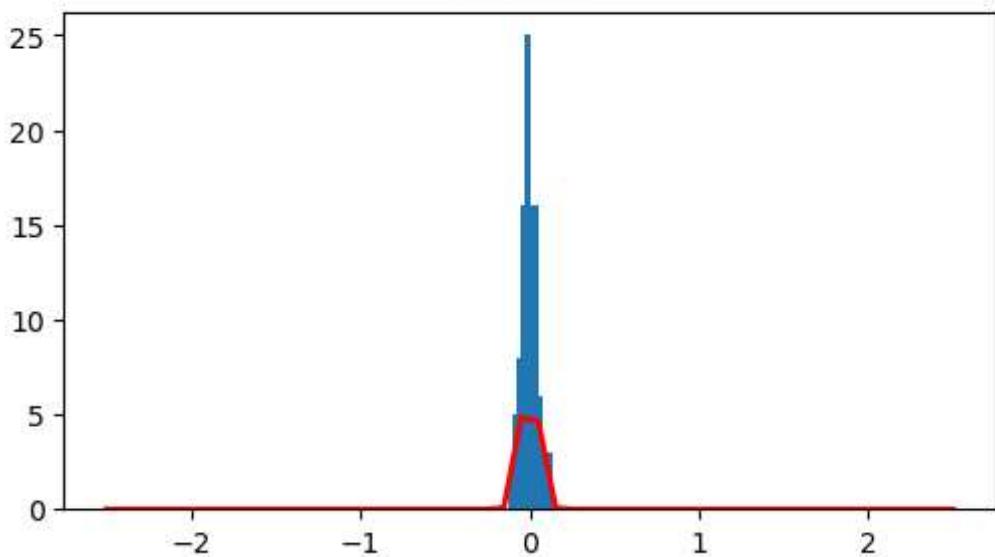


N = 378

Média = -0.0009559197731827881

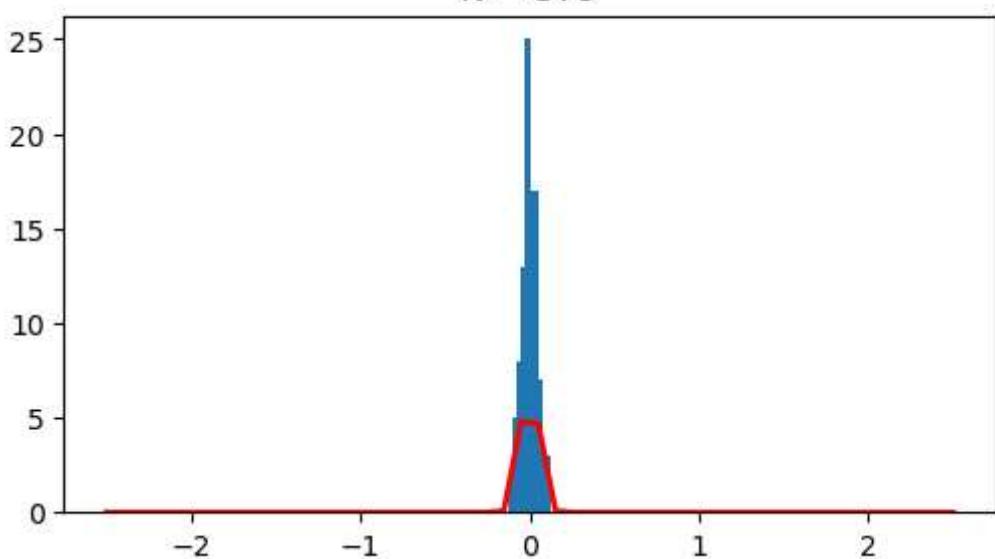
Variância = 0.0024638776156910404

N = 378



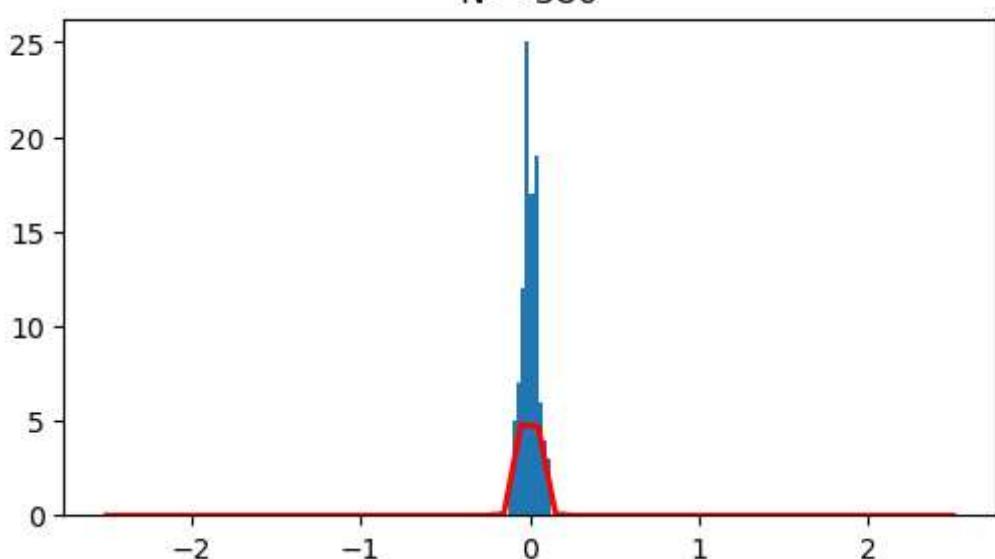
N = 379 Média = -0.0005816732725443343 Variância = 0.0024904259512441734

N = 379



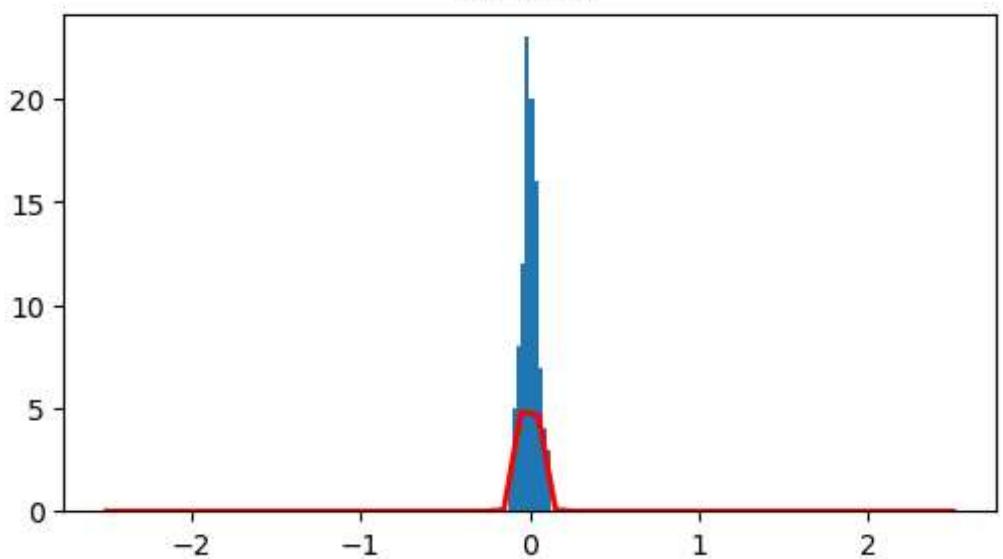
N = 380 Média = -0.0005439092079322303 Variância = 0.0024422809840124616

N = 380



N = 381 Média = -0.0007088979194710836 Variância = 0.002419101391692912

N = 381

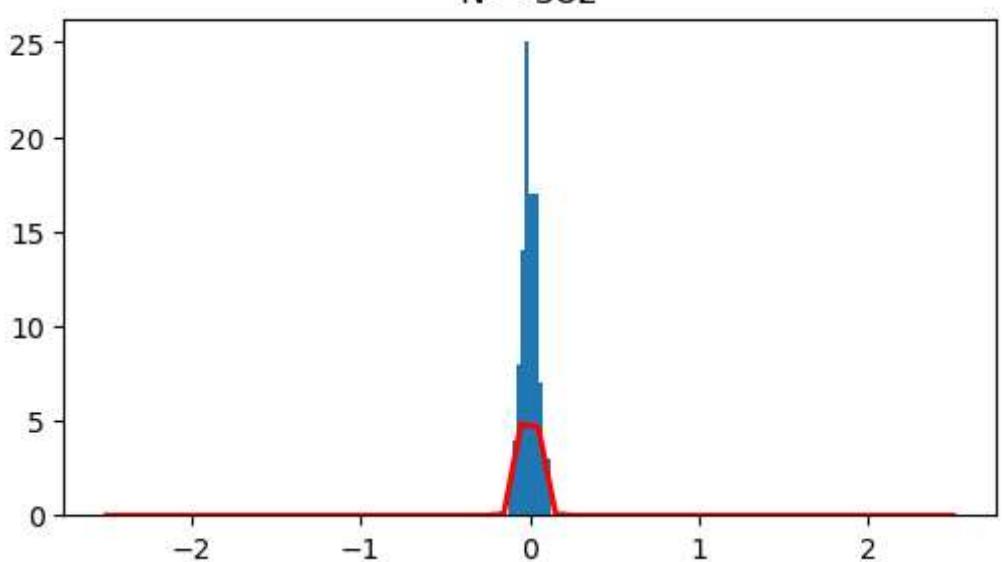


N = 382

Média = -0.0008056267232905969

Variância = 0.0024628805445795214

N = 382

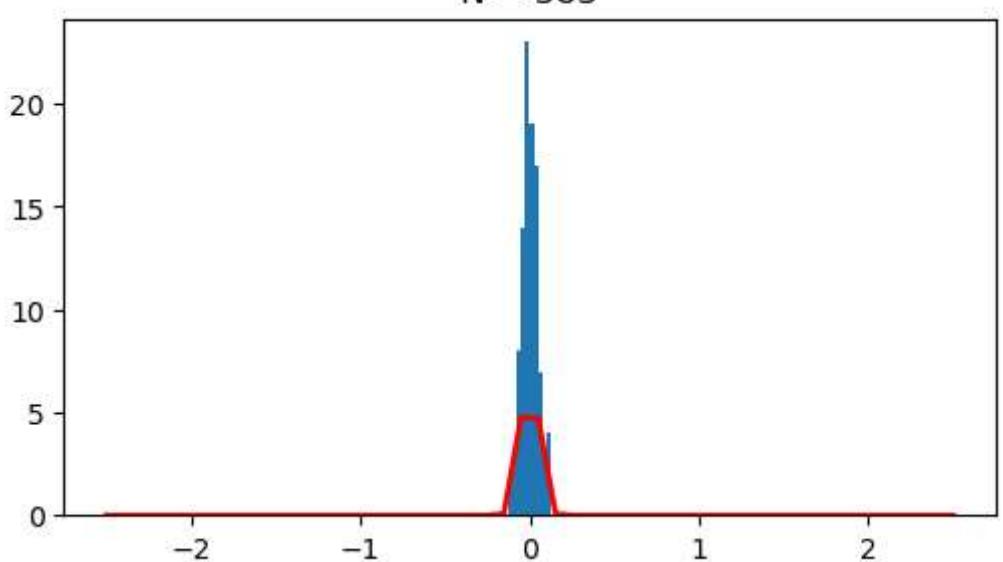


N = 383

Média = -0.000219380625160253

Variância = 0.00246992330632683

N = 383

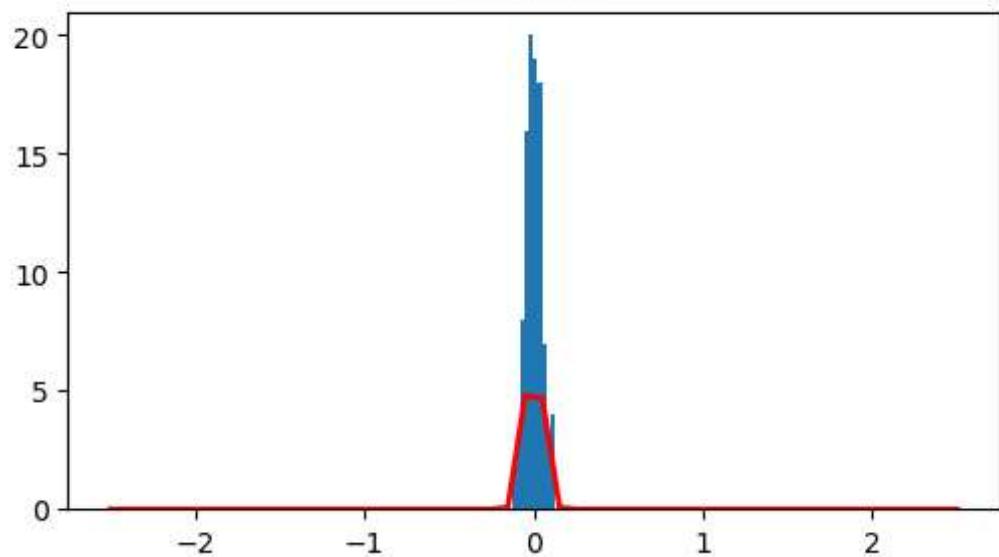


N = 384

Média = -0.0005375621060335821

Variância = 0.002470687548669948

N = 384

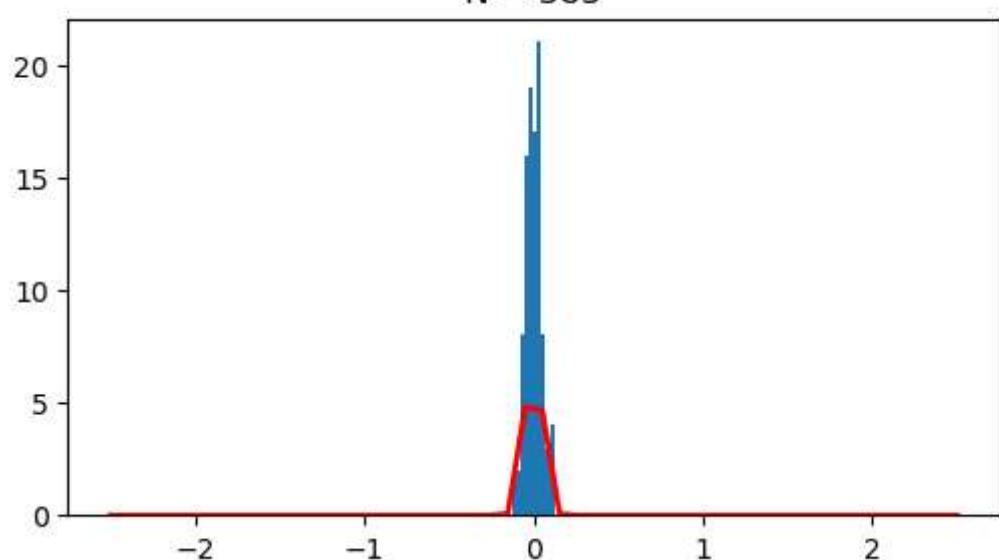


N = 385

Média = -0.0008210002100339733

Variância = 0.002439284407594845

N = 385

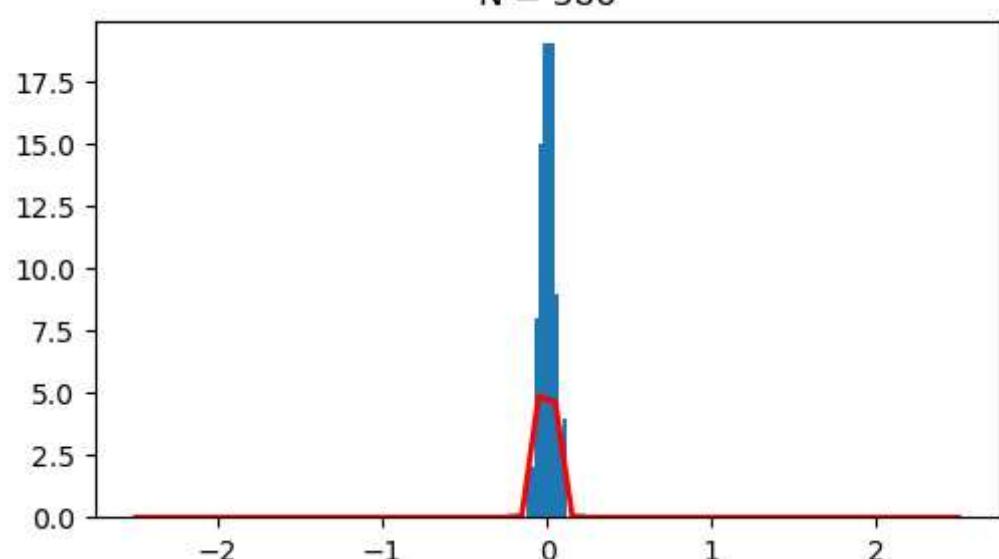


N = 386

Média = -0.001197181667088064

Variância = 0.002420769811495365

N = 386

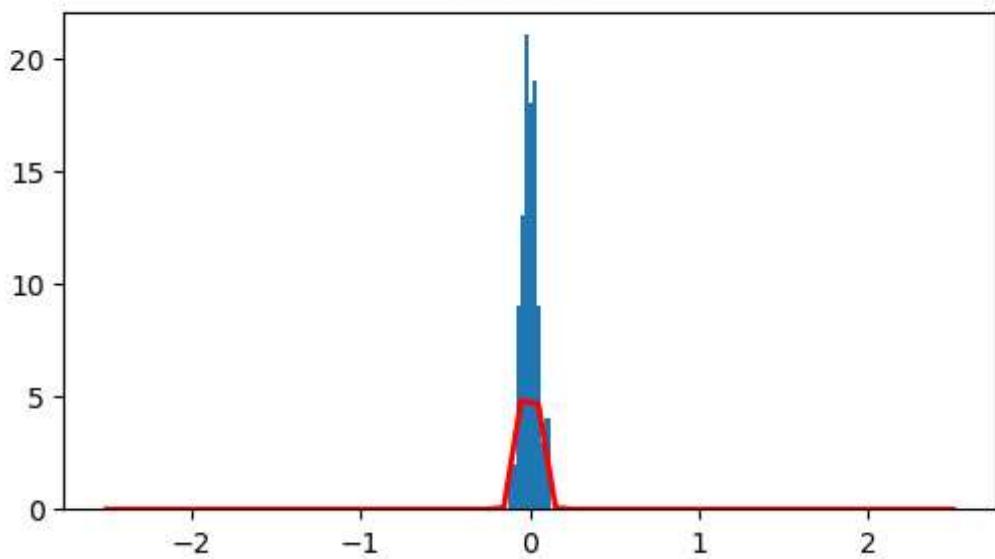


N = 387

Média = -0.0007537654489399312

Variância = 0.0024222367130025415

N = 387

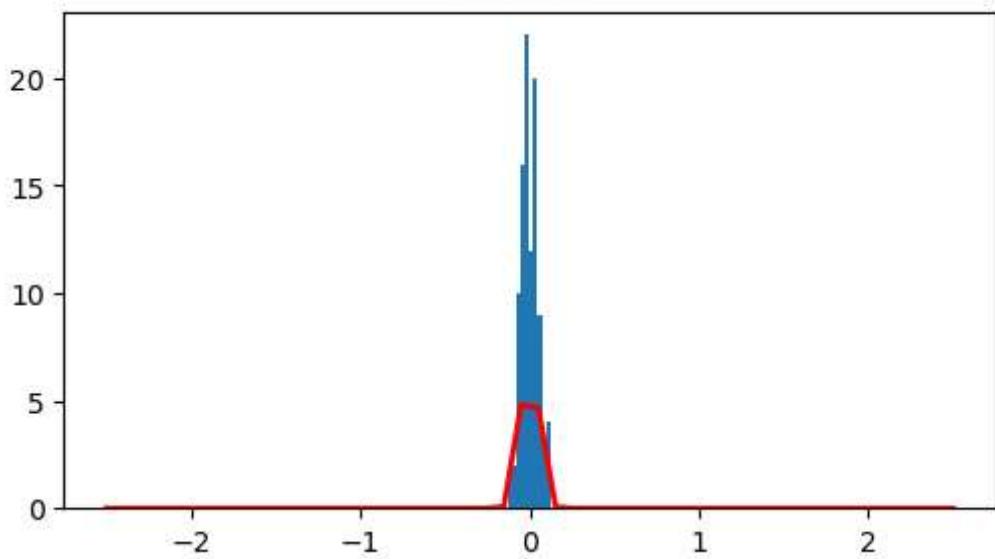


N = 388

Média = -0.000658095563159895

Variância = 0.0024577983602107

N = 388

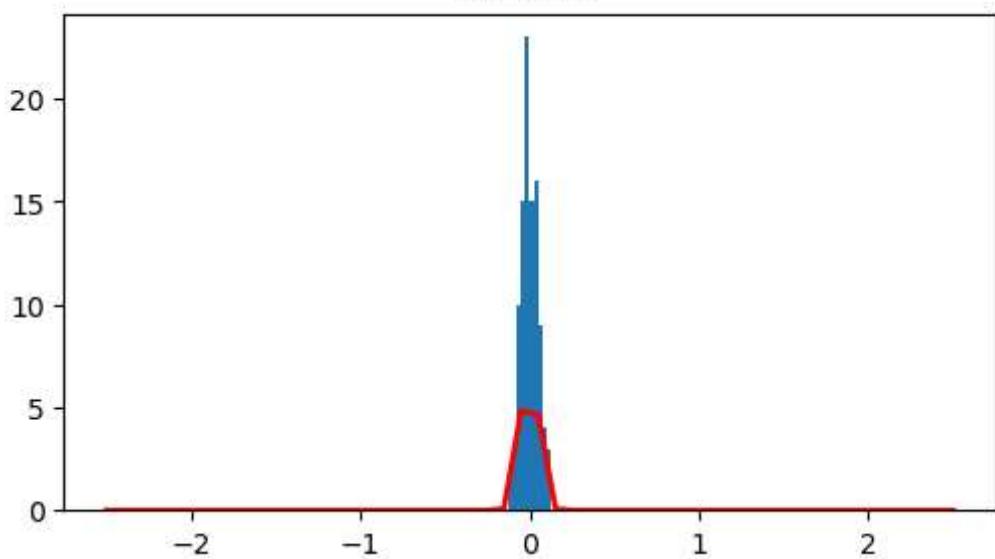


N = 389

Média = -0.00092743796232575

Variância = 0.002457878336064669

N = 389

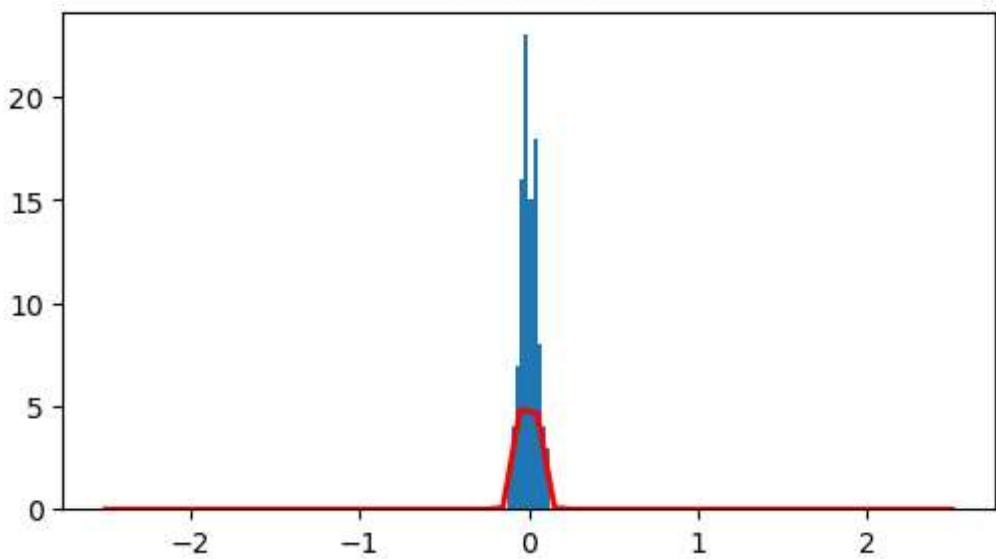


N = 390

Média = -0.0007827857485061204

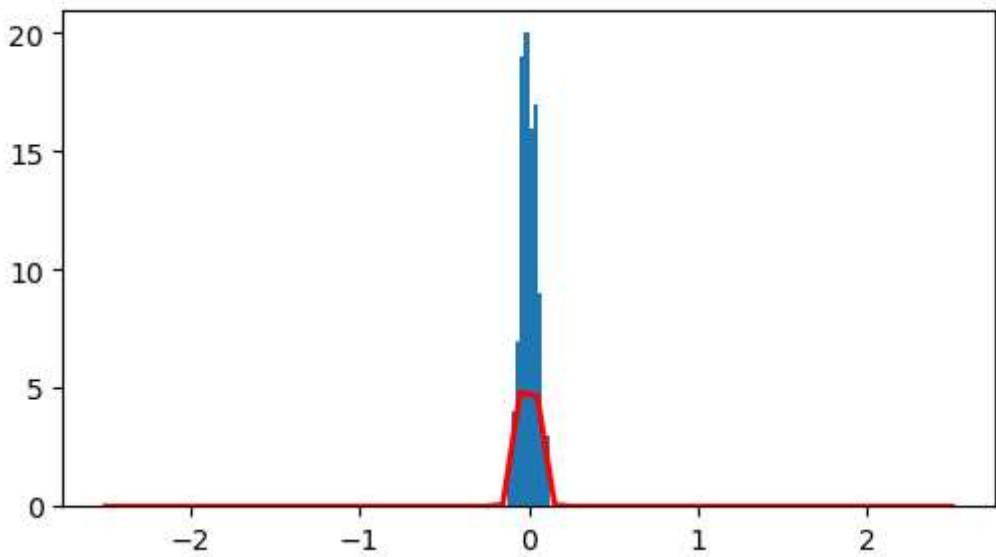
Variância = 0.0024372686619228592

N = 390



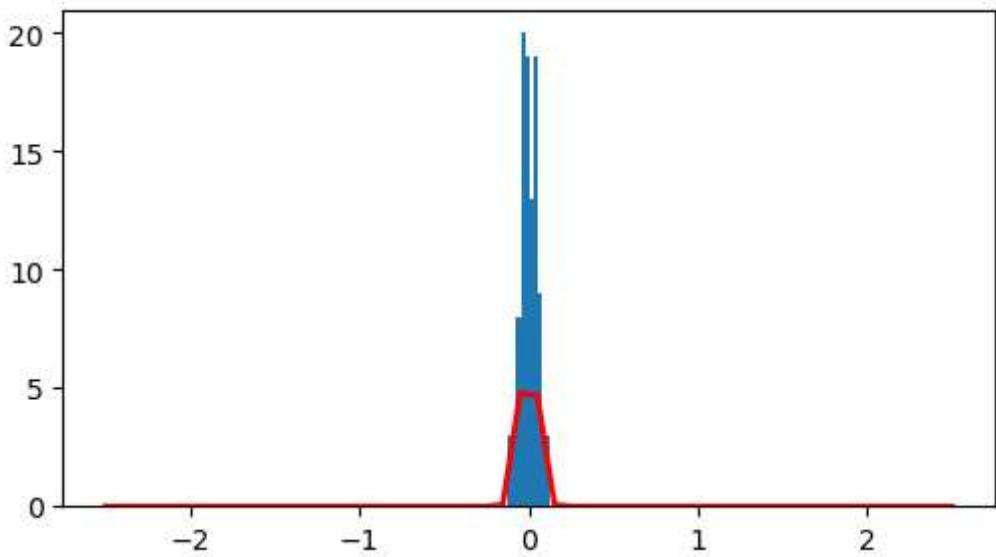
N = 391 Média = -0.0007895343834492724 Variância = 0.0024167476816593114

N = 391



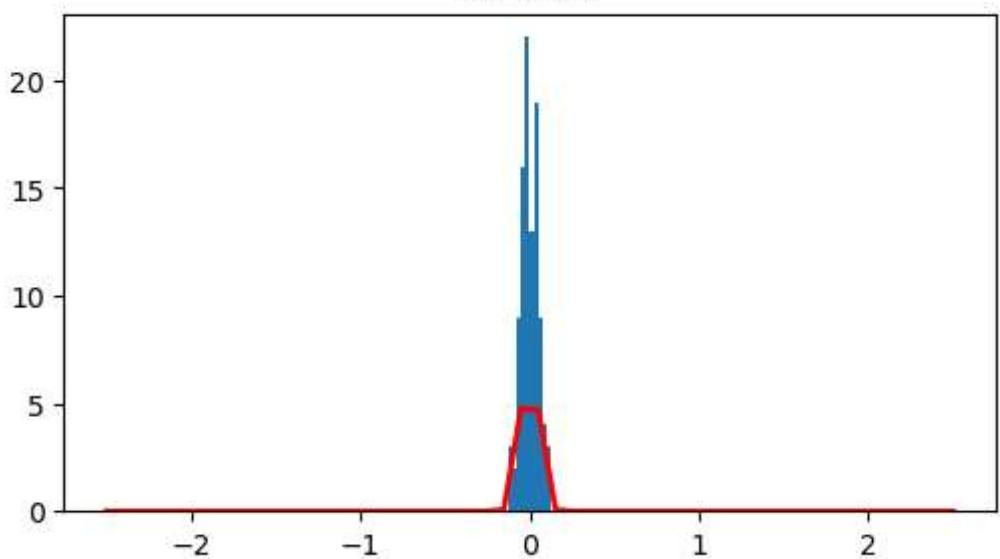
N = 392 Média = -0.0005037167584056062 Variância = 0.0024573996841902547

N = 392



N = 393 Média = -0.00030007014283000747 Variância = 0.002467781975496391
6

N = 393

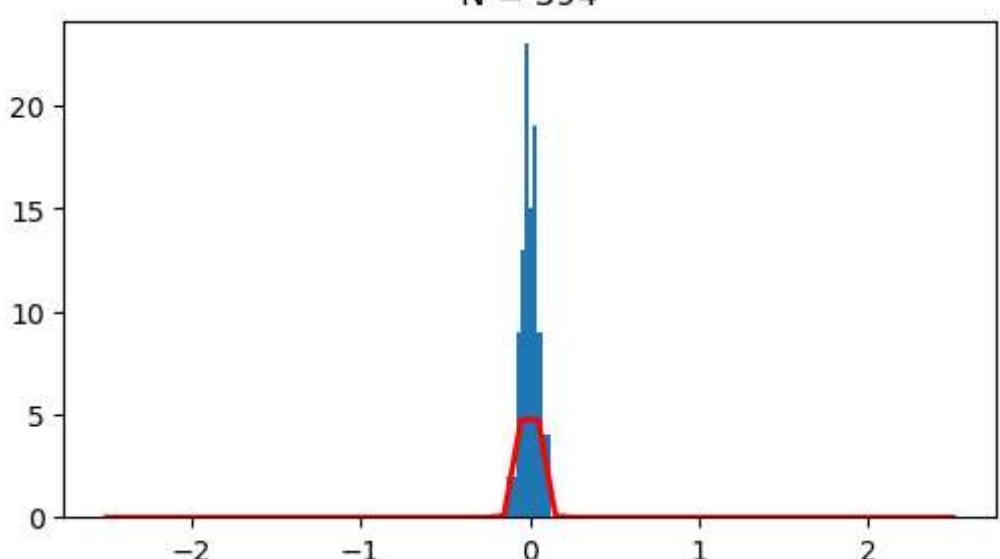


N = 394

Média = 1.082094957825859e-05

Variância = 0.002477657729643726

N = 394

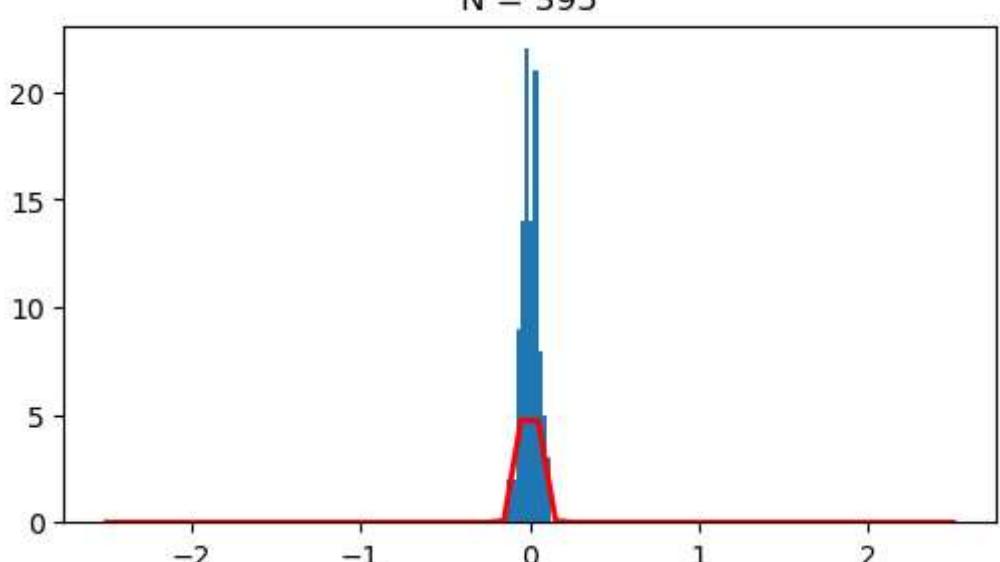


N = 395

Média = -8.356912162026276e-05

Variância = 0.002454046385661815

N = 395

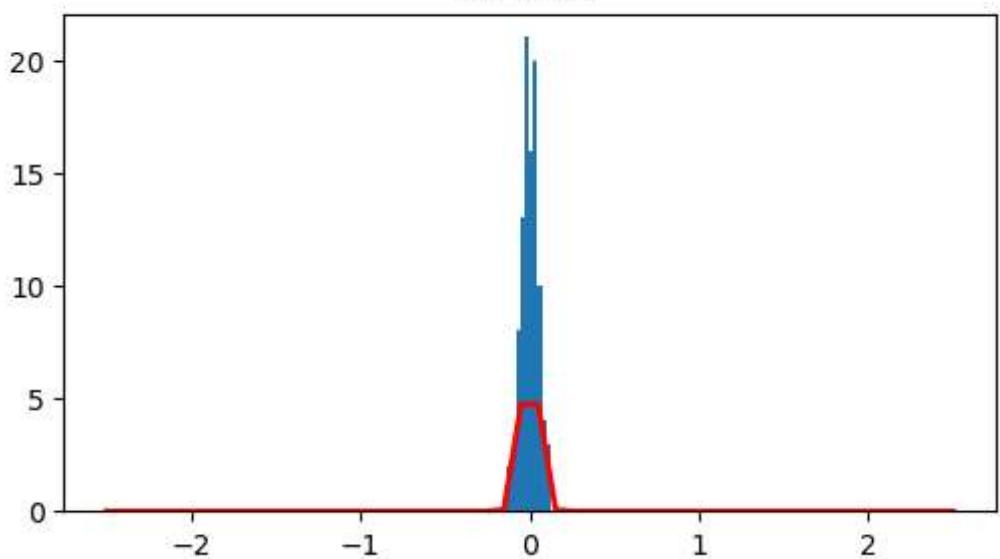


N = 396

Média = -8.530331062902393e-05

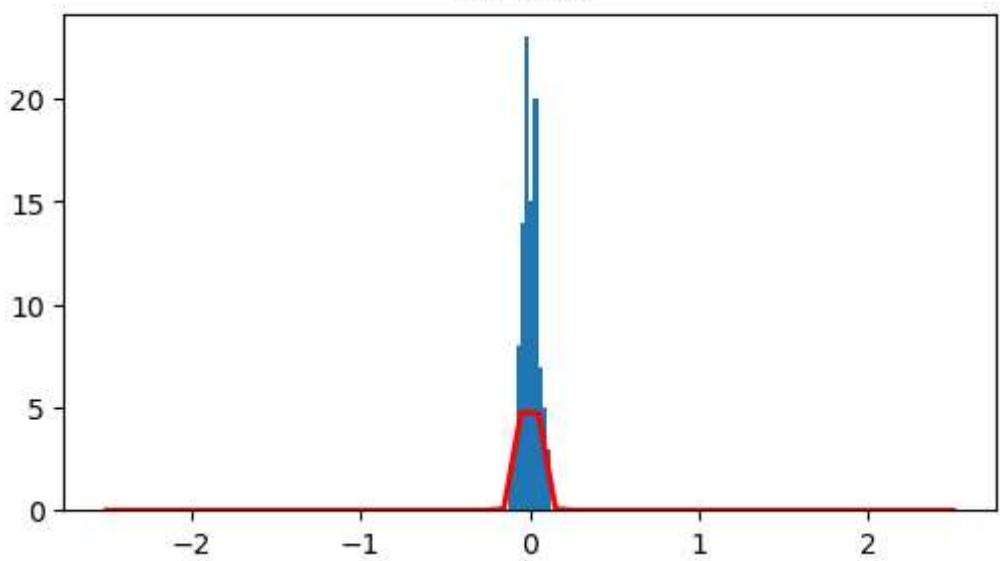
Variância = 0.0024409218558318147

N = 396



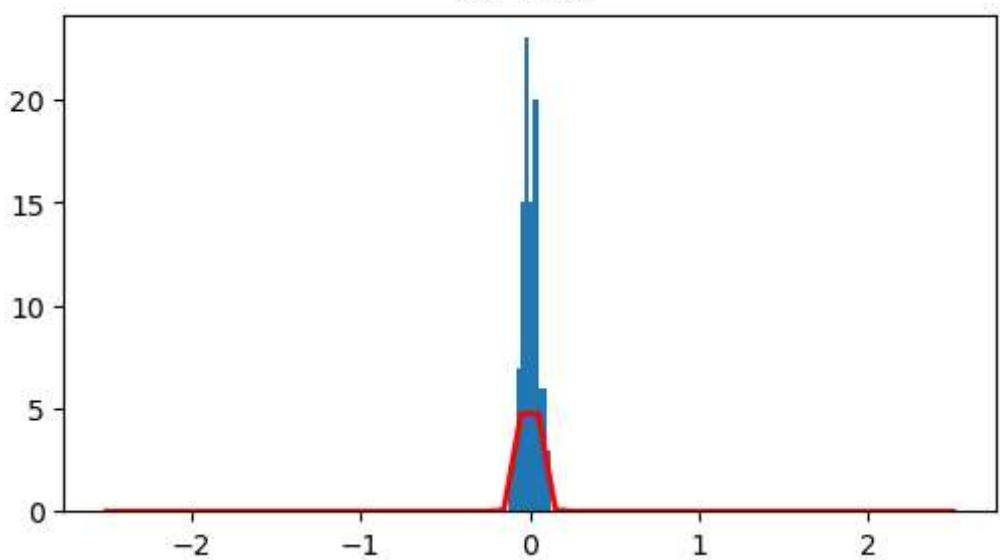
N = 397 Média = -0.00010460427514217322 Variância = 0.002445847673629280
5

N = 397



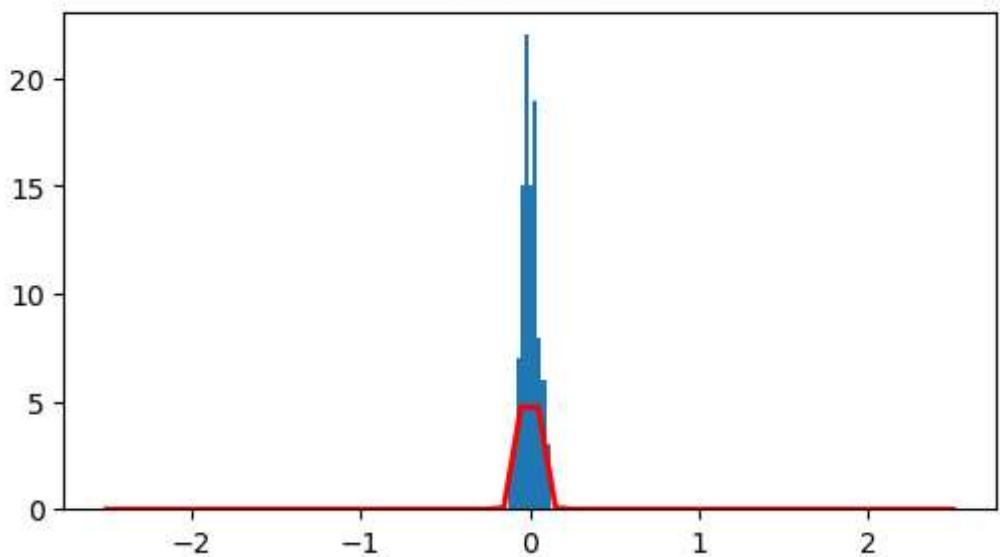
N = 398 Média = 3.084212516300103e-05 Variância = 0.0023883926308338518

N = 398



N = 399 Média = -0.00013491520300492818 Variância = 0.002413365051611345

N = 399

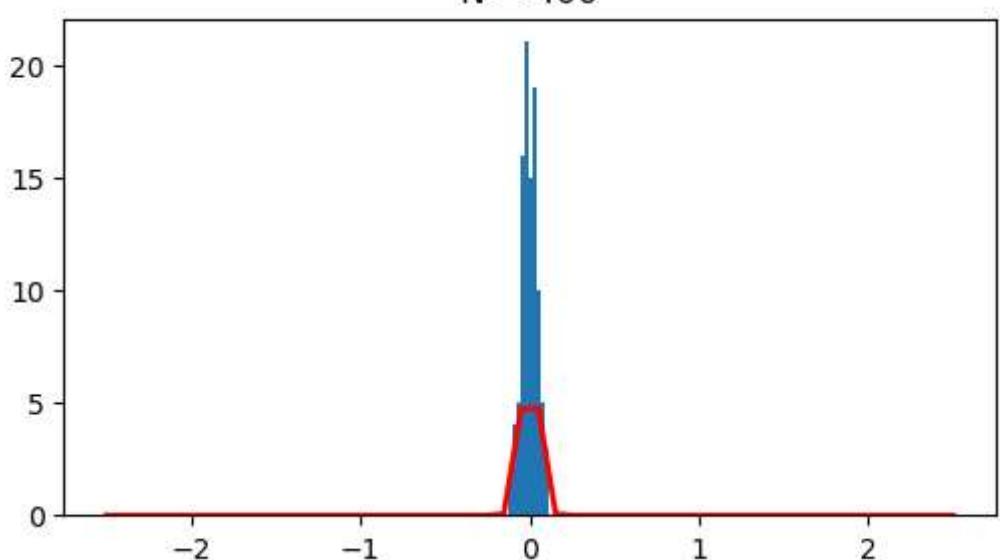


N = 400

Média = 0.00016716884846106395

Variância = 0.002400082026633223

N = 400

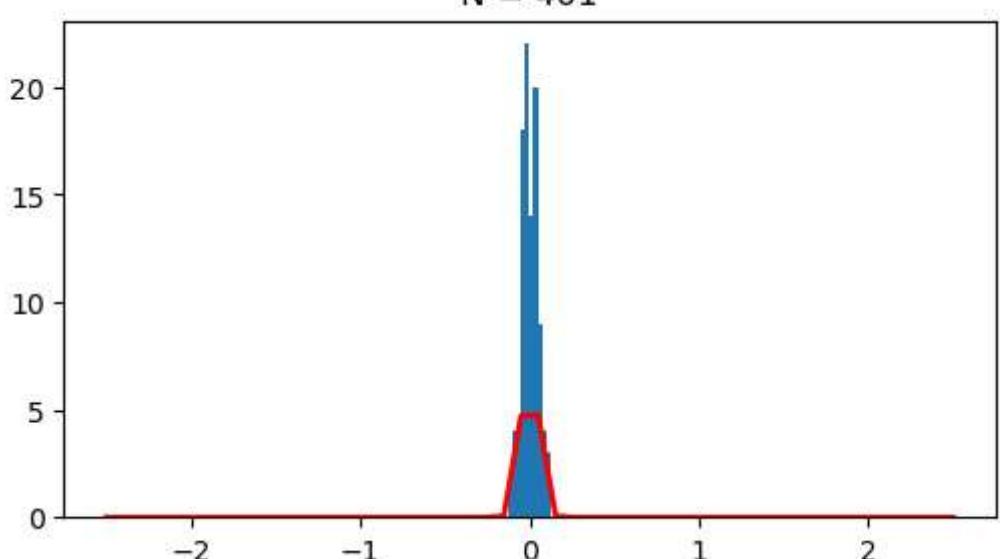


N = 401

Média = 0.00016848342667025764

Variância = 0.0023926687421731295

N = 401

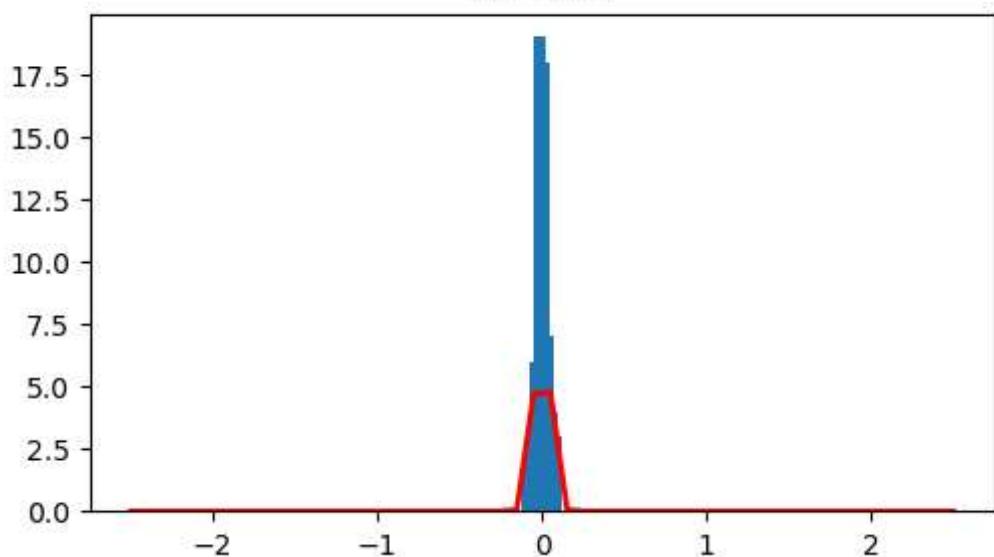


N = 402

Média = 0.00025641265174469014

Variância = 0.002400650069927116

N = 402

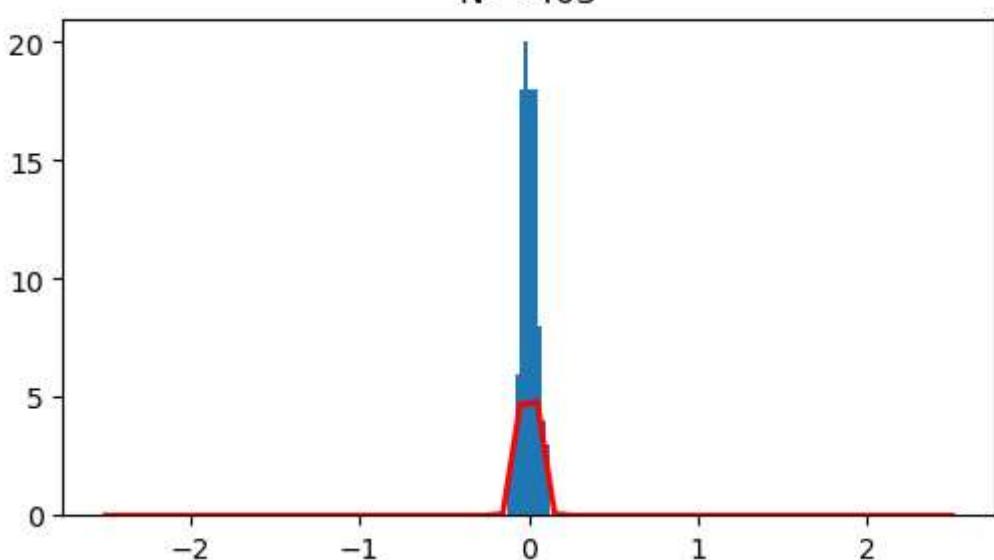


N = 403

Média = 0.0005285158980887828

Variância = 0.002417630969910158

N = 403

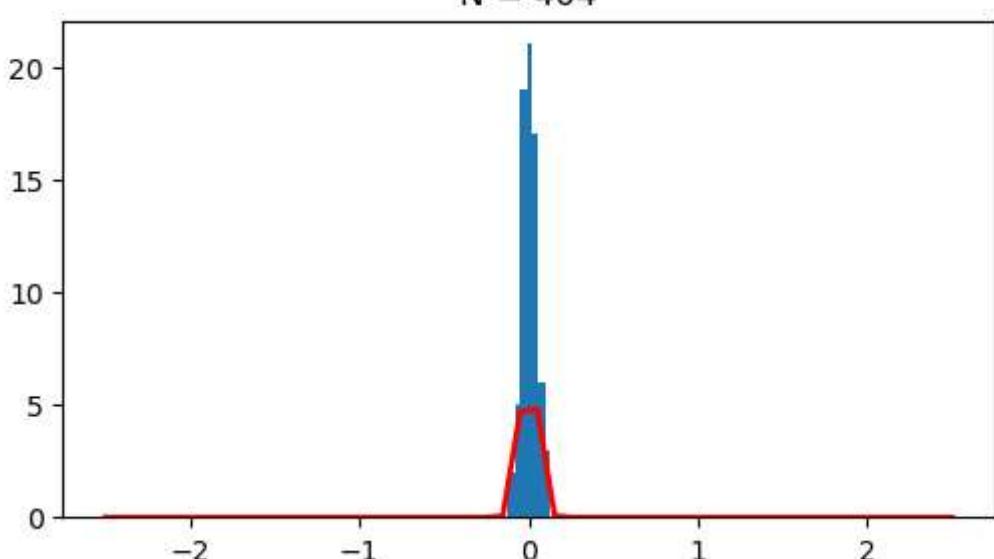


N = 404

Média = 0.0006317787016521995

Variância = 0.0024384023107011693

N = 404

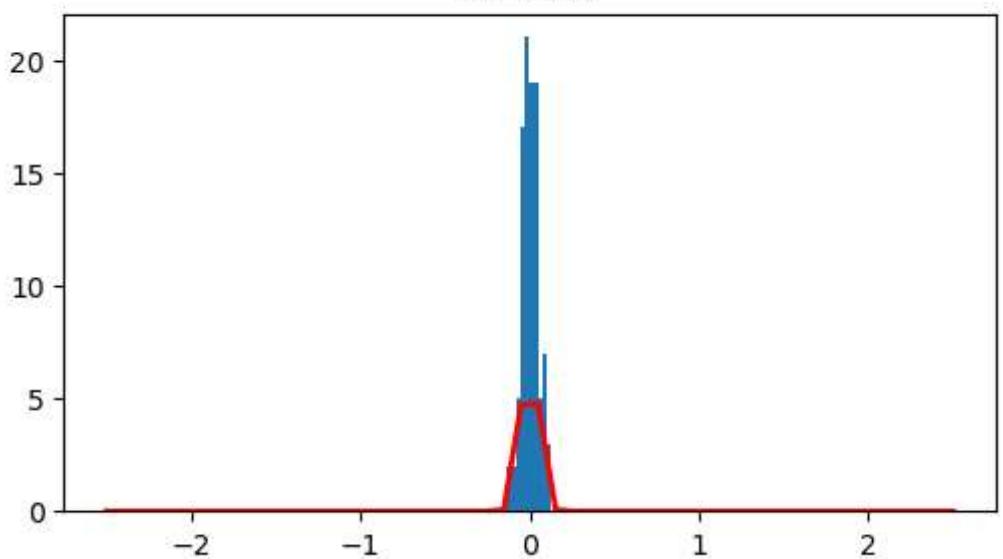


N = 405

Média = 0.00025376008758993954

Variância = 0.002451494047573664

N = 405

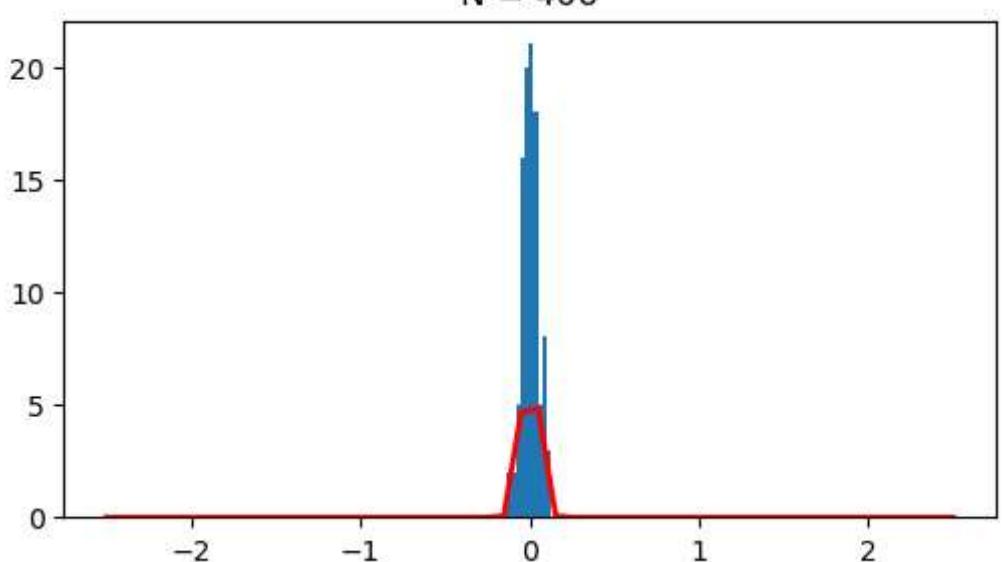


N = 406

Média = 0.0008458173945090097

Variância = 0.0024067252777860196

N = 406

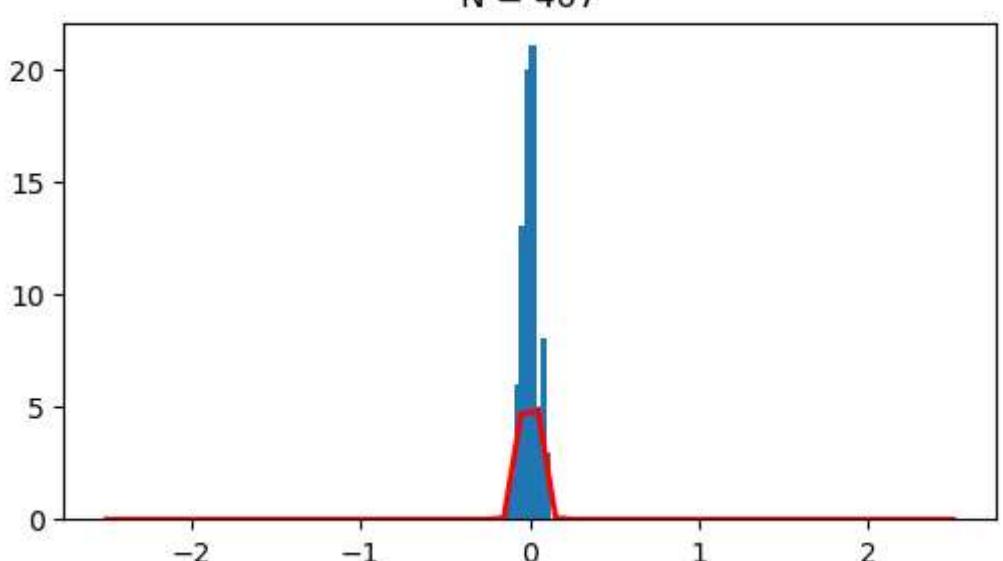


N = 407

Média = 0.0005992686660650094

Variância = 0.002372712174153584

N = 407

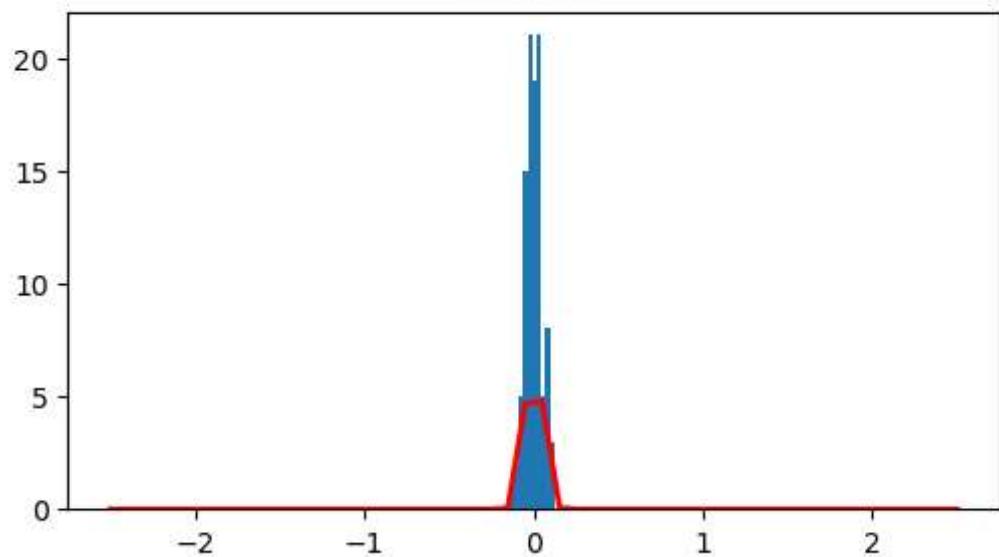


N = 408

Média = 0.0005145545644958164

Variância = 0.0023314399238303475

N = 408

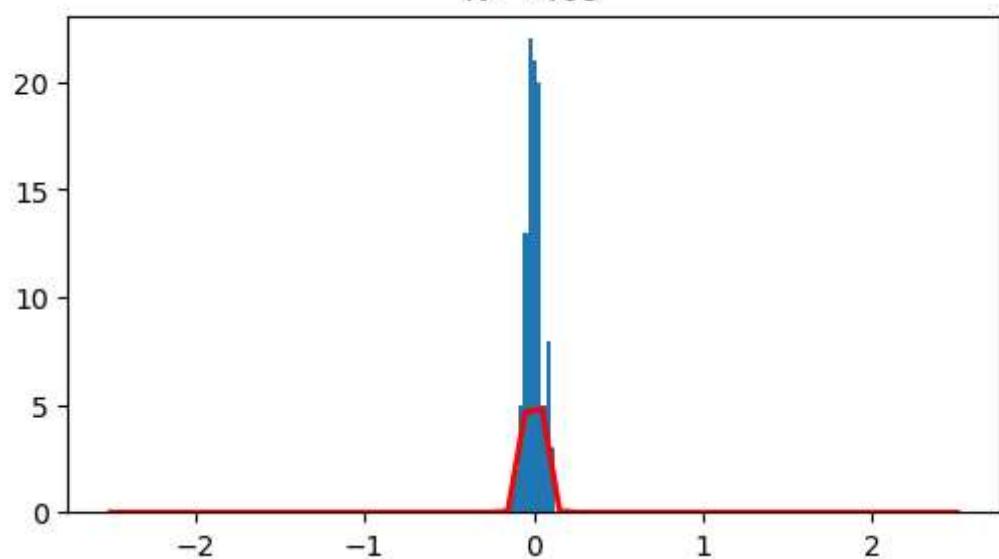


N = 409

Média = 0.0005784391351855934

Variância = 0.0023418185533919927

N = 409

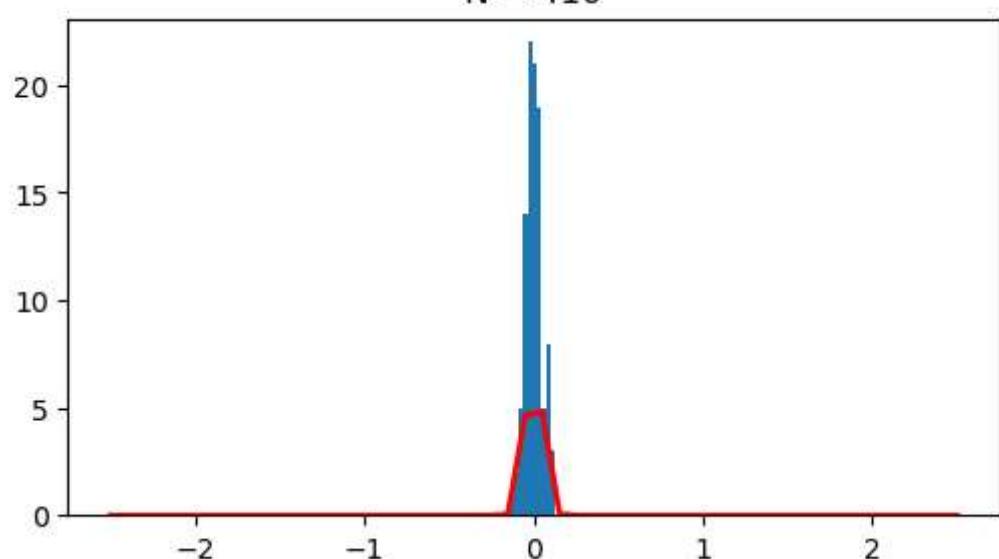


N = 410

Média = 0.0008331940352942466

Variância = 0.002344557153713095

N = 410

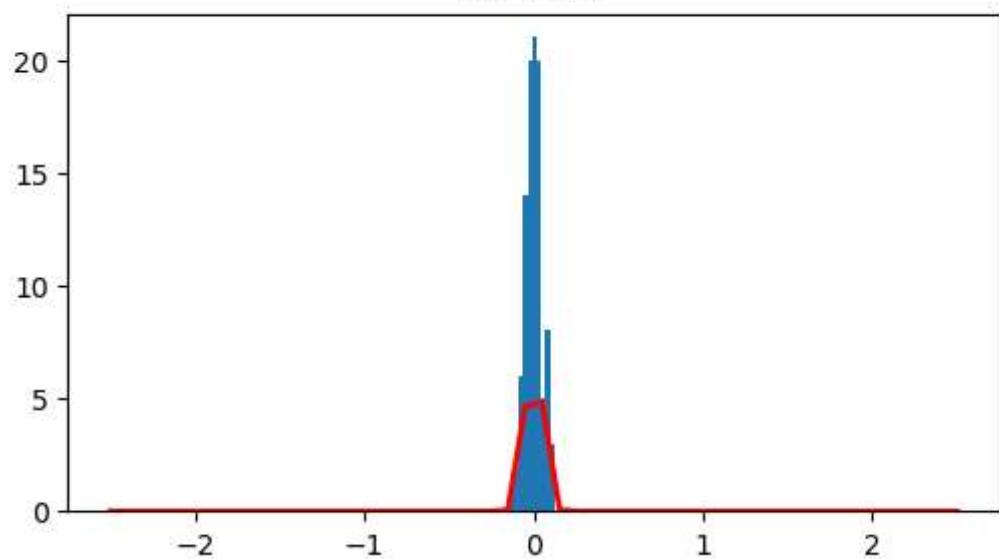


N = 411

Média = 0.0008116903339989302

Variância = 0.0023594348583829863

N = 411

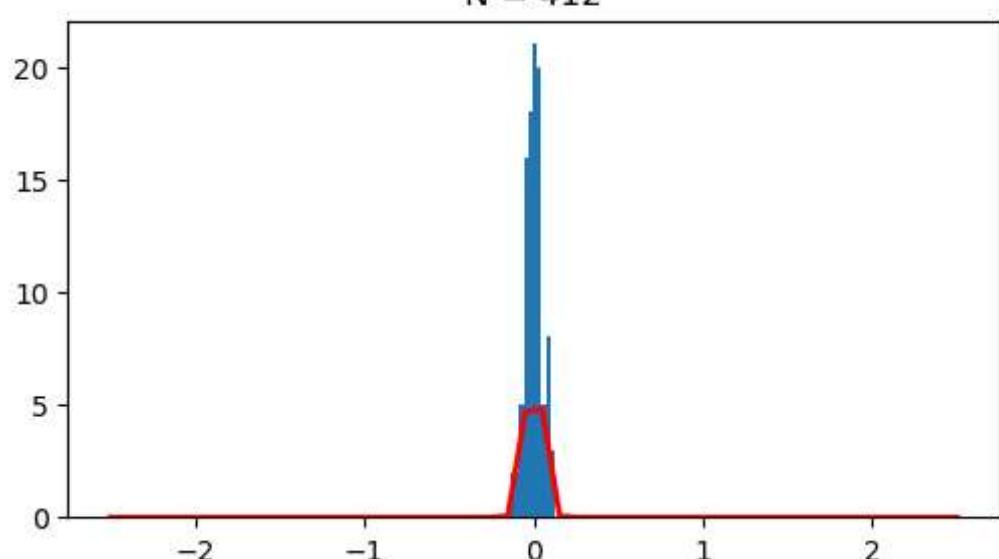


N = 412

Média = 0.0006665587759265675

Variância = 0.0023929226428786514

N = 412

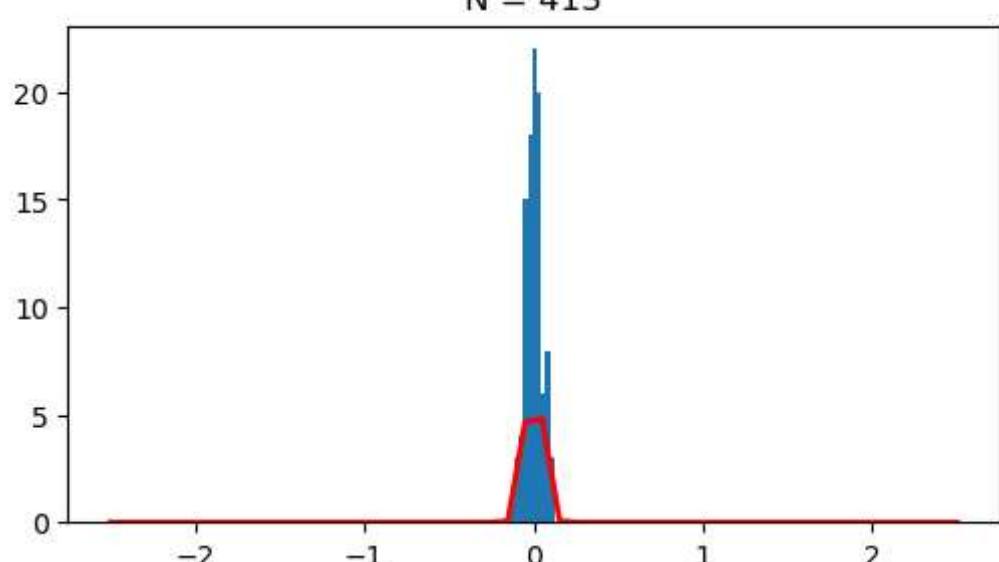


N = 413

Média = 0.0007388225182267752

Variância = 0.0023969473936667793

N = 413

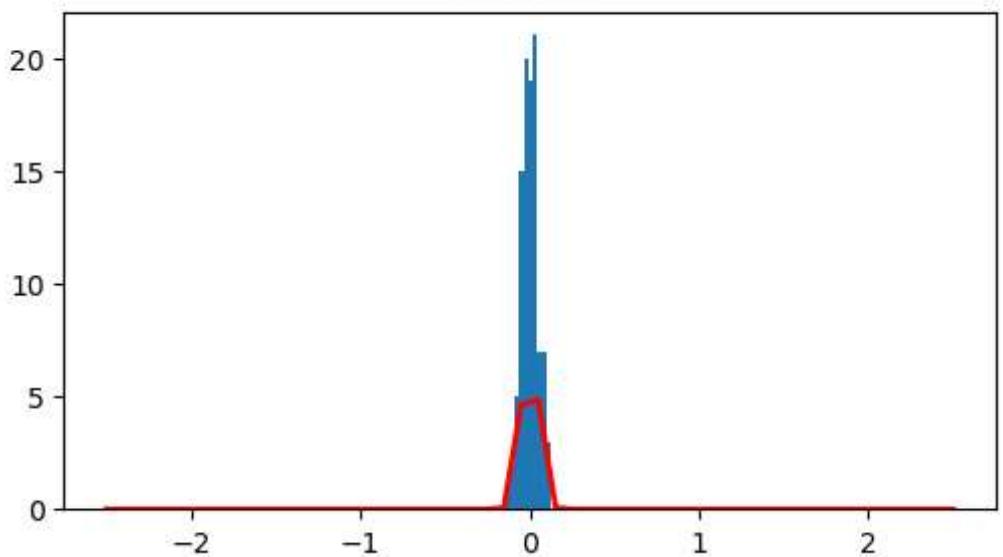


N = 414

Média = 0.001034387507005937

Variância = 0.002396385365473966

N = 414

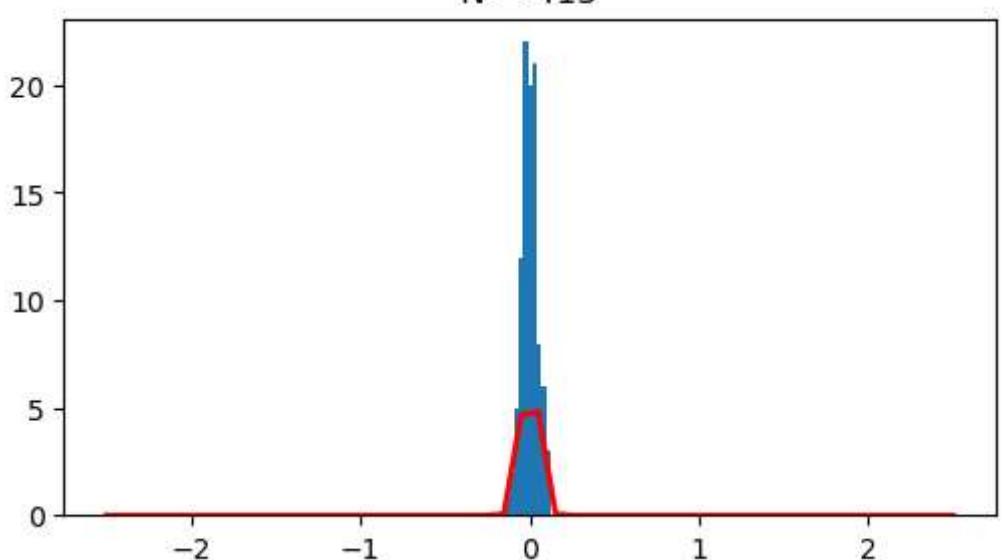


N = 415

Média = 0.0006344525293966433

Variância = 0.002393079419477725

N = 415

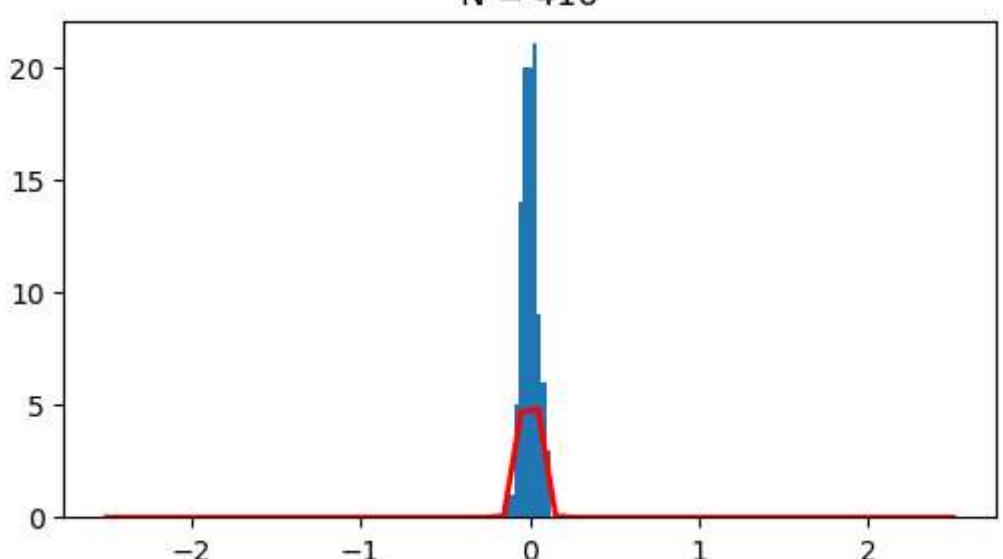


N = 416

Média = 0.0005652554093924468

Variância = 0.0023709608525292543

N = 416

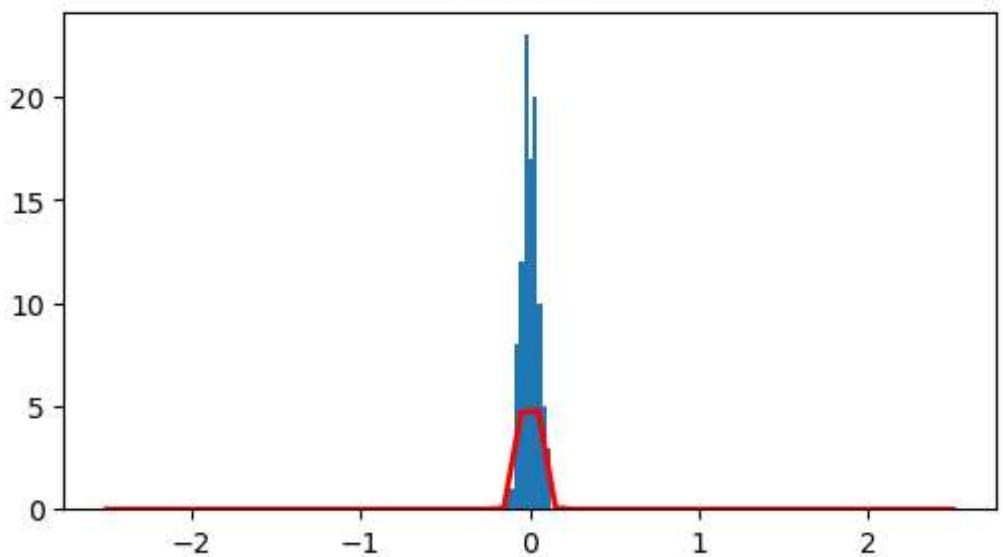


N = 417

Média = 0.00045695789884748

Variância = 0.0023662078459912844

N = 417

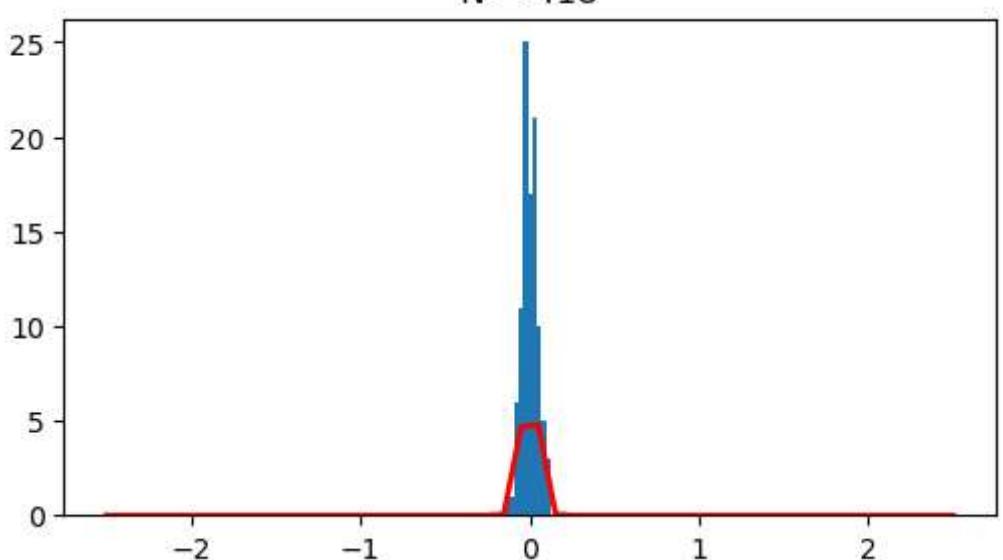


N = 418

Média = 0.0004604642207065773

Variância = 0.0023505731685099437

N = 418

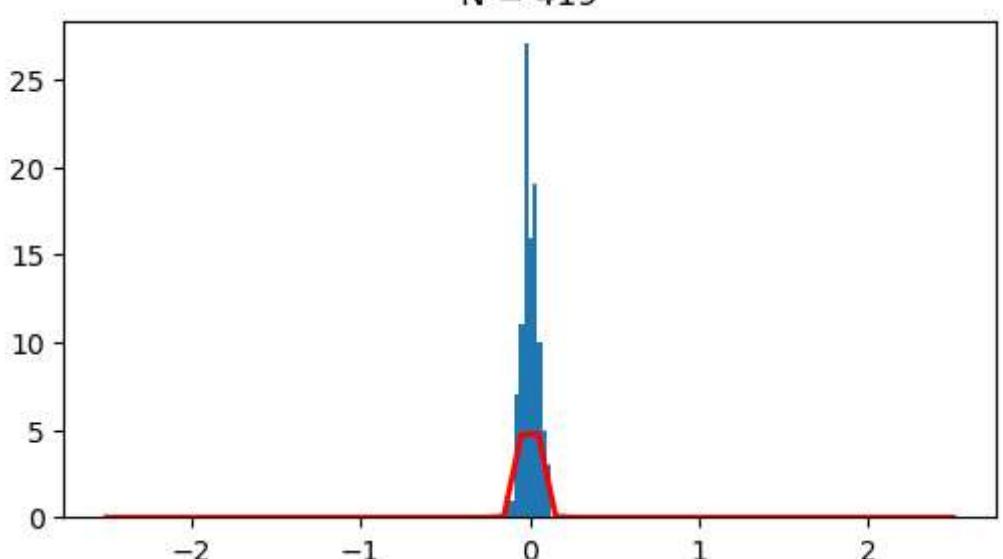


N = 419

Média = 0.00028932843618847216

Variância = 0.0023253671855340005

N = 419

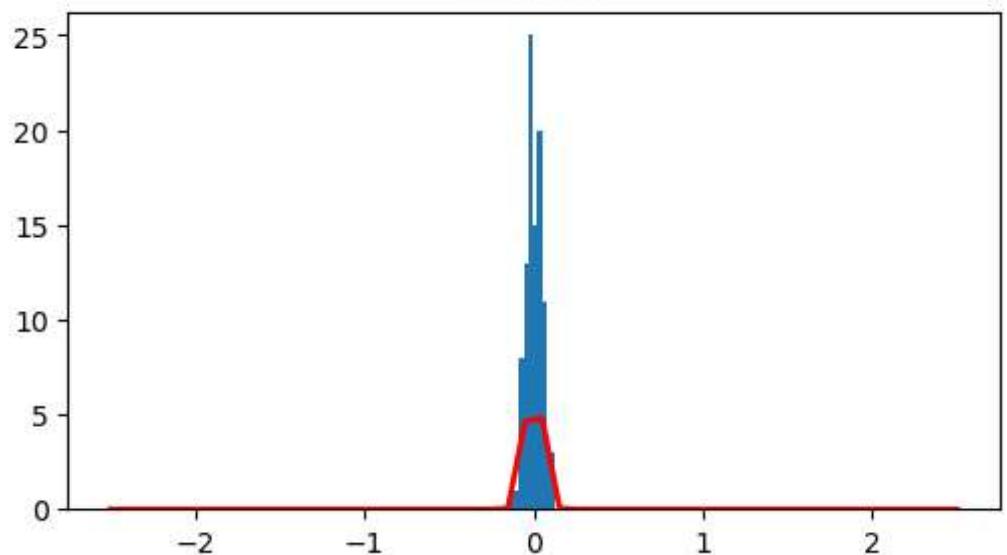


N = 420

Média = 0.0006512647716851289

Variância = 0.002262706977629682

N = 420

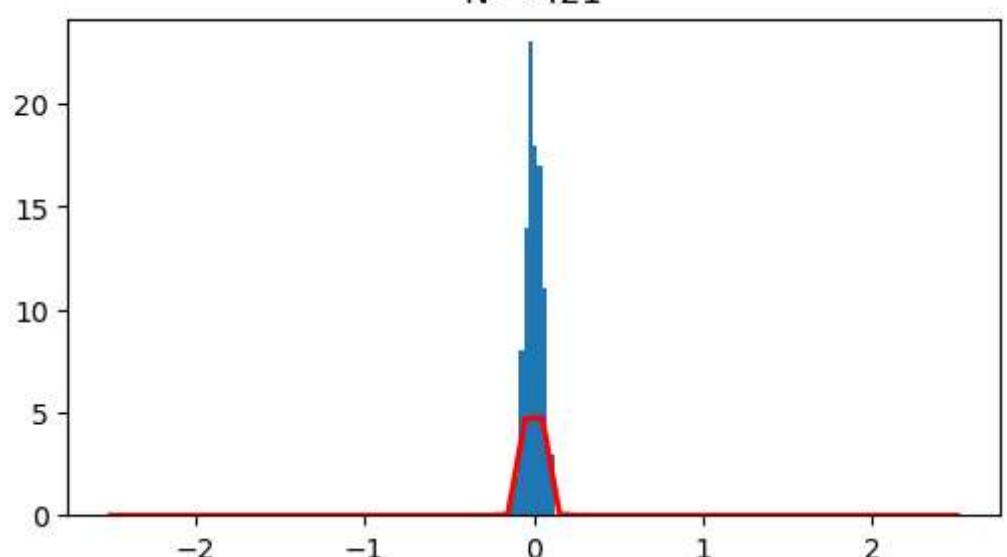


N = 421

Média = 0.0002869602978570524

Variância = 0.002236578042058463

N = 421

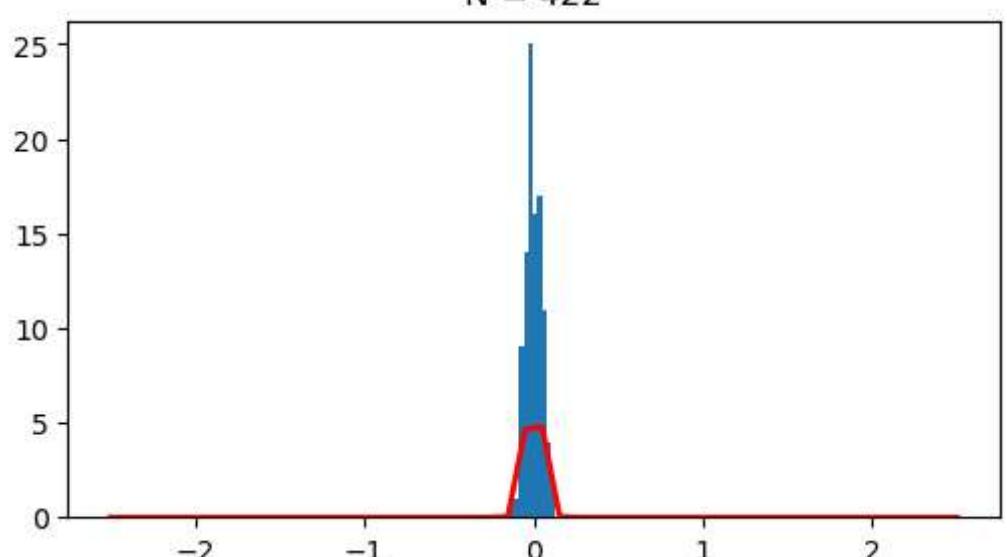


N = 422

Média = 0.0005232646386572946

Variância = 0.0022396167398191194

N = 422

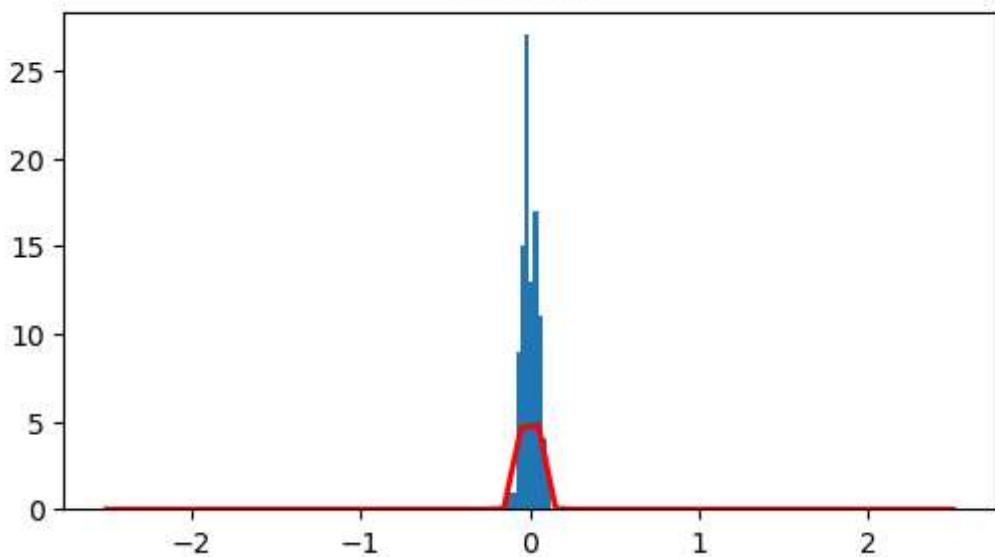


N = 423

Média = 0.0007816054205357573

Variância = 0.002237238910908067

N = 423

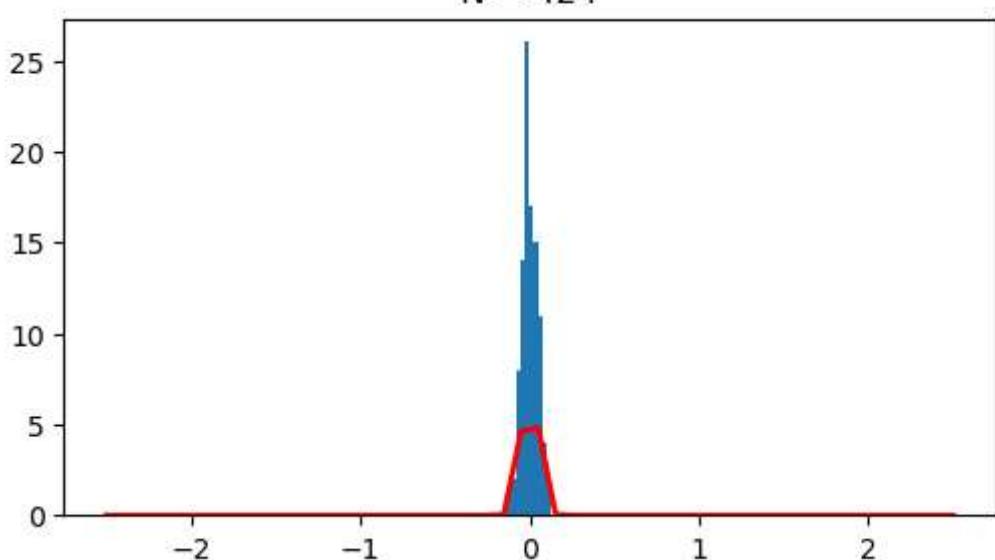


N = 424

Média = 0.0009233138775569796

Variância = 0.00223142476410888

N = 424

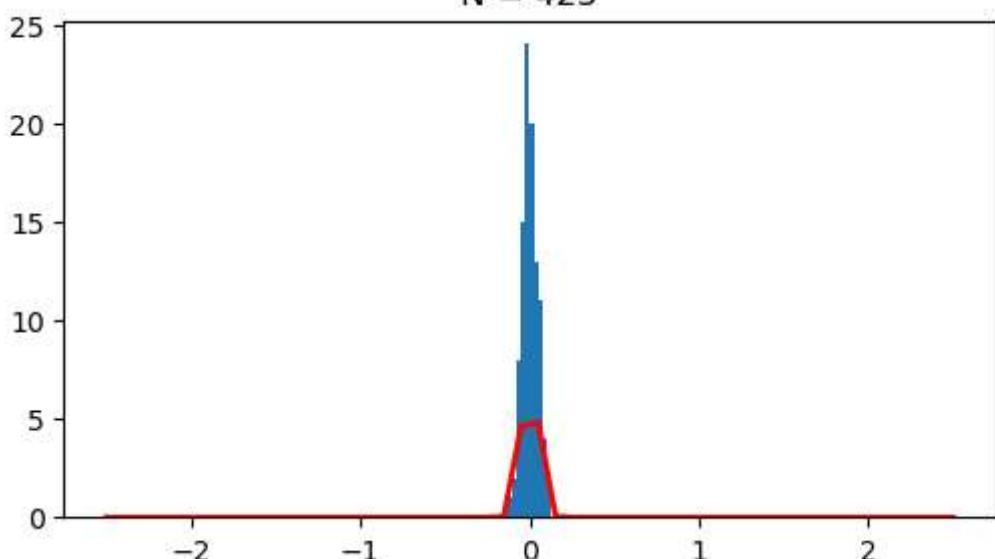


N = 425

Média = 0.000940818480748383

Variância = 0.0022355559847808035

N = 425

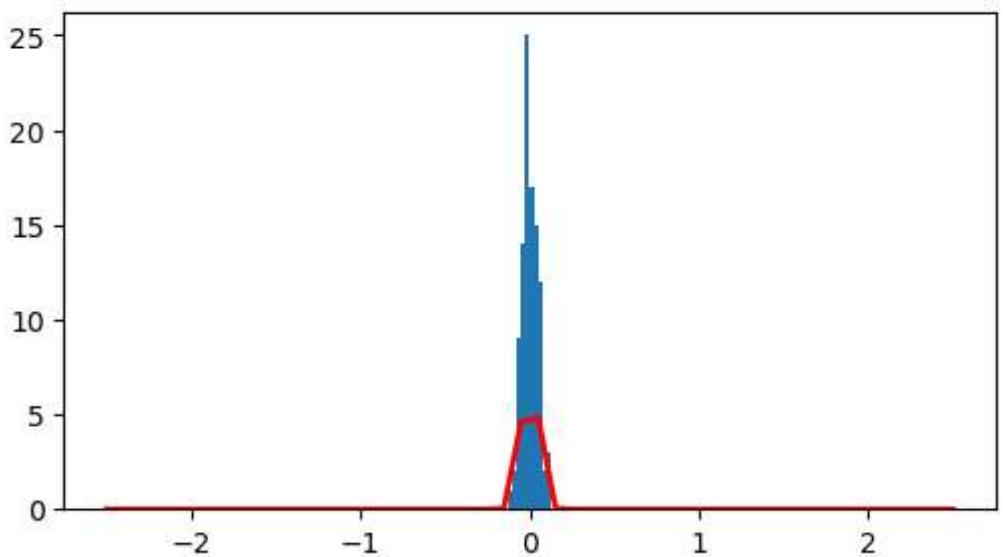


N = 426

Média = 0.0009792503101323127

Variância = 0.002219728480478871

N = 426

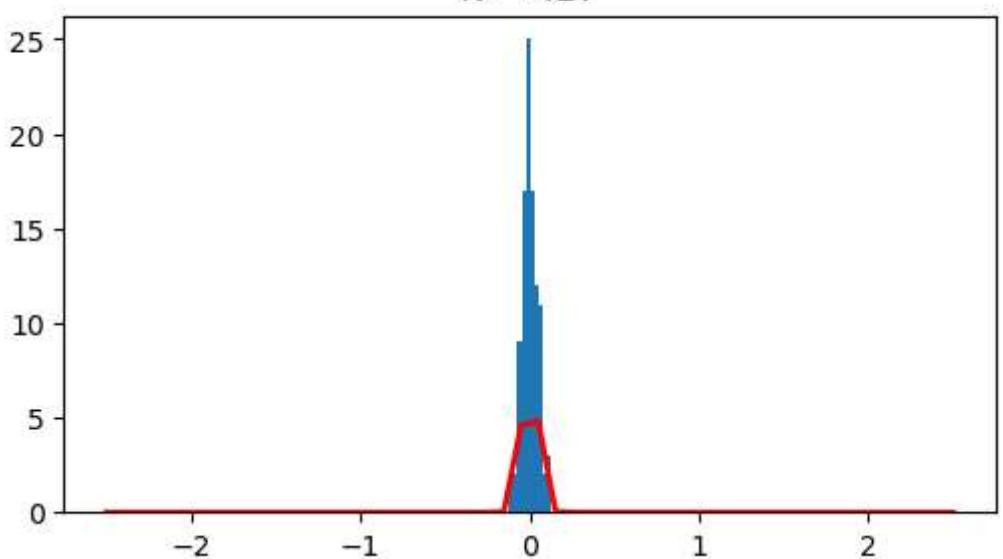


N = 427

Média = 0.0009778704684172018

Variância = 0.002183907914047461

N = 427

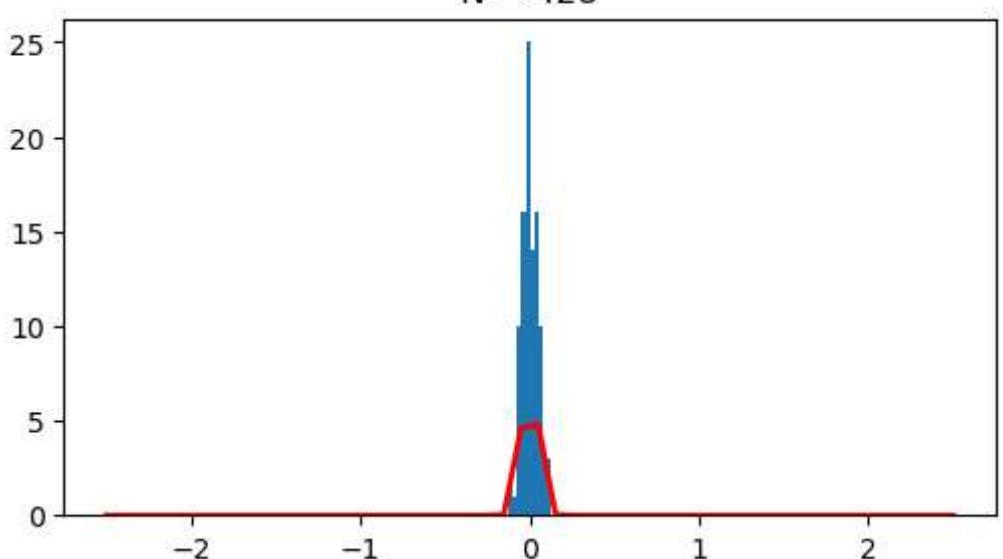


N = 428

Média = 0.0007639022112545257

Variância = 0.0022008955925931903

N = 428

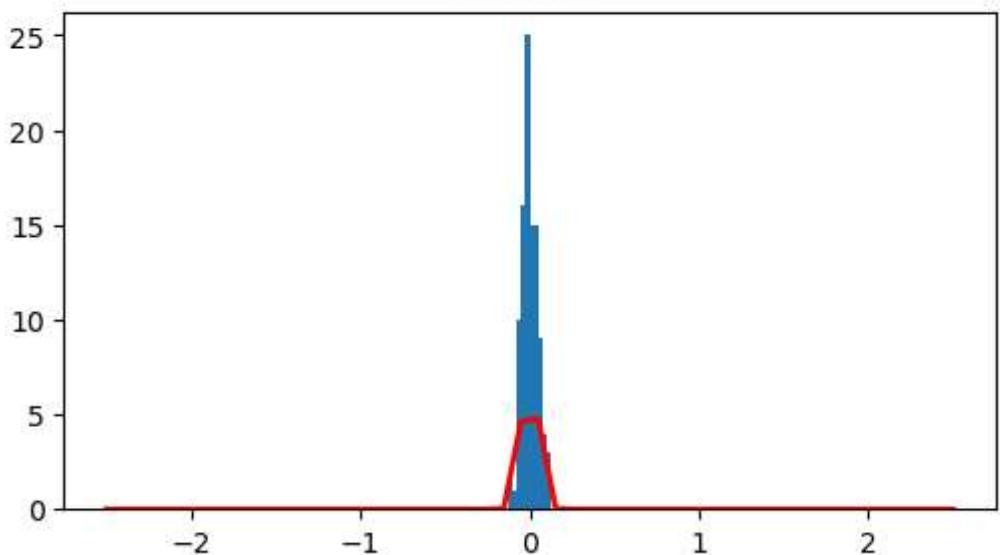


N = 429

Média = 0.0005056390439857558

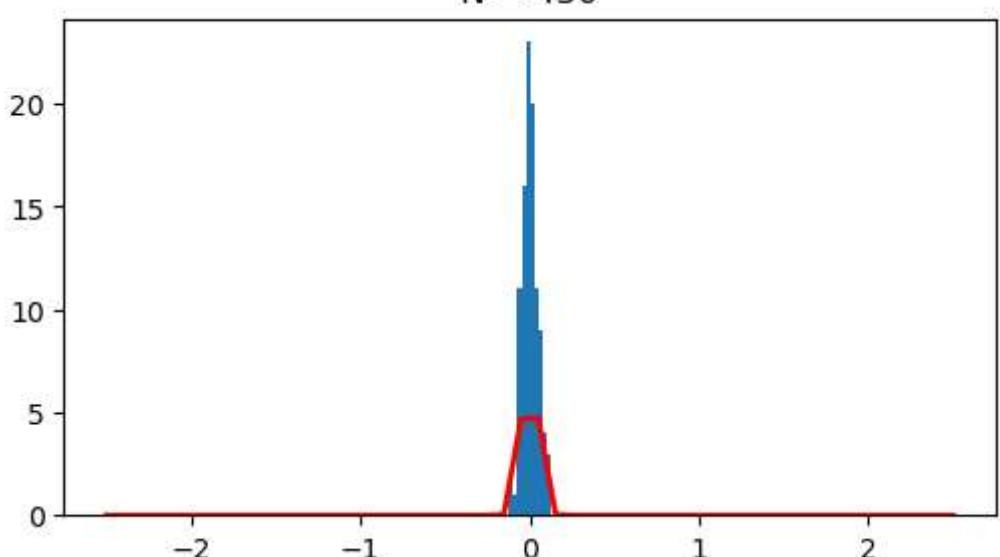
Variância = 0.0021905255906438455

N = 429



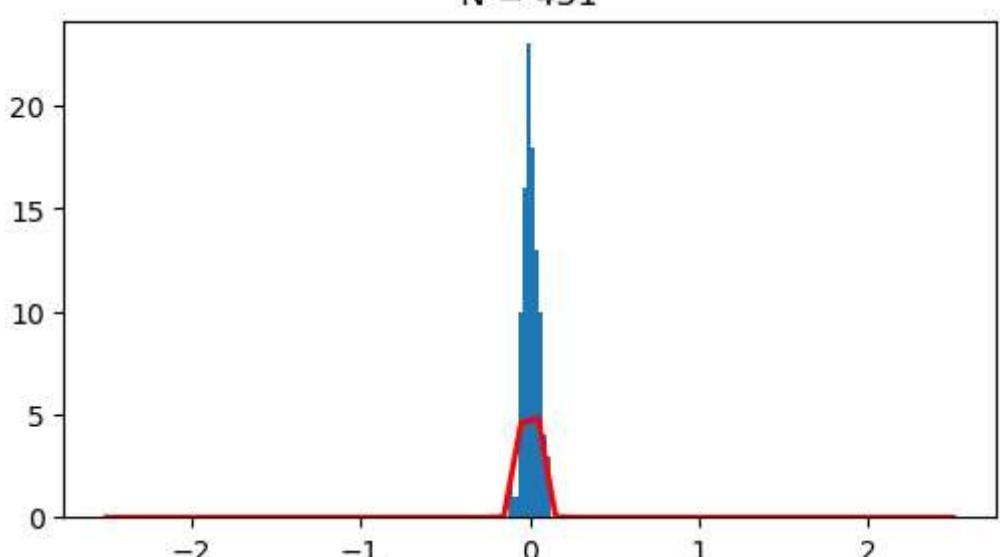
N = 430 Média = 0.00039654840821947085 Variância = 0.0021806568132442064

N = 430



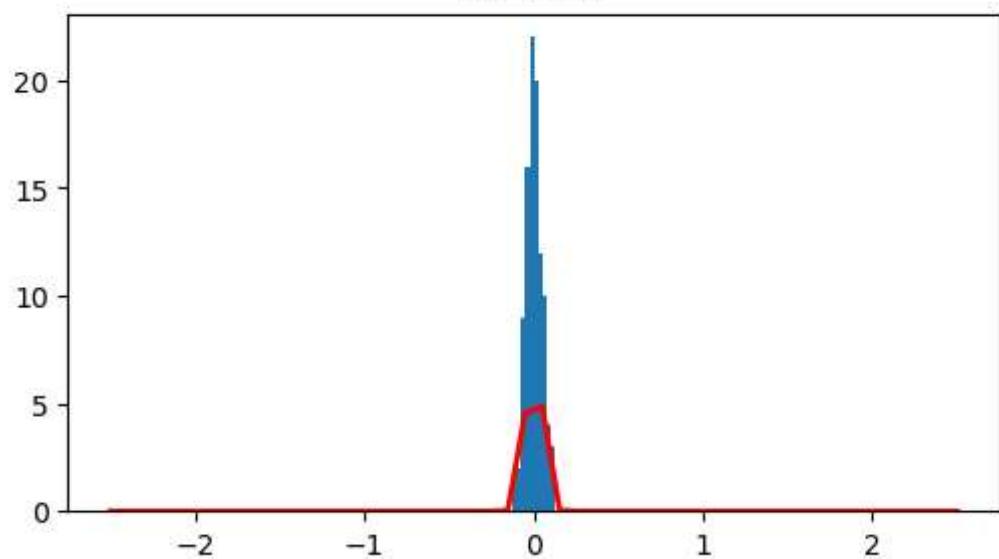
N = 431 Média = 0.000953925623146322 Variância = 0.0021594169470292184

N = 431



N = 432 Média = 0.0013124773349952243 Variância = 0.0021845990500303936

N = 432

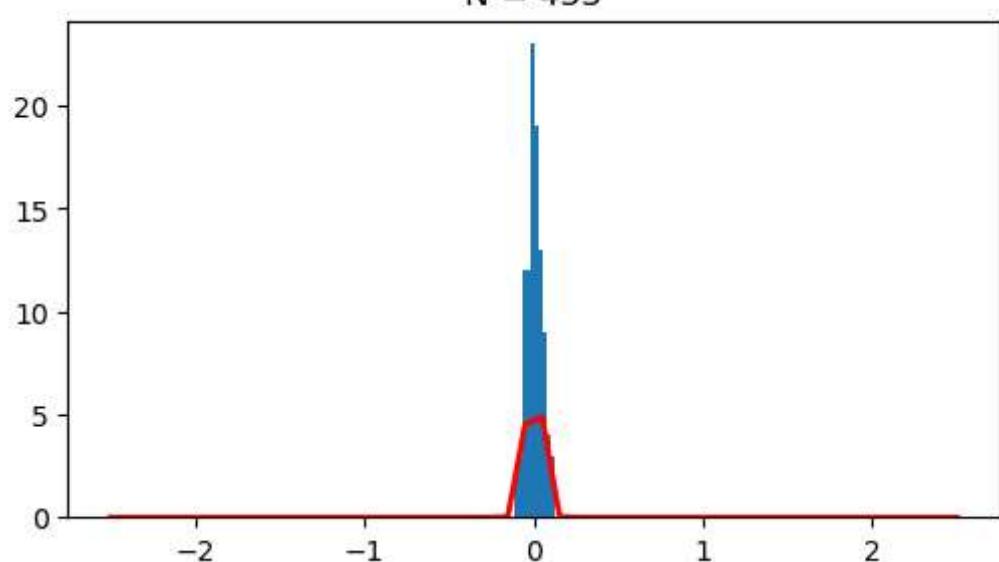


N = 433

Média = 0.0015484433592357412

Variância = 0.002140424563895673

N = 433

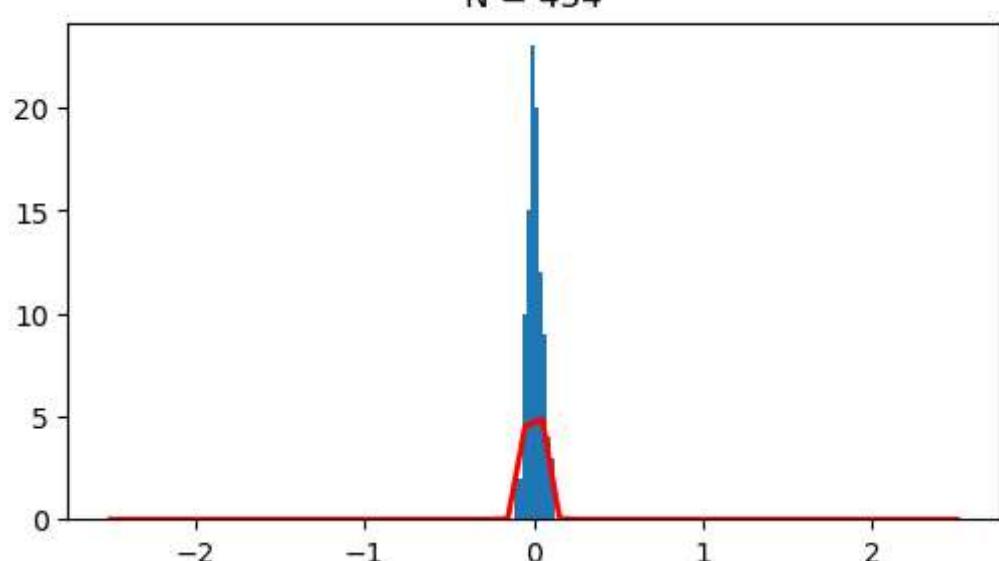


N = 434

Média = 0.0015520346676272318

Variância = 0.0021336981823607062

N = 434

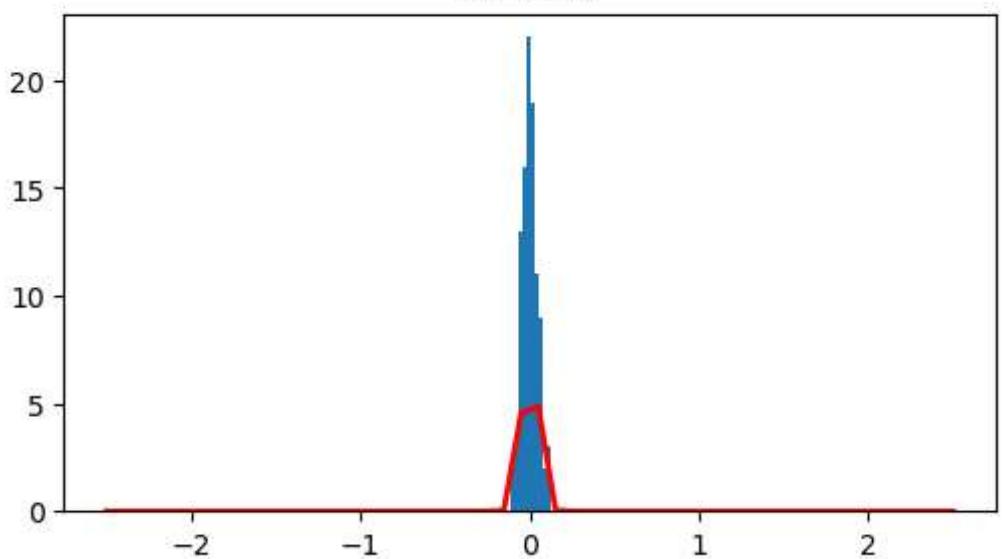


N = 435

Média = 0.0014407046161499508

Variância = 0.0021873551846729898

N = 435

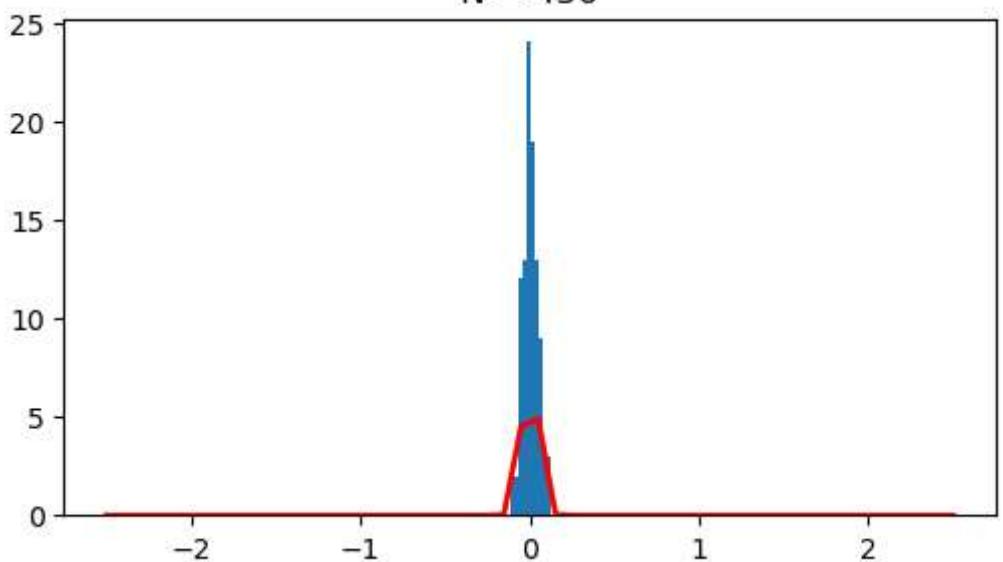


N = 436

Média = 0.0015587875473121512

Variância = 0.0021703269731302897

N = 436

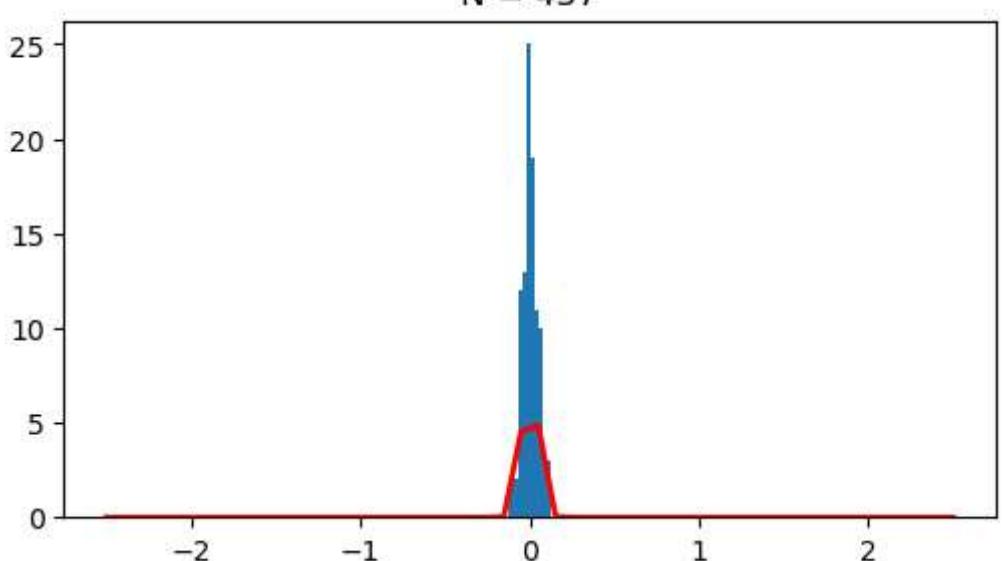


N = 437

Média = 0.0014535805737608272

Variância = 0.002151272609601627

N = 437

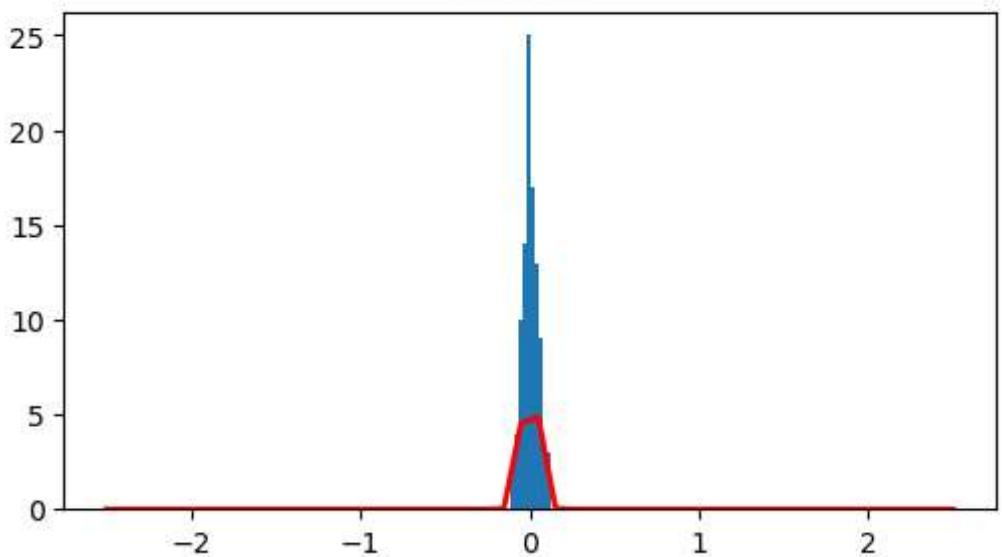


N = 438

Média = 0.0013917982928709283

Variância = 0.002142822508570187

N = 438

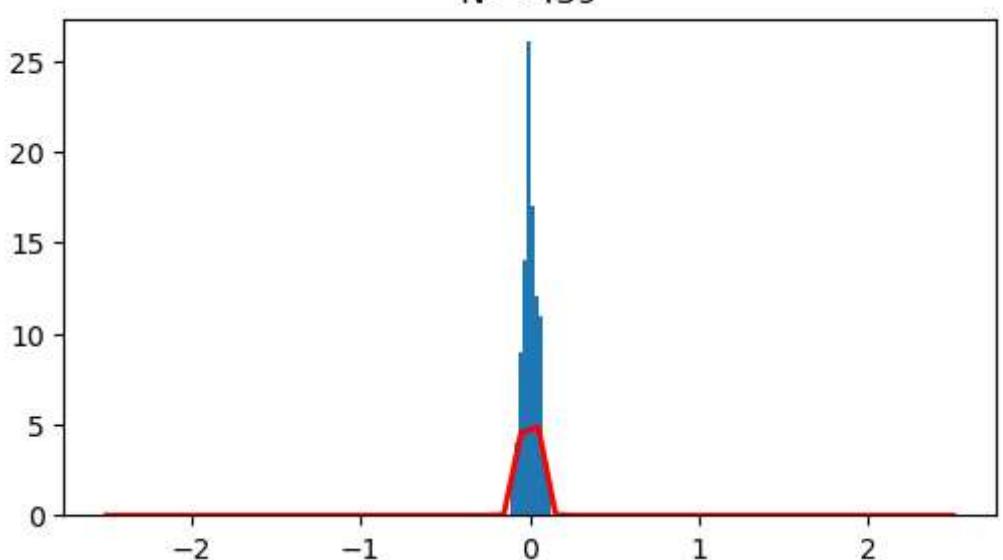


N = 439

Média = 0.0013486652837768499

Variância = 0.0021302654314928047

N = 439

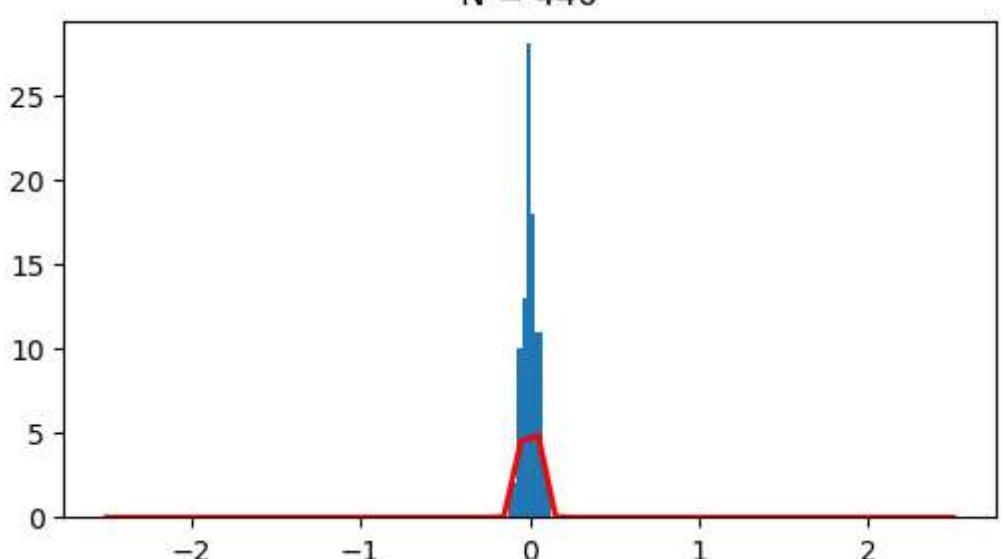


N = 440

Média = 0.0014604247032430112

Variância = 0.002125018440184276

N = 440

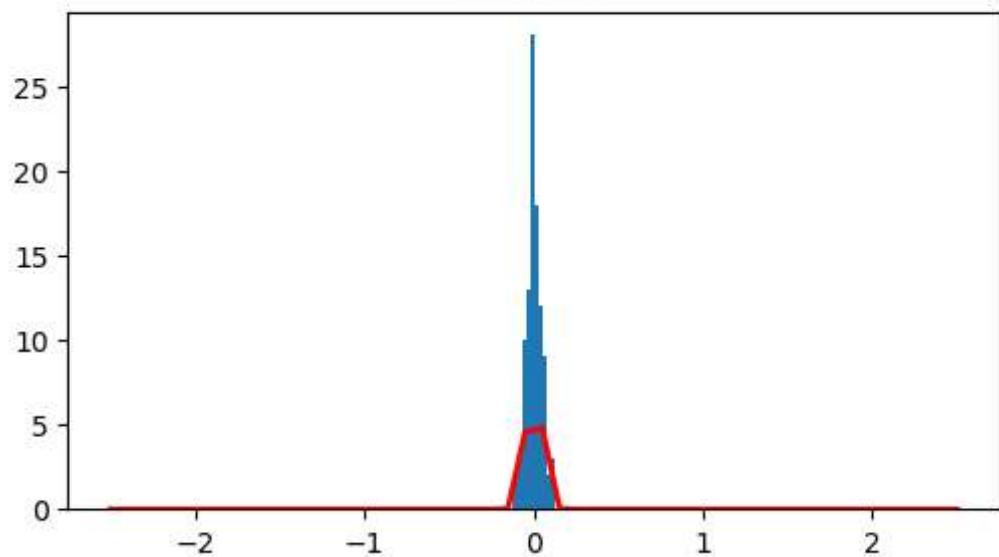


N = 441

Média = 0.0011274710090005816

Variância = 0.002104169559214576

N = 441

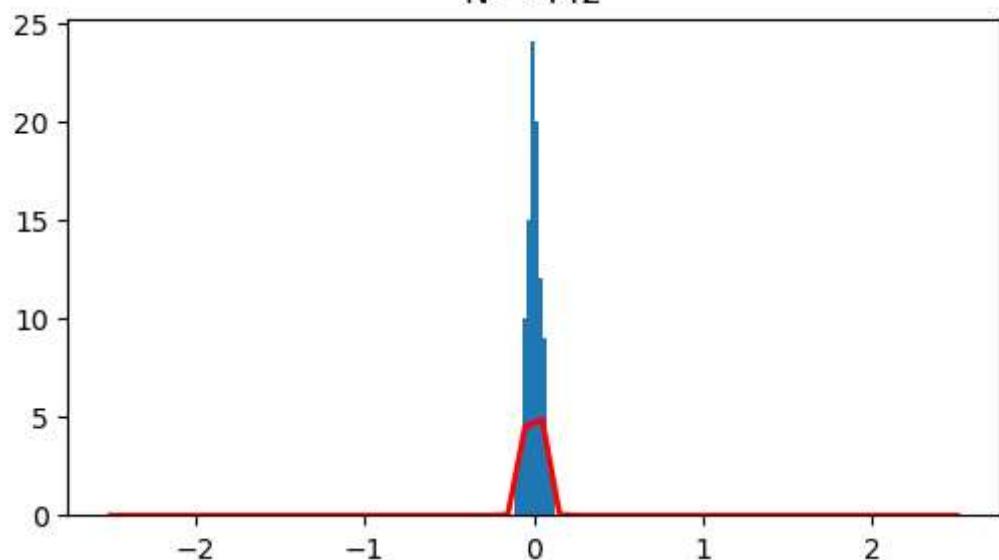


N = 442

Média = 0.0014390269789489821

Variância = 0.002066677351267038

N = 442

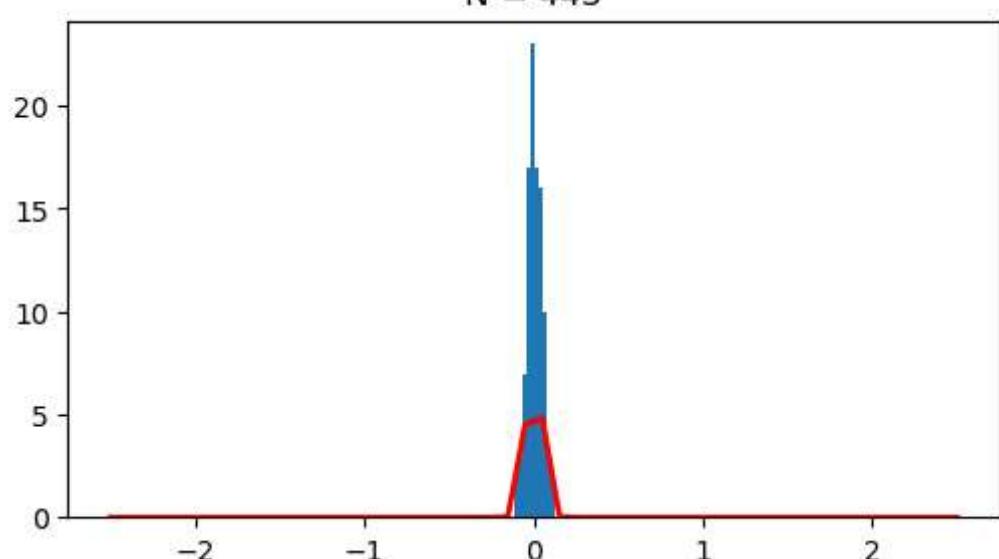


N = 443

Média = 0.0013619831613291369

Variância = 0.0020466150876205682

N = 443

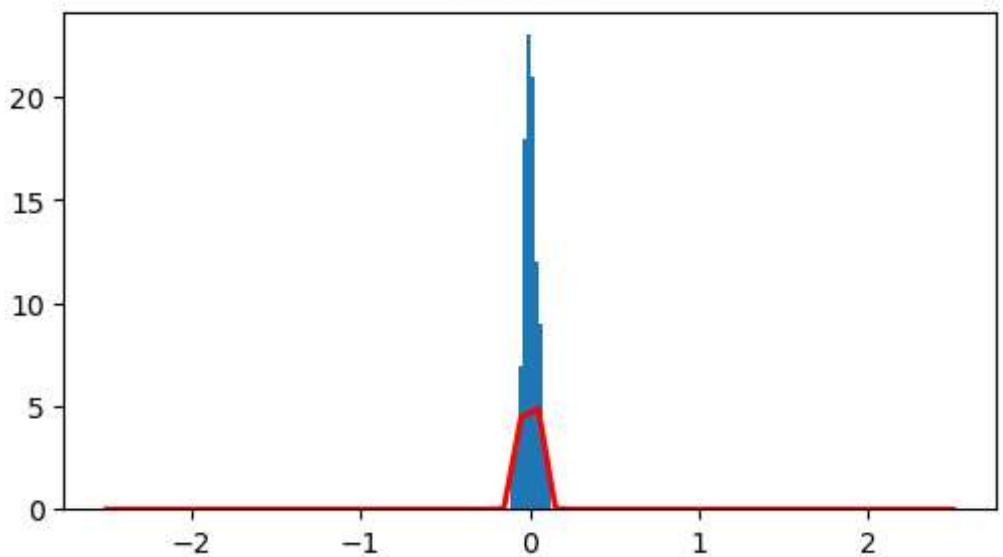


N = 444

Média = 0.0017721673098991075

Variância = 0.002058977580054996

N = 444

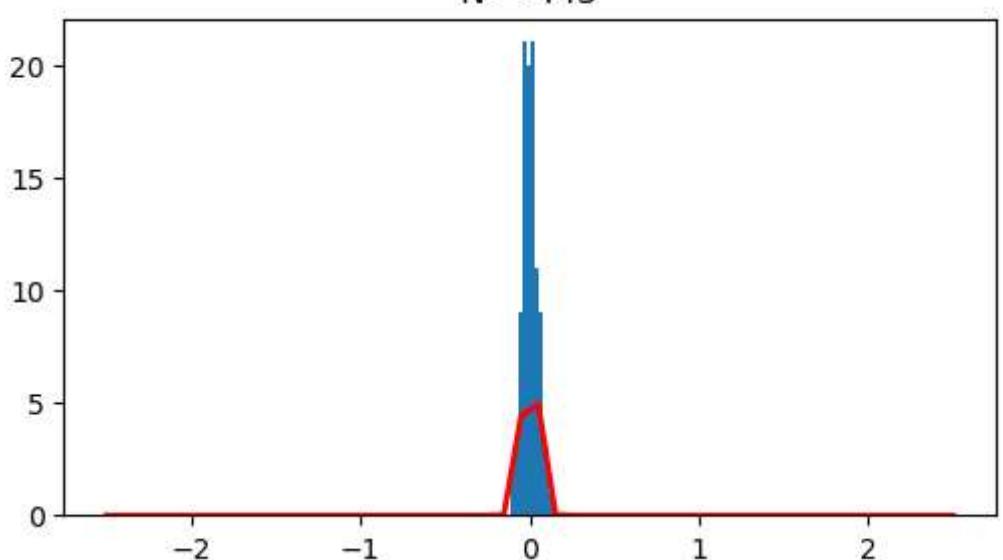


N = 445

Média = 0.0022168589306321676

Variância = 0.002057351710979986

N = 445

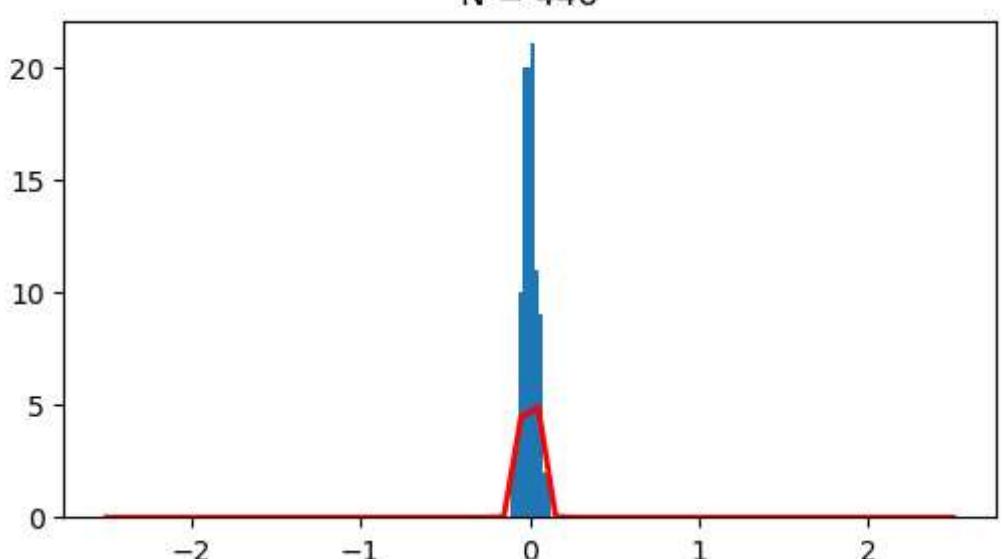


N = 446

Média = 0.0017557958180342797

Variância = 0.0020540617813753492

N = 446

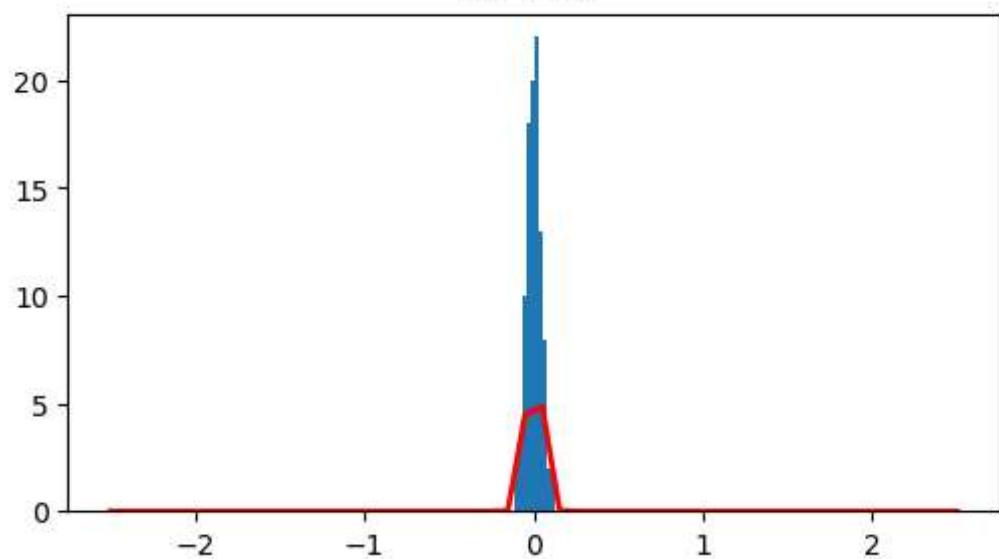


N = 447

Média = 0.0015566488488428225

Variância = 0.0020499898468972215

N = 447

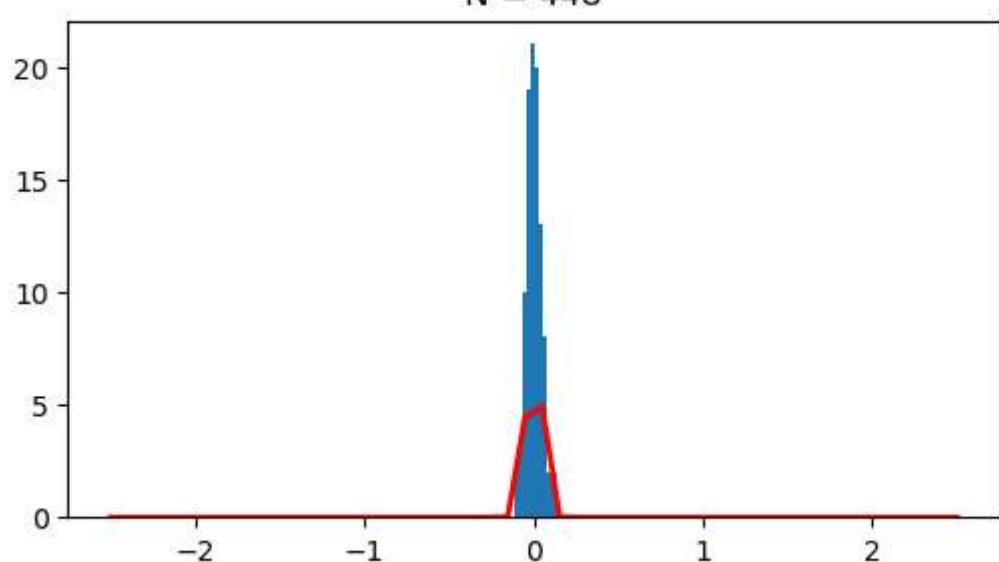


N = 448

Média = 0.001887590697621234

Variância = 0.002060938476145909

N = 448

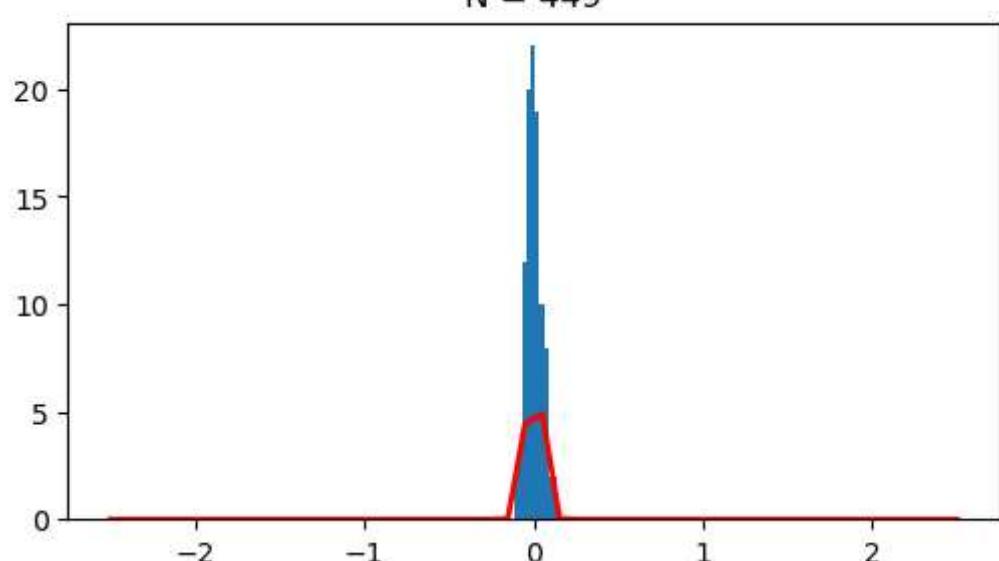


N = 449

Média = 0.0019712610656679366

Variância = 0.0020862653673287394

N = 449

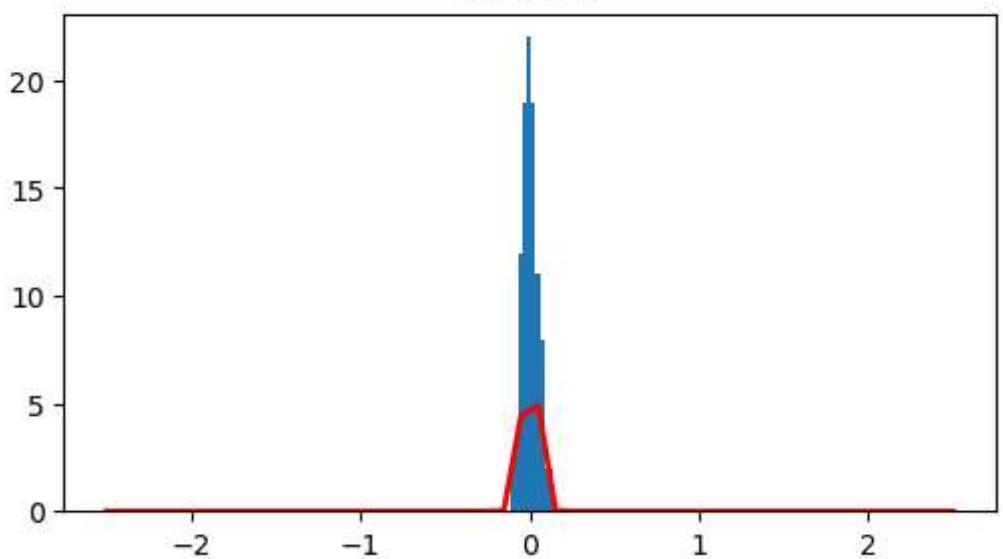


N = 450

Média = 0.0019965255349108104

Variância = 0.00208435024854735

N = 450

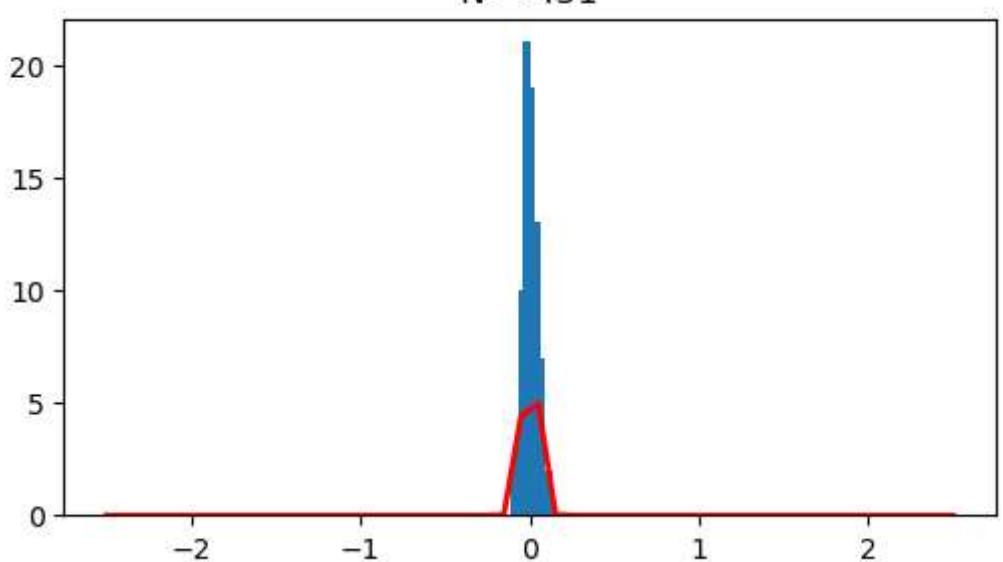


N = 451

Média = 0.00228136006868421

Variância = 0.0020865576862618015

N = 451

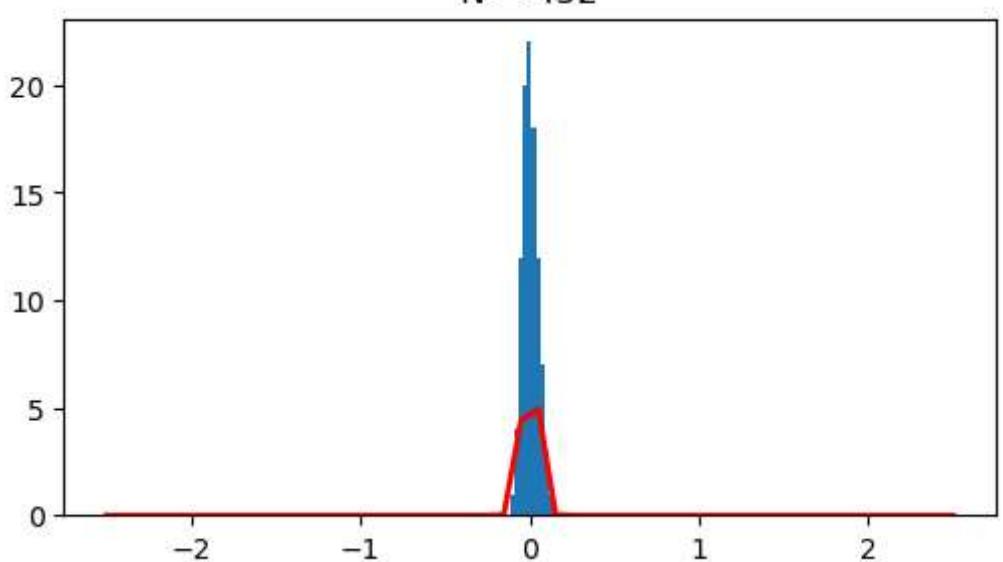


N = 452

Média = 0.002234436256446835

Variância = 0.0020826942812969215

N = 452

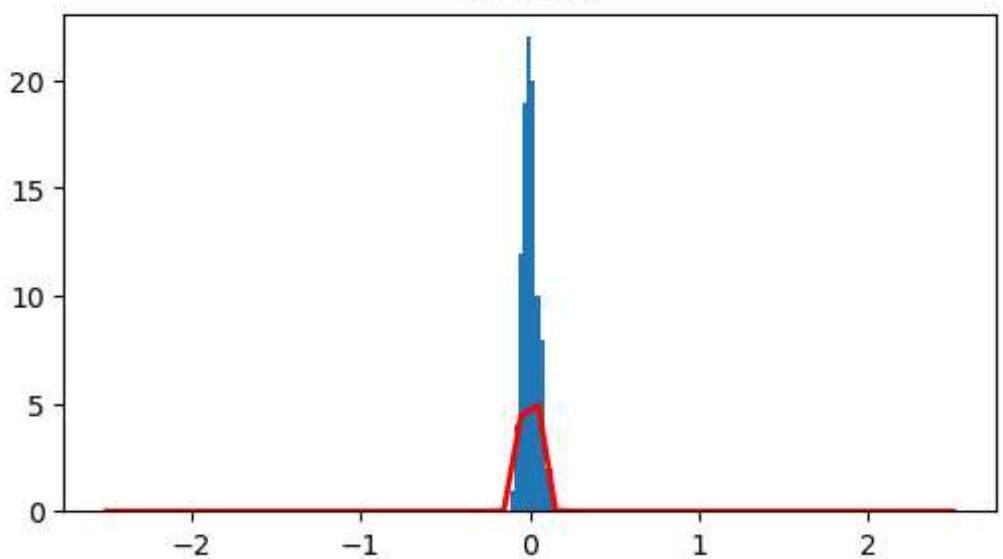


N = 453

Média = 0.0020278558331649522

Variância = 0.0021020579592462567

N = 453

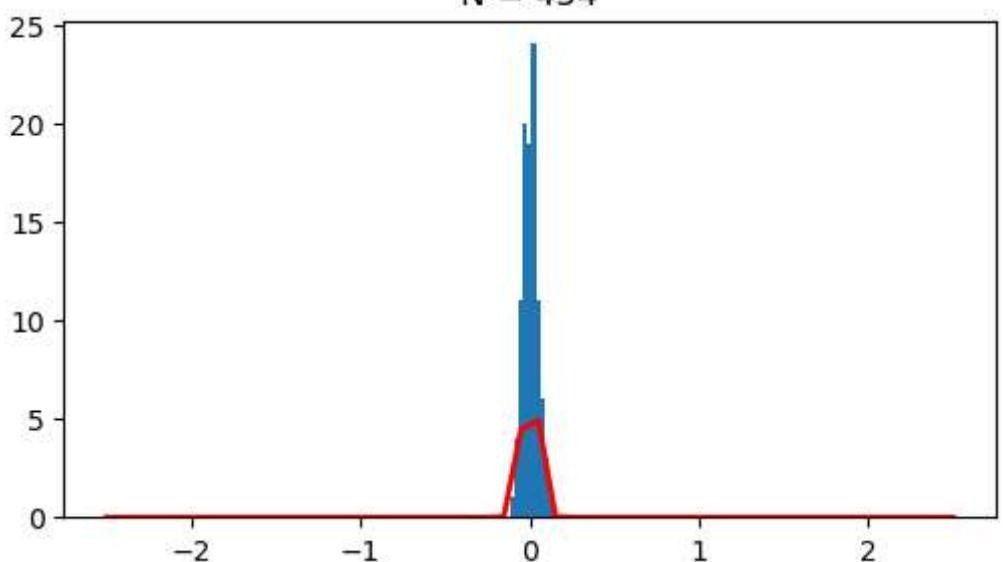


N = 454

Média = 0.0020214625971187107

Variância = 0.0020998755542463946

N = 454

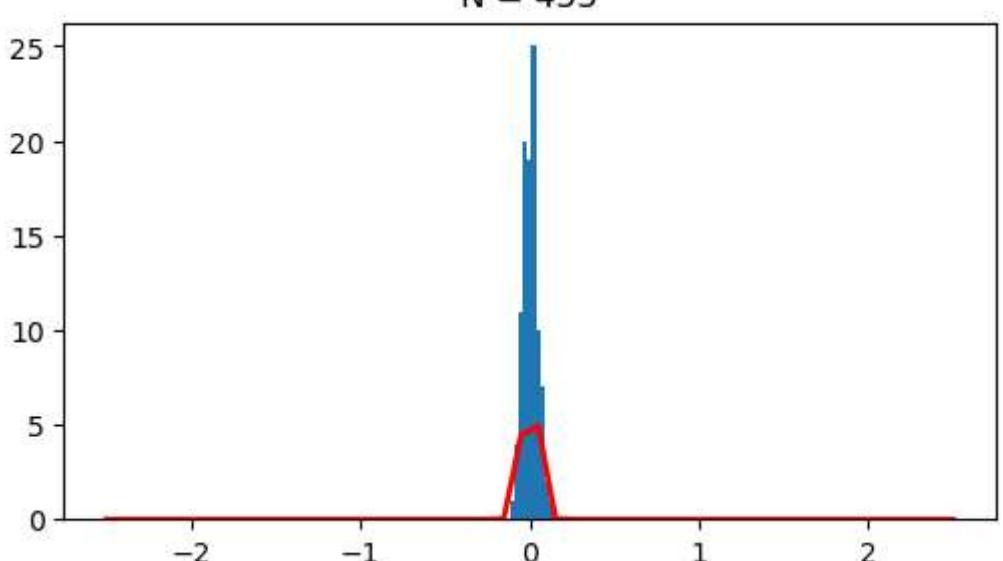


N = 455

Média = 0.002104079287305631

Variância = 0.002106630353568435

N = 455

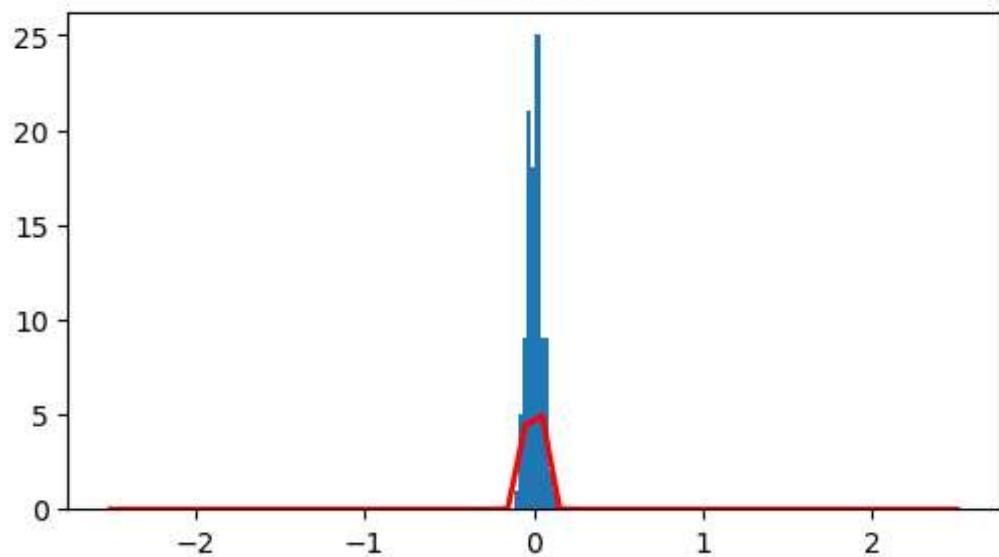


N = 456

Média = 0.002135315414964636

Variância = 0.0020627531043786976

N = 456

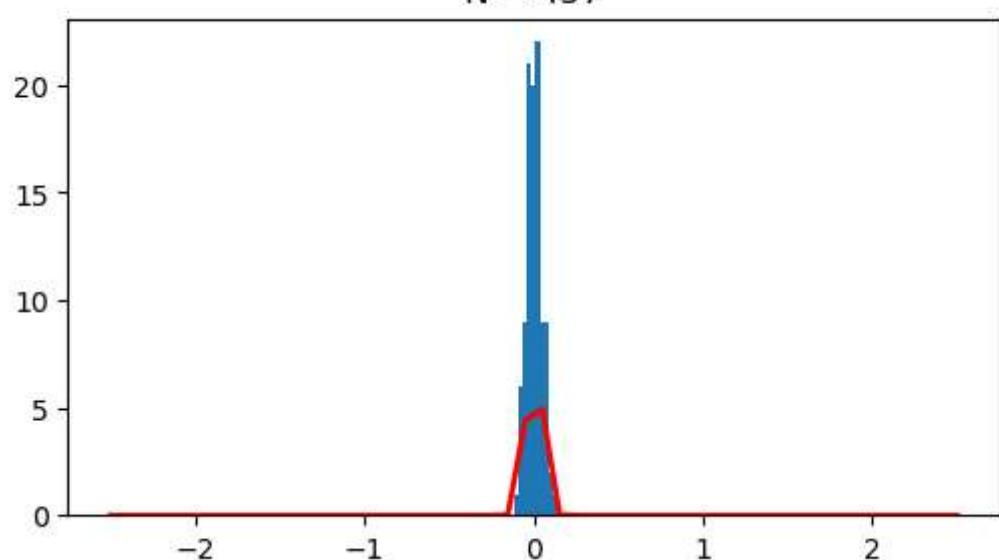


N = 457

Média = 0.002297622037521353

Variância = 0.002057043364439783

N = 457

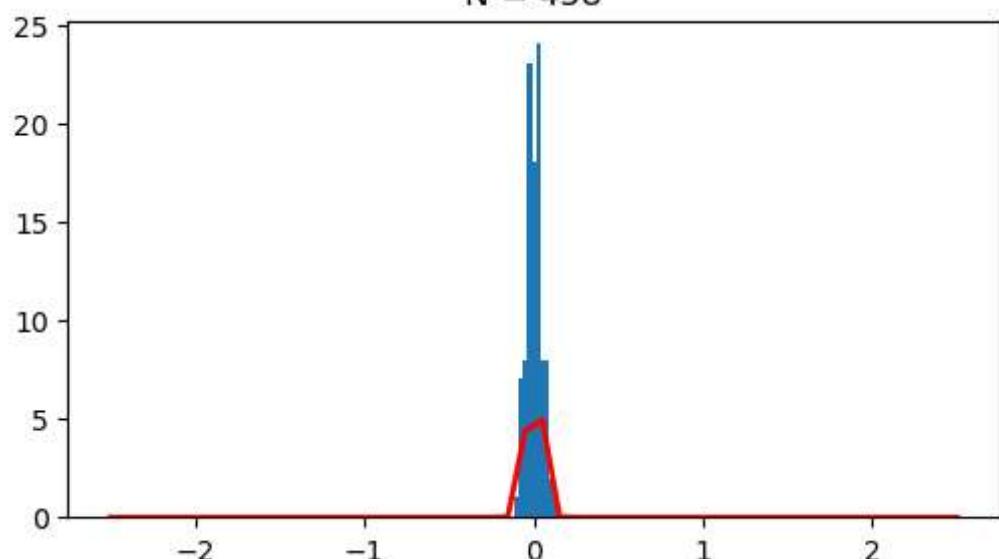


N = 458

Média = 0.0023614509195904873

Variância = 0.002026929128803312

N = 458

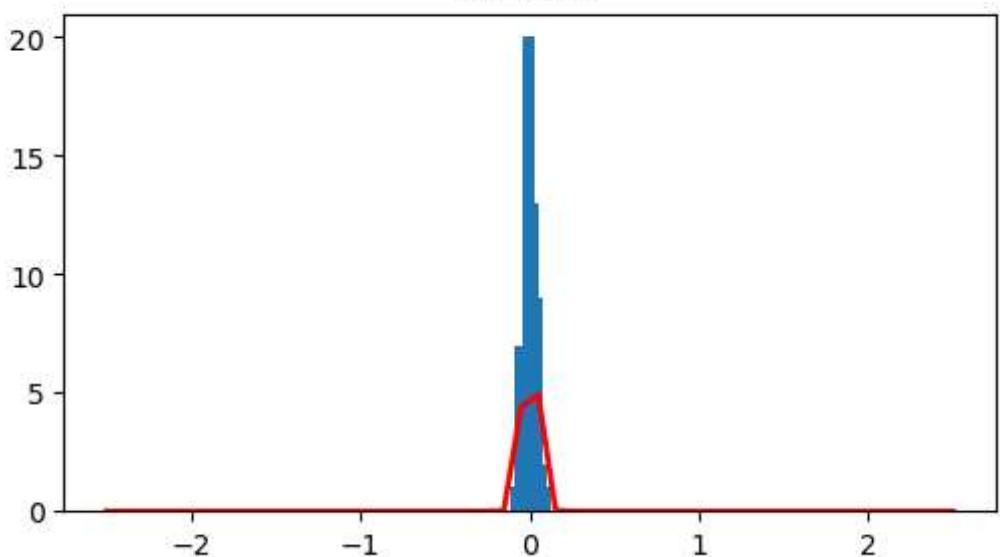


N = 459

Média = 0.002288527948743327

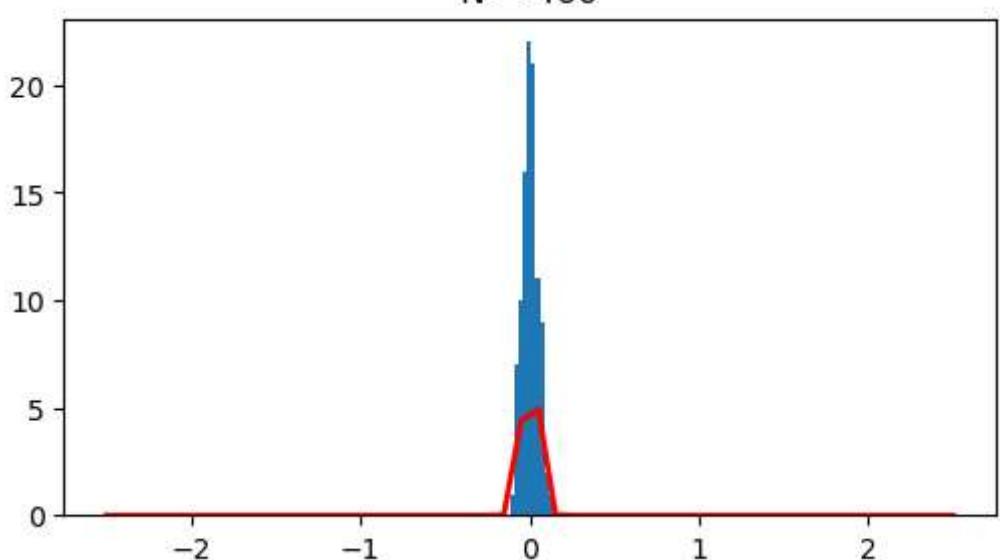
Variância = 0.002021288588411038

N = 459



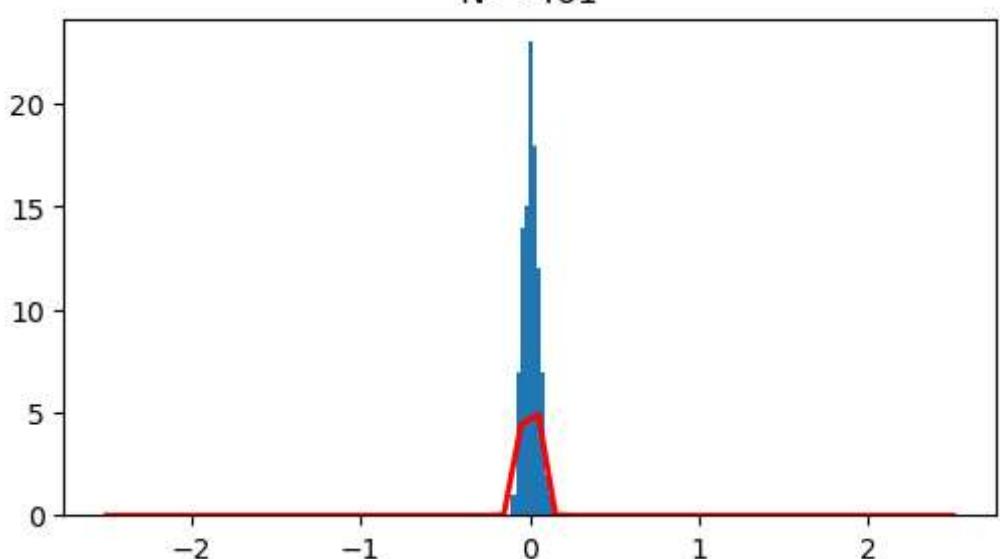
N = 460 Média = 0.002250602623738061 Variância = 0.0020202976843736765

N = 460



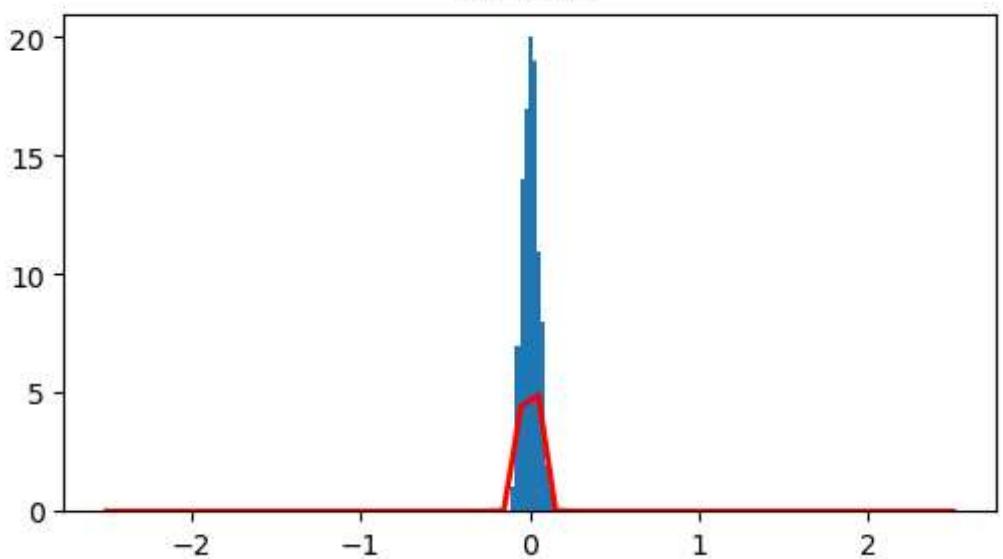
N = 461 Média = 0.002068284223718034 Variância = 0.0020183070671167236

N = 461



N = 462 Média = 0.001951543391393189 Variância = 0.0020465095090362296

N = 462

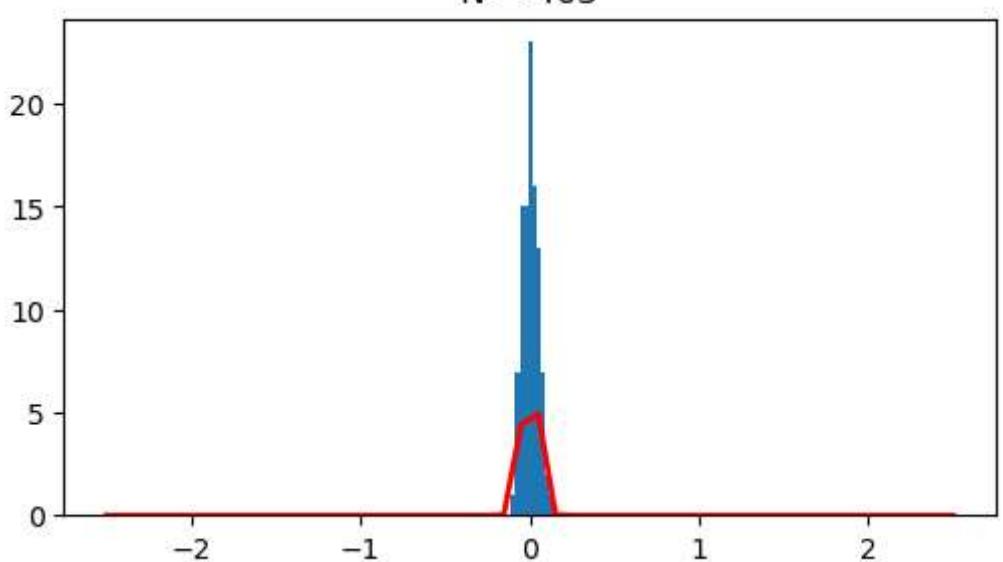


N = 463

Média = 0.0022100255105201943

Variância = 0.0020490280237223098

N = 463

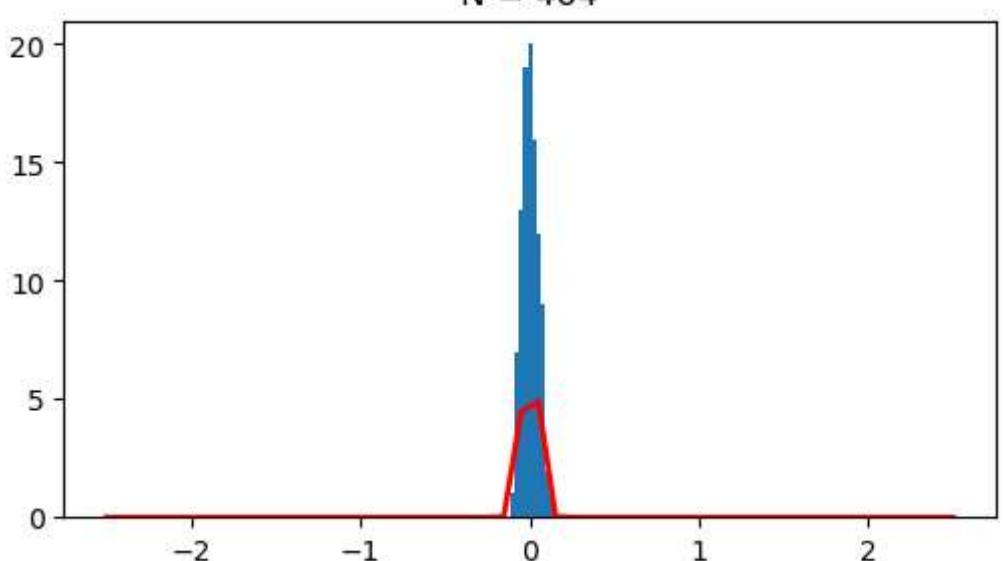


N = 464

Média = 0.00195079798431217

Variância = 0.00208206578399078

N = 464

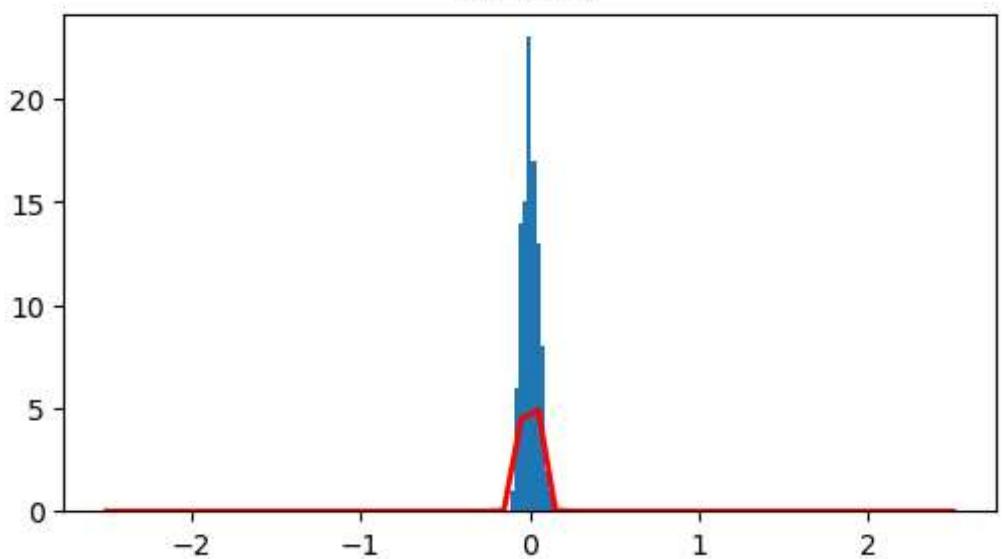


N = 465

Média = 0.001910620515255343

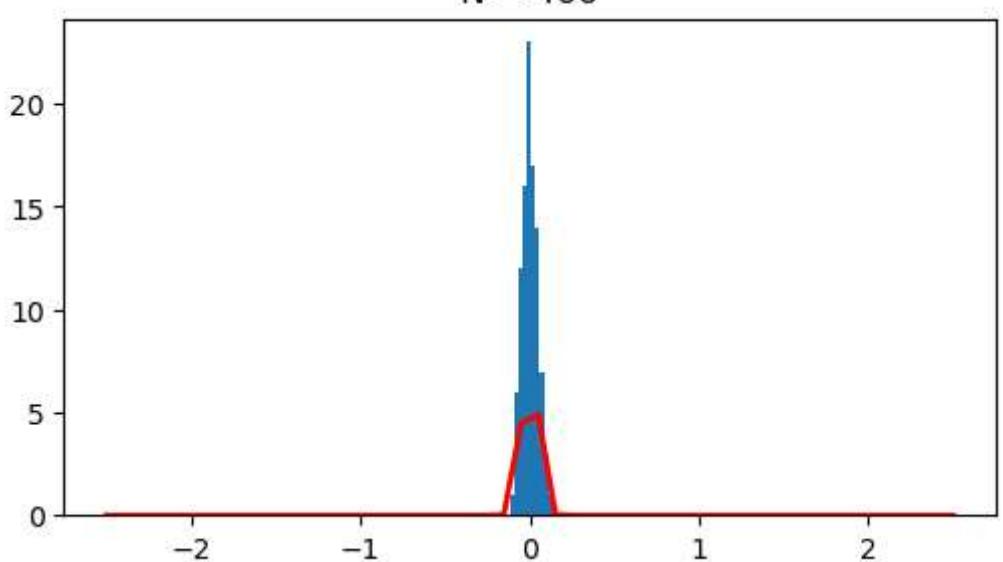
Variância = 0.002104970823301233

N = 465



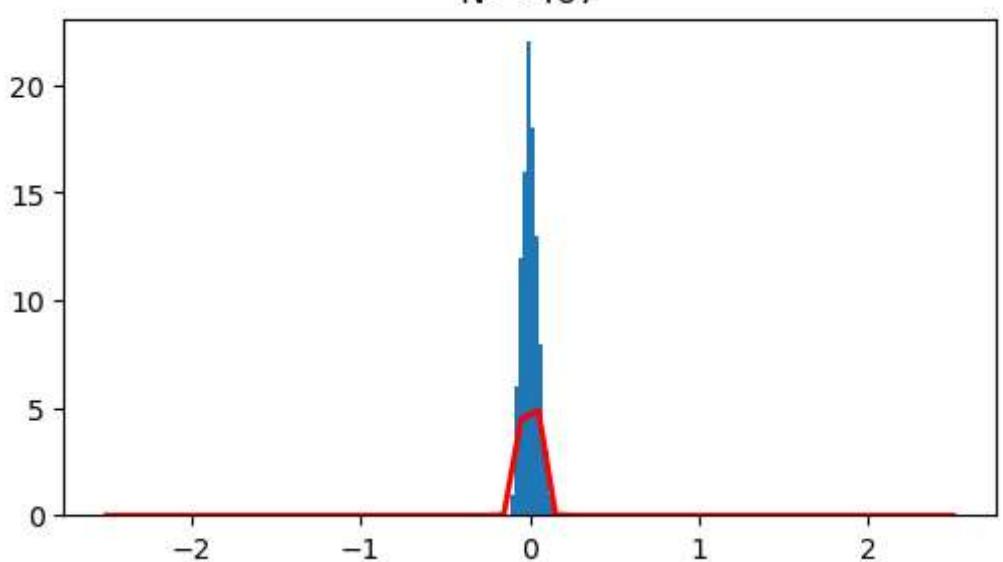
N = 466 Média = 0.0018434582712585884 Variância = 0.0020860652935773523

N = 466



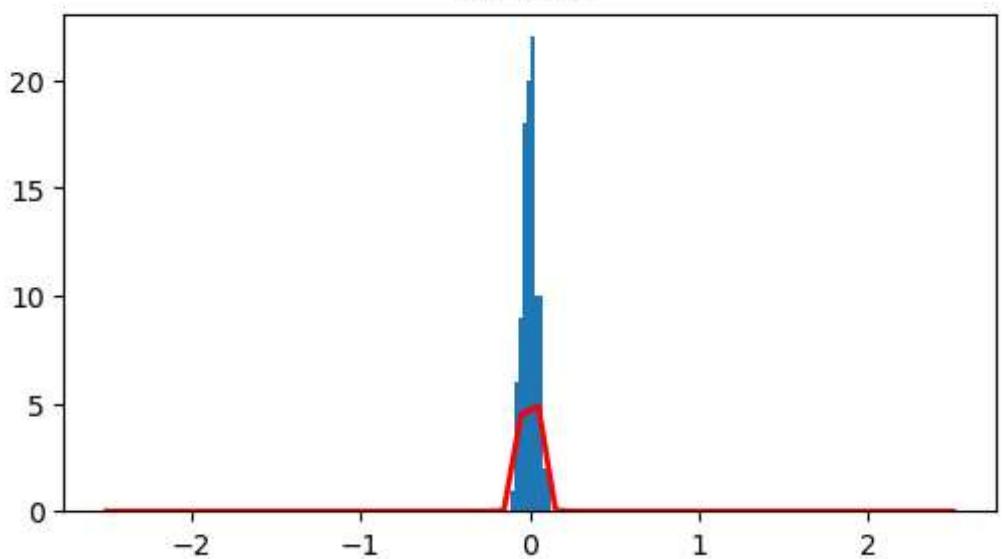
N = 467 Média = 0.0018187214717979633 Variância = 0.0020832985436545493

N = 467



N = 468 Média = 0.0017897398773724206 Variância = 0.0020950028159117634

N = 468

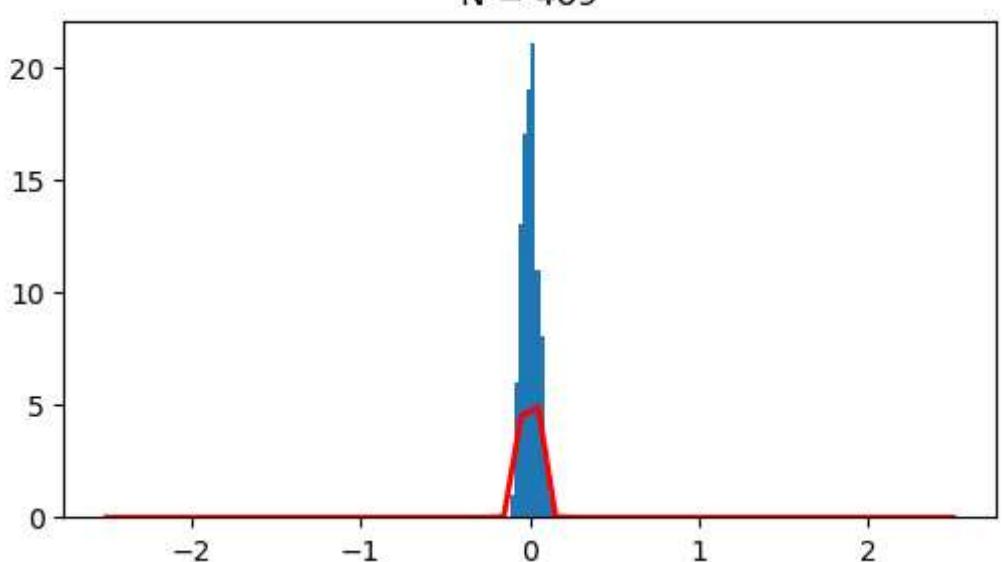


N = 469

Média = 0.0016614008925621832

Variância = 0.0020919663410471985

N = 469

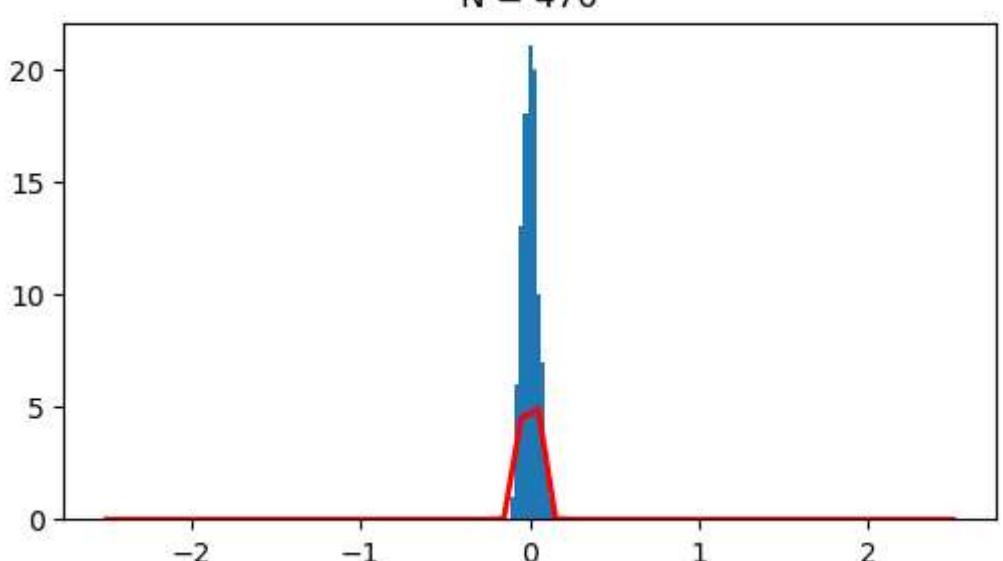


N = 470

Média = 0.001719795964724695

Variância = 0.0020851362874753994

N = 470

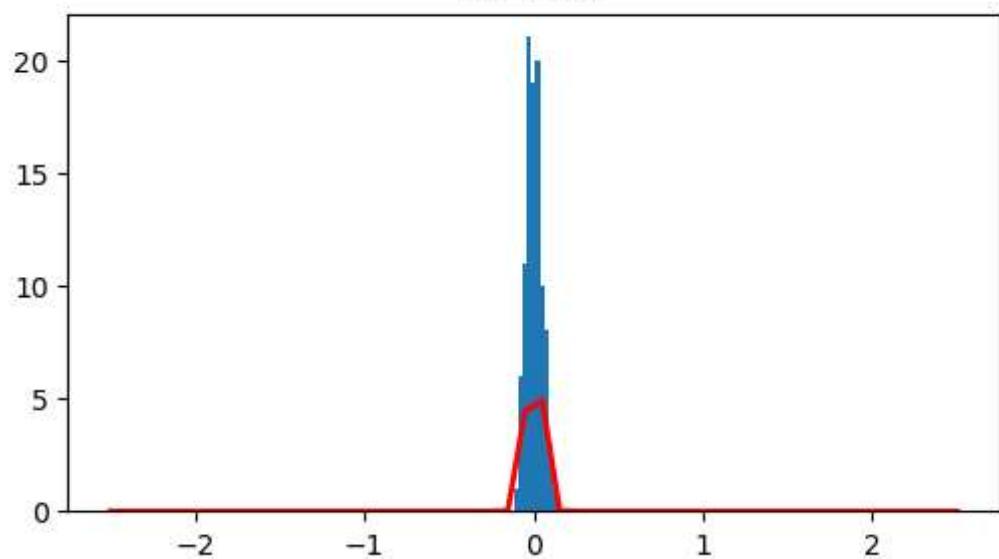


N = 471

Média = 0.0018421565263056535

Variância = 0.0020625626263724877

N = 471

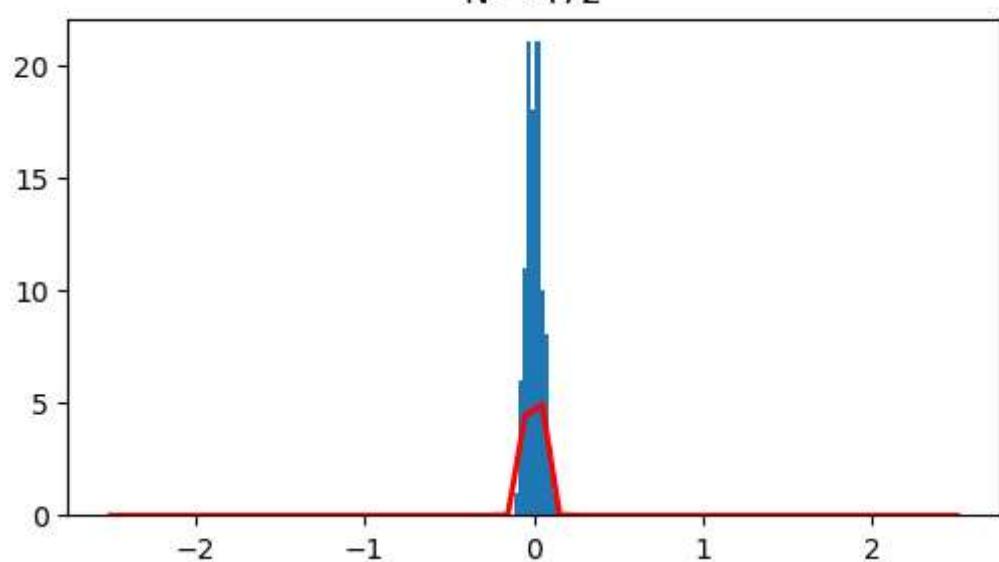


N = 472

Média = 0.001990130182592297

Variância = 0.0020543523203307833

N = 472

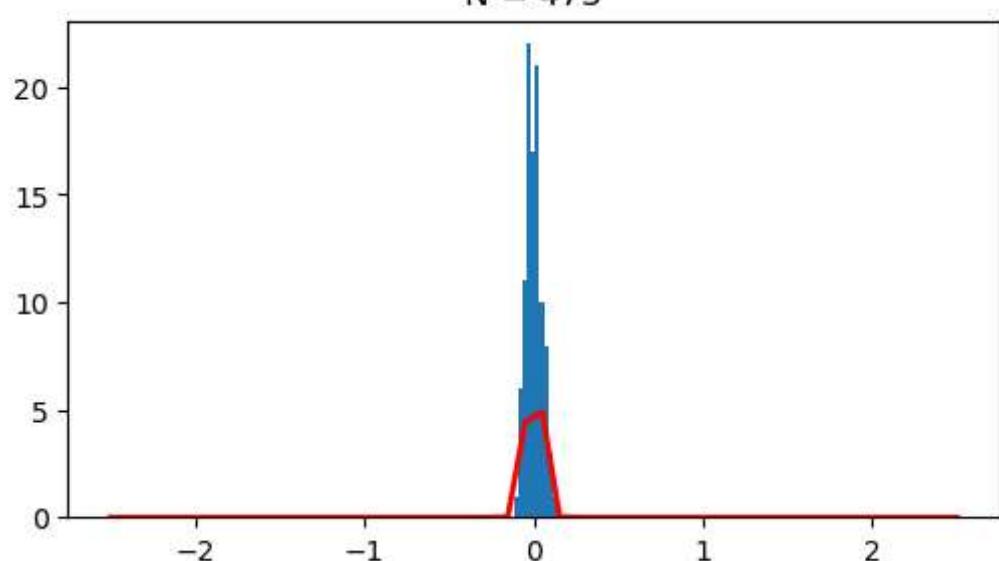


N = 473

Média = 0.002001651302218668

Variância = 0.0020450874207250647

N = 473

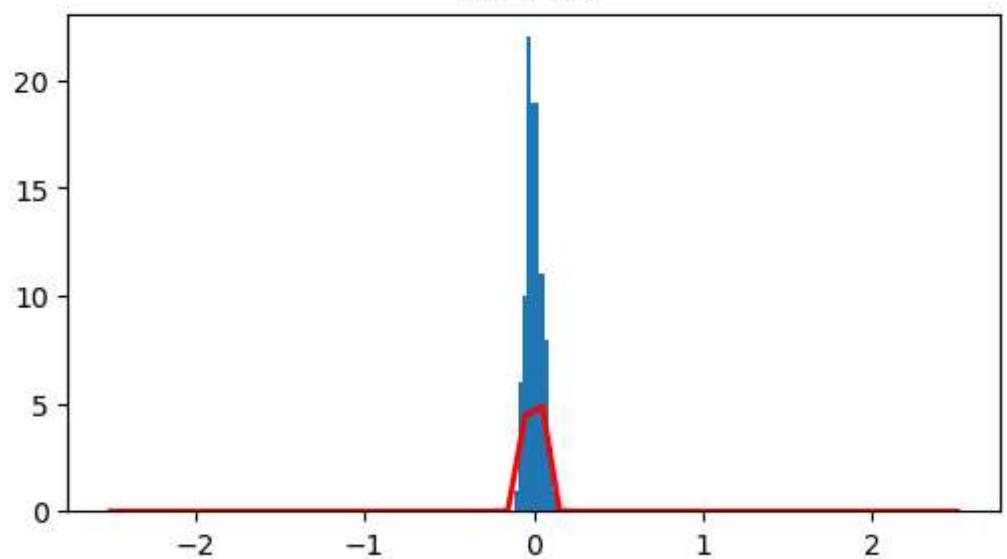


N = 474

Média = 0.0018362634696746365

Variância = 0.002016715170447062

N = 474

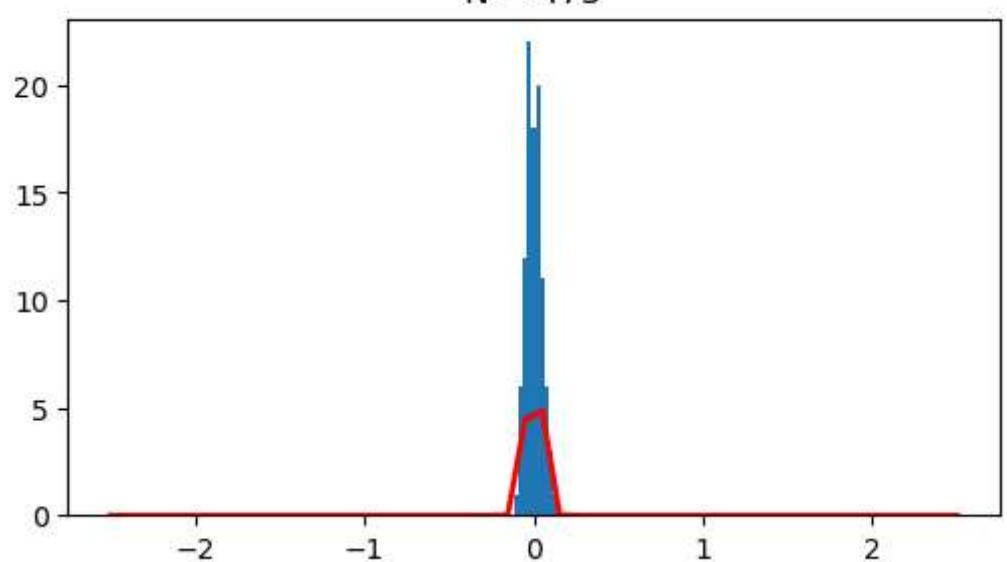


N = 475

Média = 0.0016982728118953593

Variância = 0.002012027275432485

N = 475

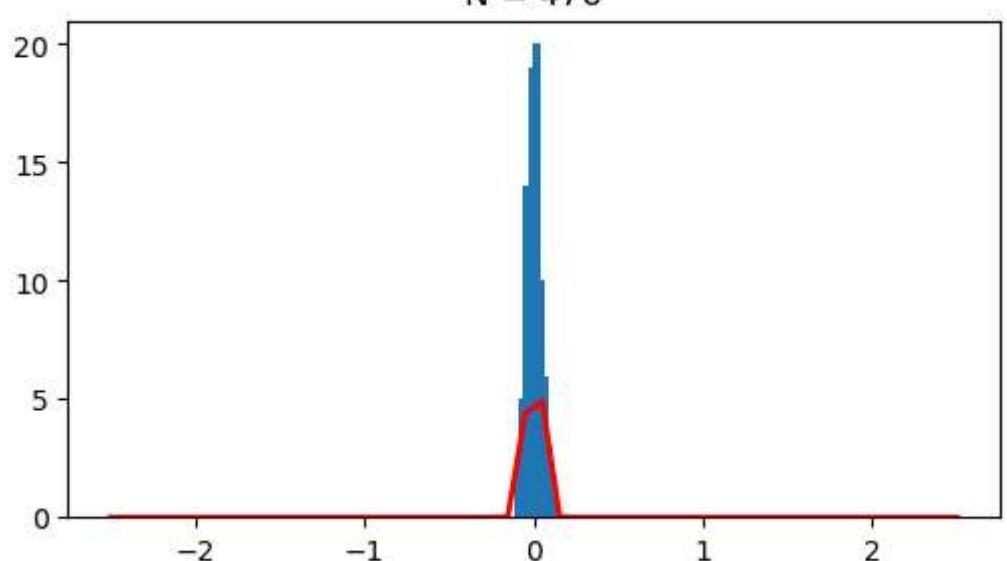


N = 476

Média = 0.0021962139331773585

Variância = 0.0019678137468330126

N = 476

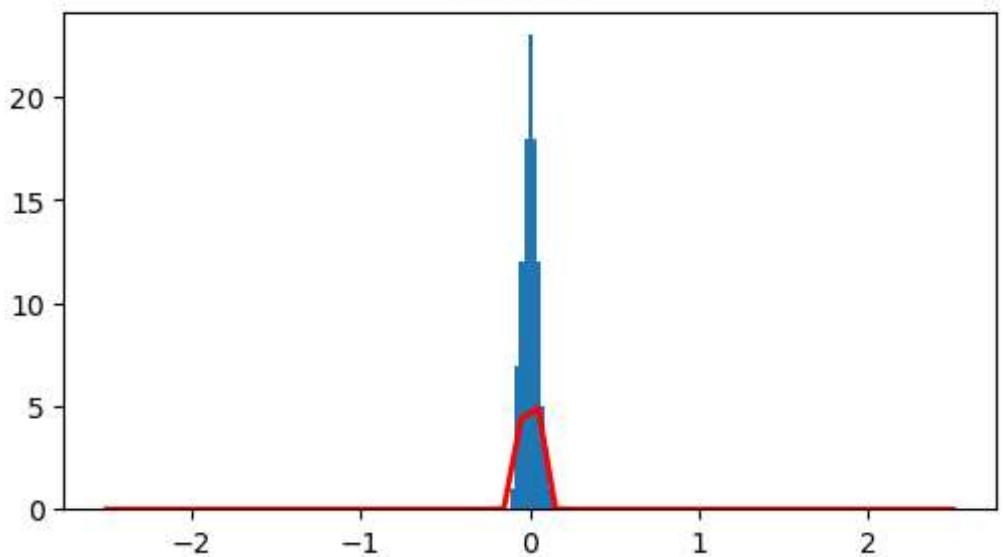


N = 477

Média = 0.002126134112565056

Variância = 0.0019725250645181848

N = 477

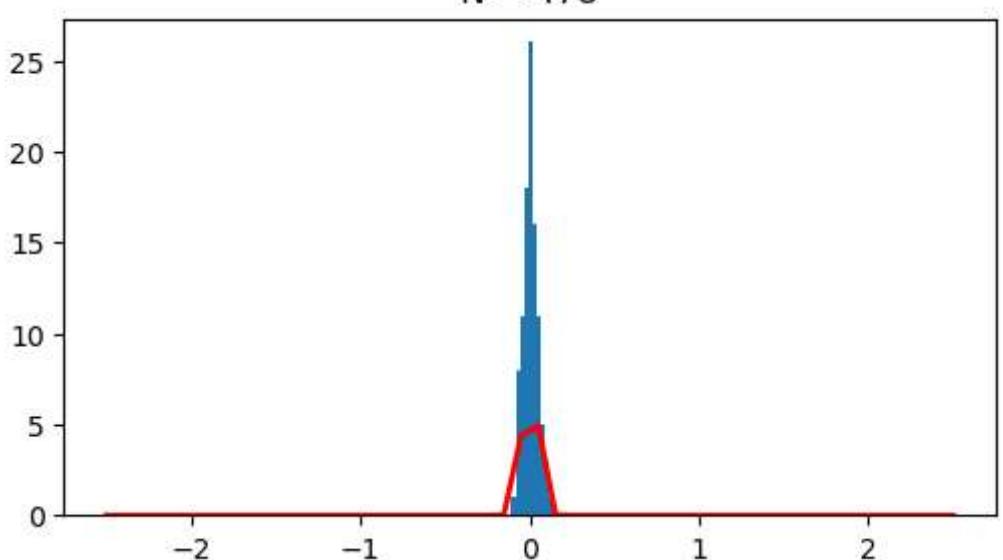


N = 478

Média = 0.0022581551937350367

Variância = 0.0019843982133610086

N = 478

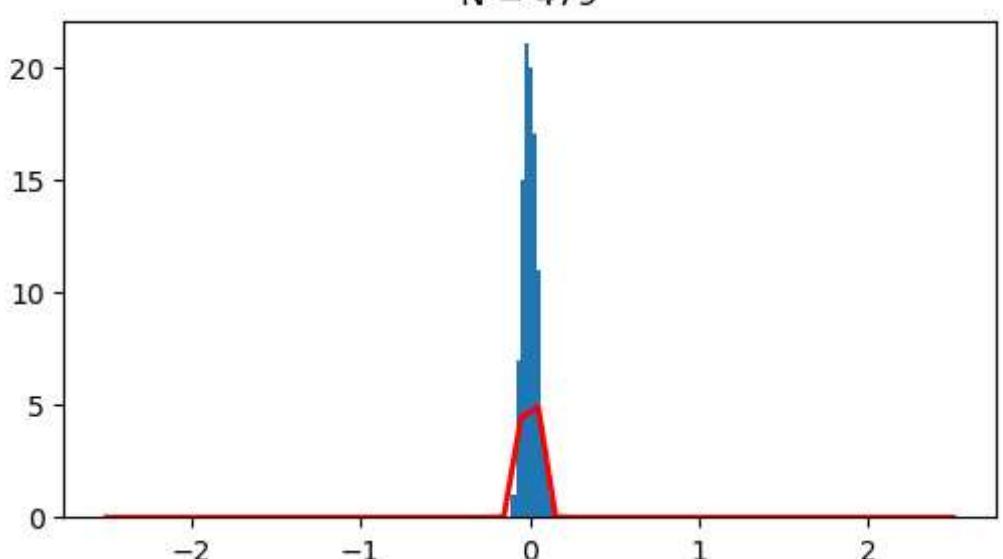


N = 479

Média = 0.001905845811958729

Variância = 0.0019926321092283653

N = 479

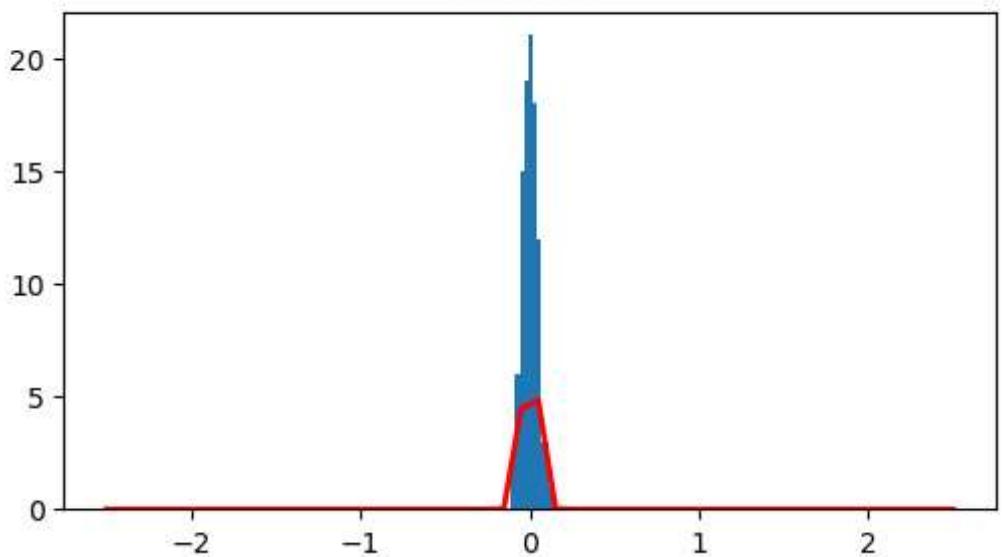


N = 480

Média = 0.0015520306737890138

Variância = 0.001988639755292741

N = 480

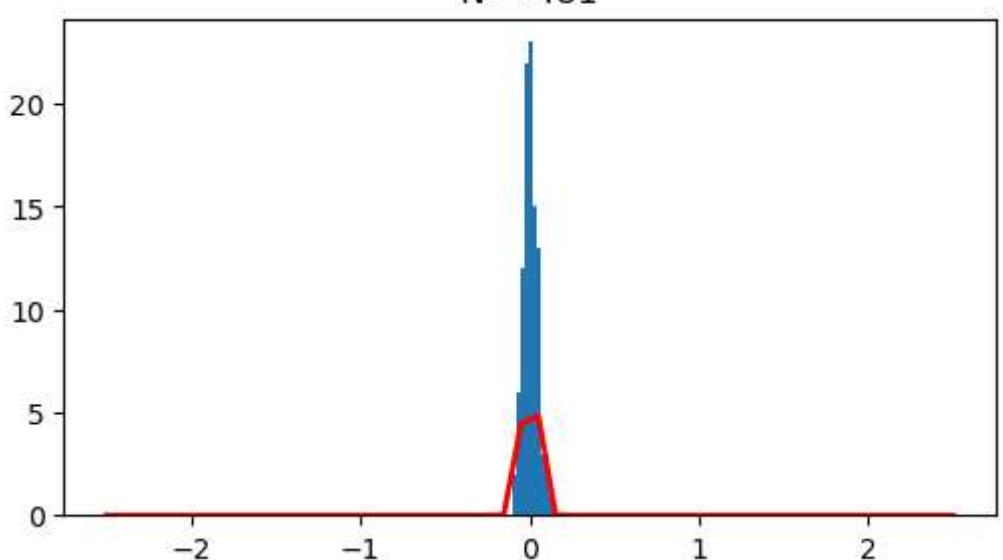


N = 481

Média = 0.0016751687697504497

Variância = 0.001976416467991391

N = 481

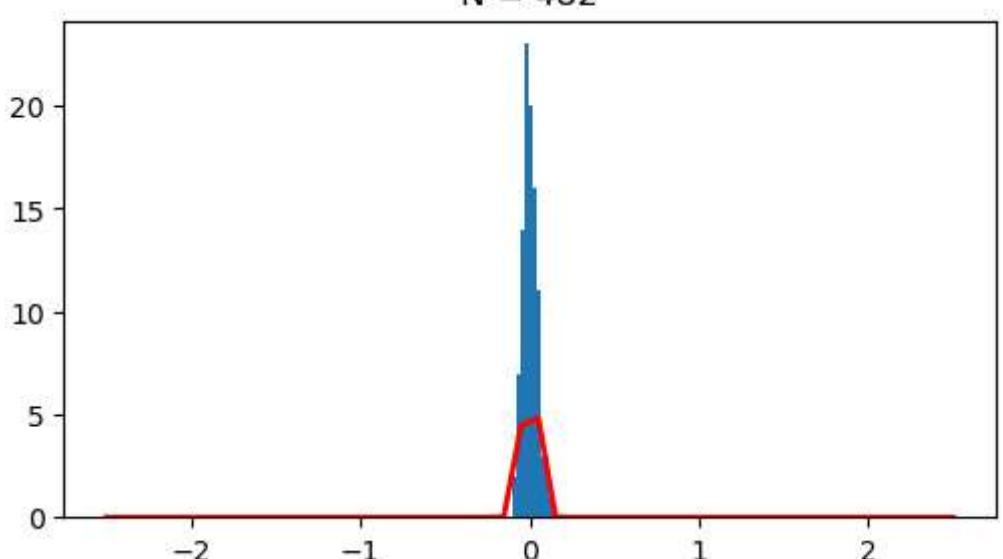


N = 482

Média = 0.0016289643136589394

Variância = 0.0019600292874465976

N = 482

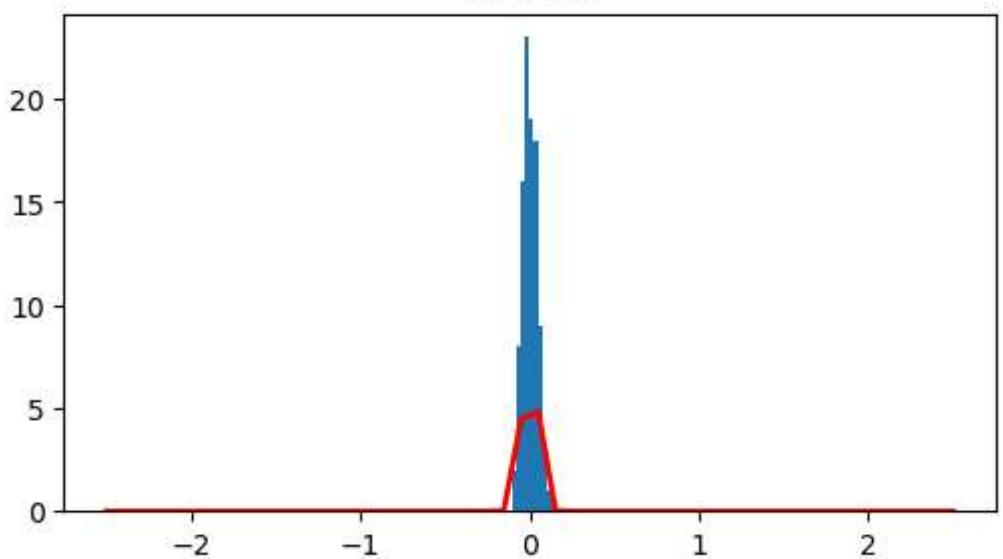


N = 483

Média = 0.001524121242803338

Variância = 0.001977050055784698

N = 483

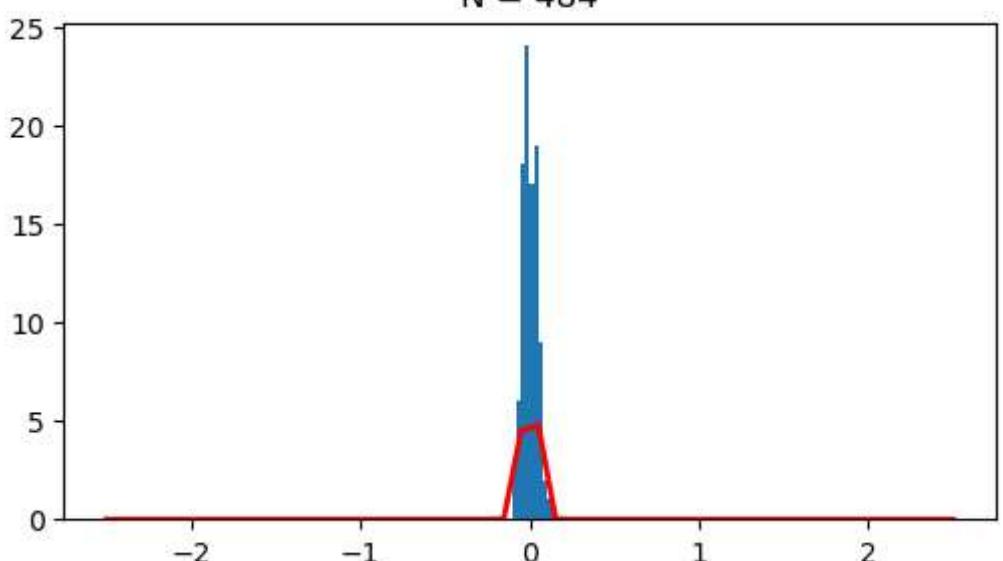


N = 484

Média = 0.0012117241101718718

Variância = 0.001971130451116047

N = 484

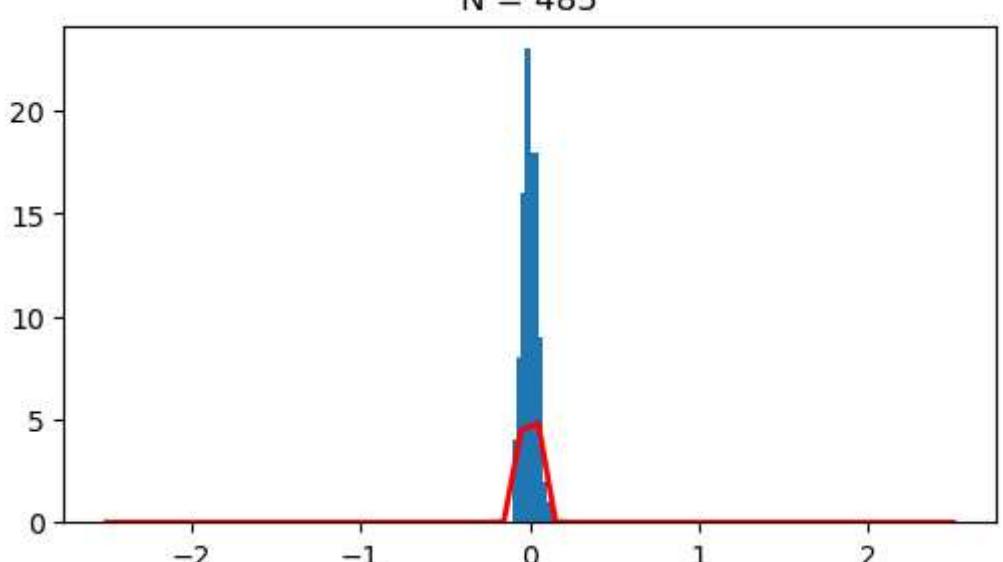


N = 485

Média = 0.0013974982176832168

Variância = 0.001974060775398947

N = 485

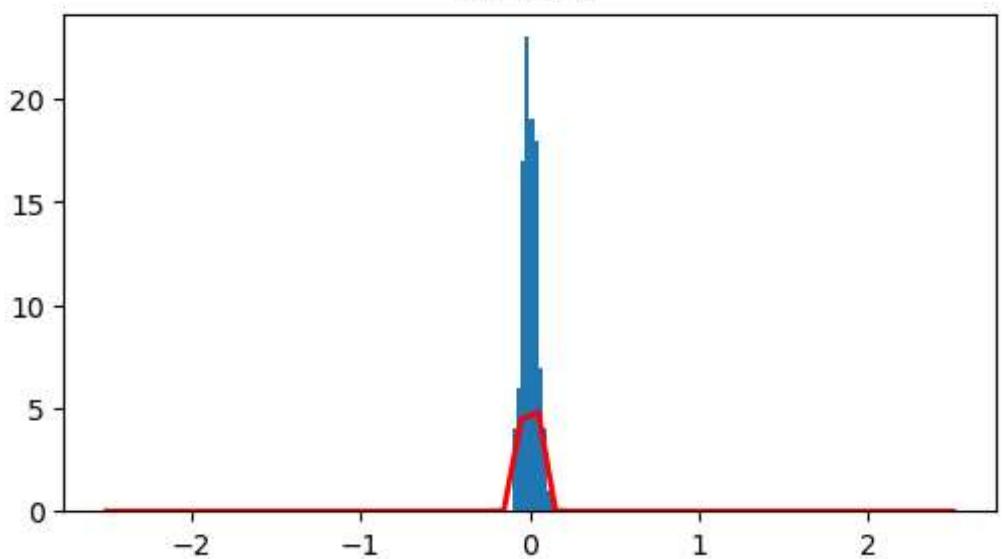


N = 486

Média = 0.0014370596661253659

Variância = 0.0019382131395911863

N = 486

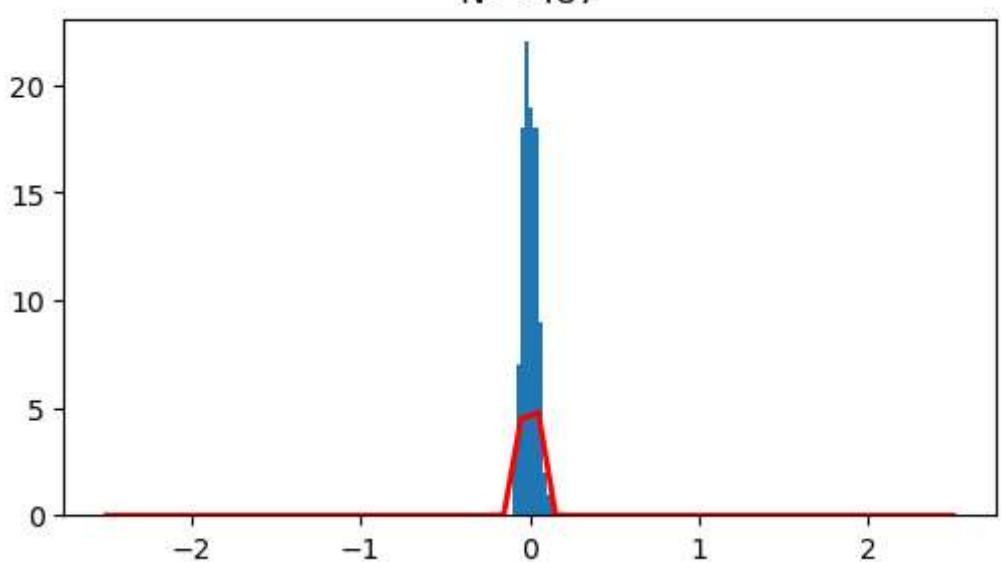


N = 487

Média = 0.00123521989553072

Variância = 0.001944571662541965

N = 487

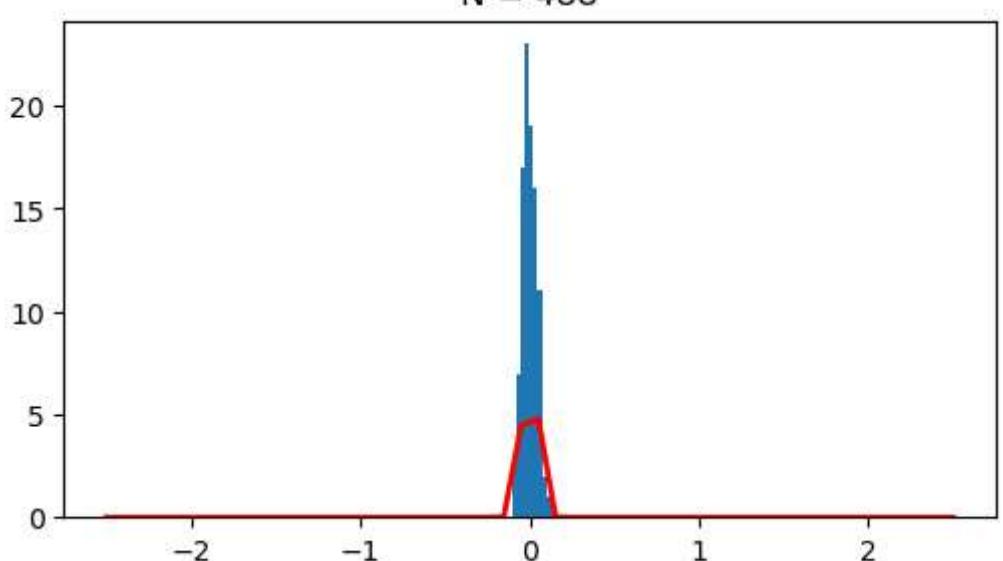


N = 488

Média = 0.0013685742973353423

Variância = 0.0019362861392165454

N = 488

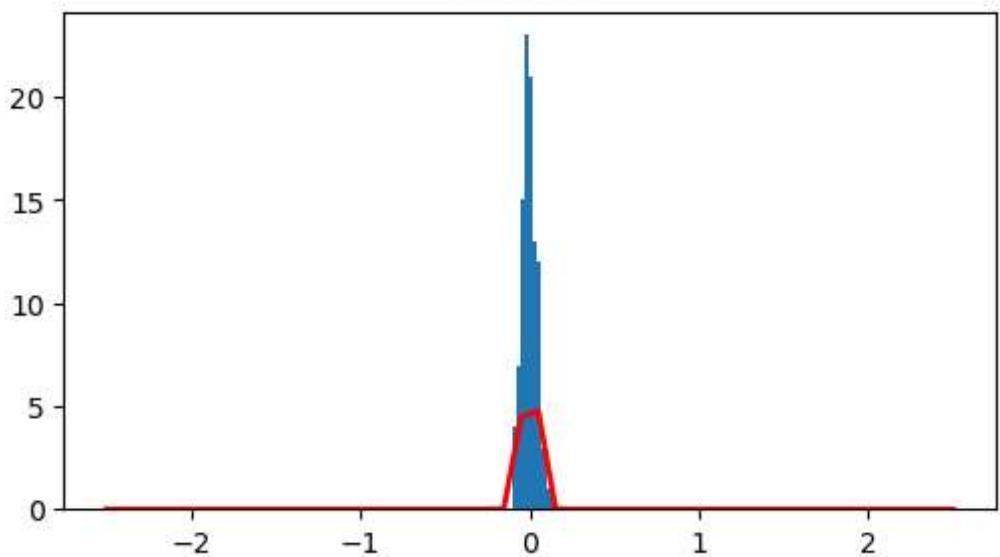


N = 489

Média = 0.0011530972654181077

Variância = 0.0019190236566785136

N = 489

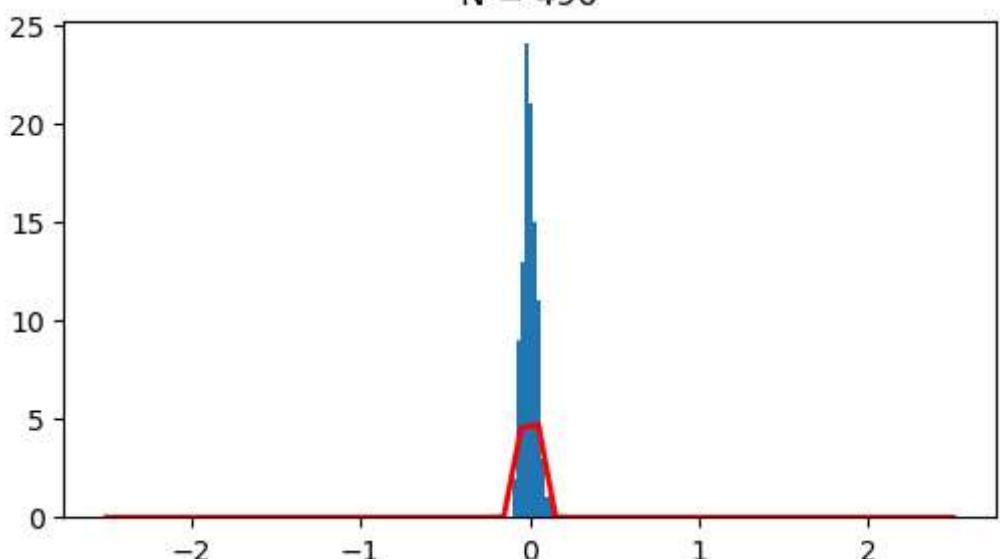


N = 490

Média = 0.0007788526285962519

Variância = 0.001921664556858373

N = 490

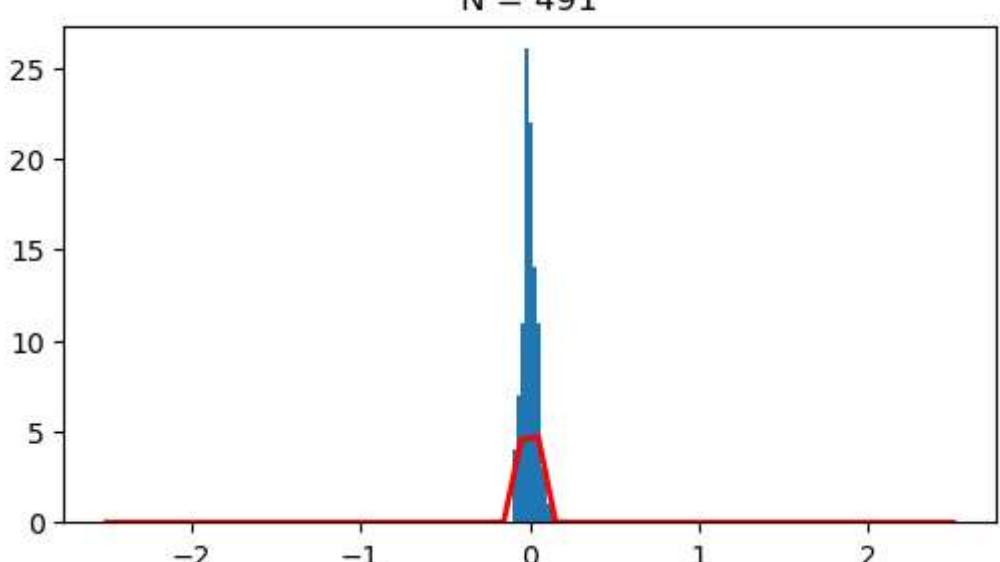


N = 491

Média = 0.0006260351329291515

Variância = 0.001918562563536113

N = 491

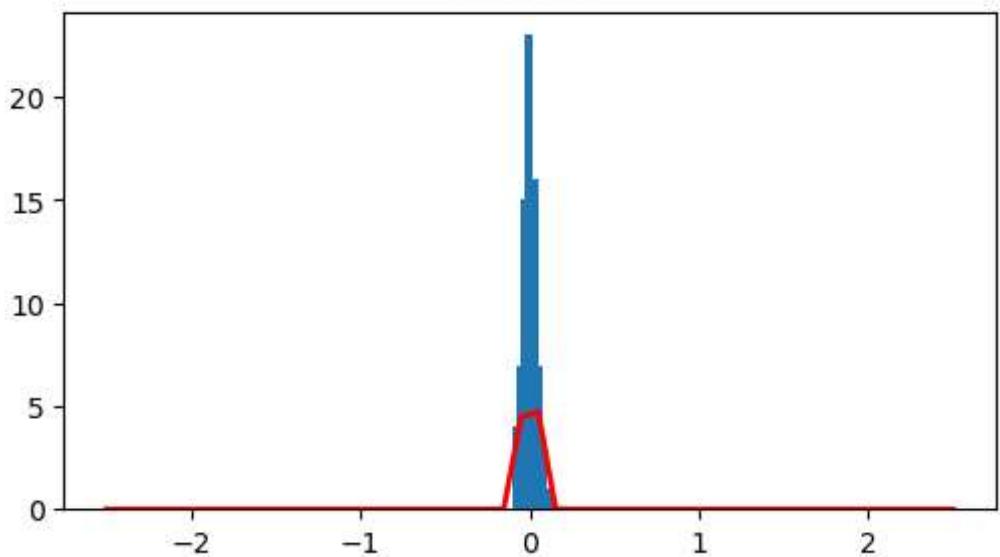


N = 492

Média = 0.0009739913183124936

Variância = 0.0018793288312028286

N = 492

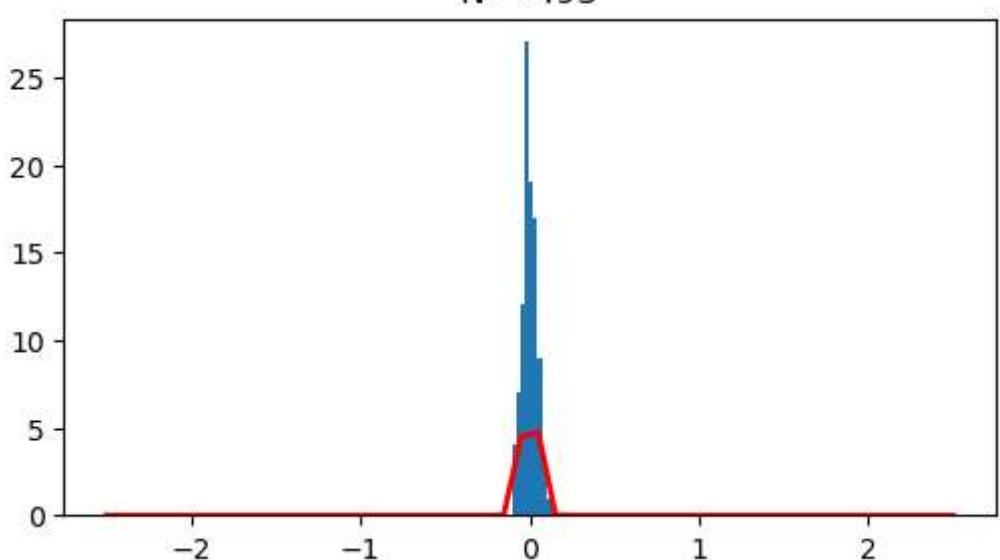


N = 493

Média = 0.0010125334738094764

Variância = 0.0018917464608834663

N = 493

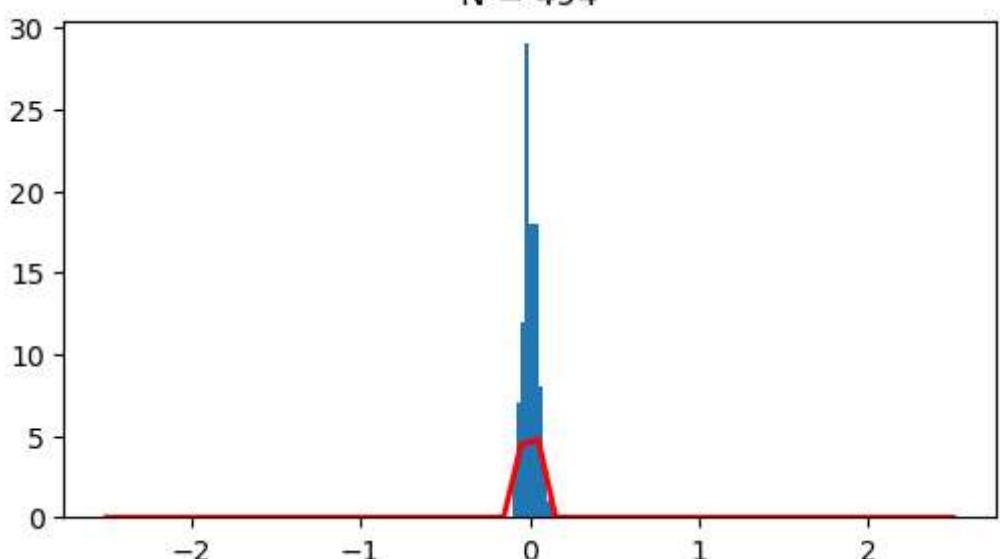


N = 494

Média = 0.0012348159537932495

Variância = 0.0018932580653902105

N = 494

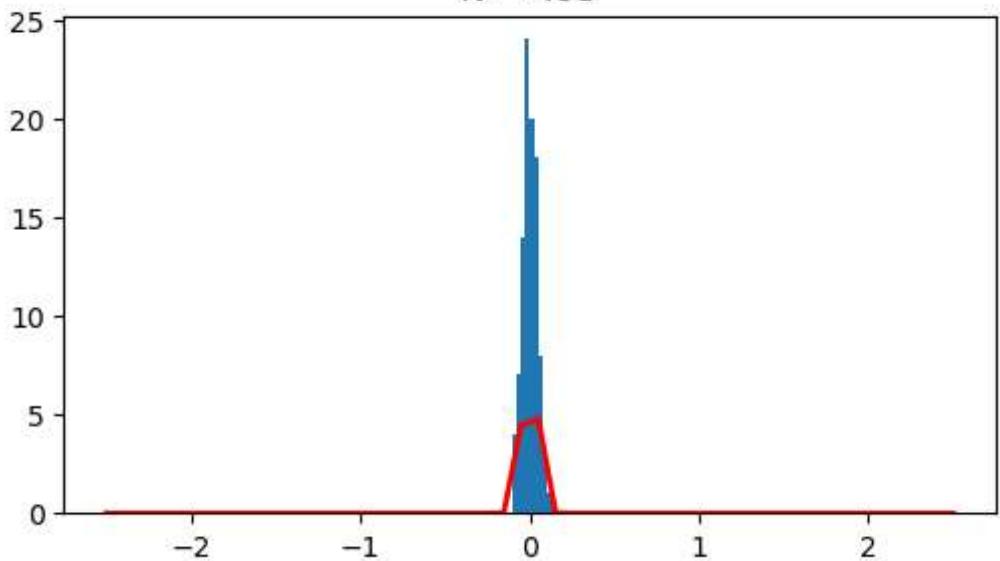


N = 495

Média = 0.0013212001888293354

Variância = 0.0019100427637574848

N = 495

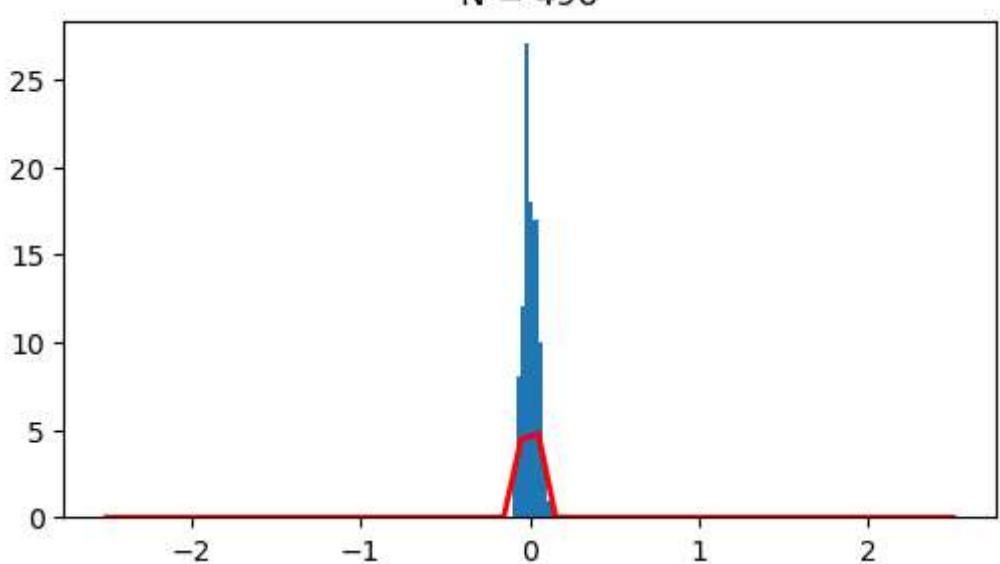


N = 496

Média = 0.0014257964366899834

Variância = 0.0018994135343241637

N = 496

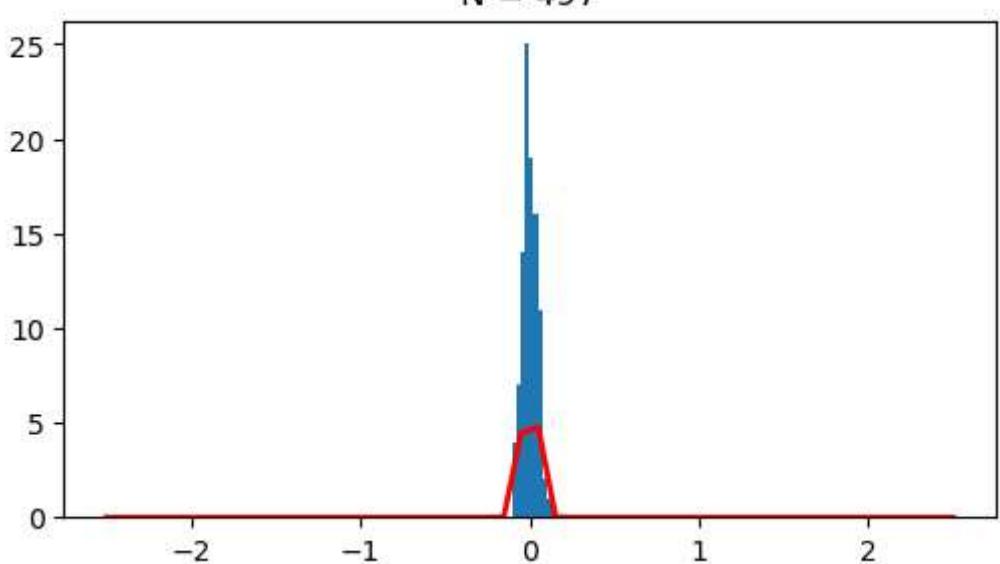


N = 497

Média = 0.0012729651063988223

Variância = 0.0019012411204389536

N = 497

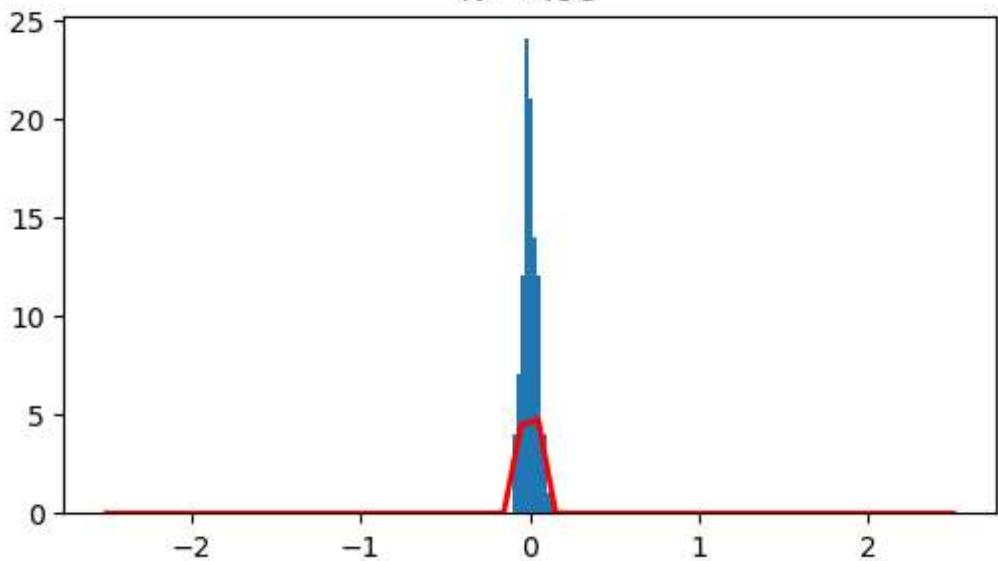


N = 498

Média = 0.001056681537774227

Variância = 0.0018863251075517022

N = 498

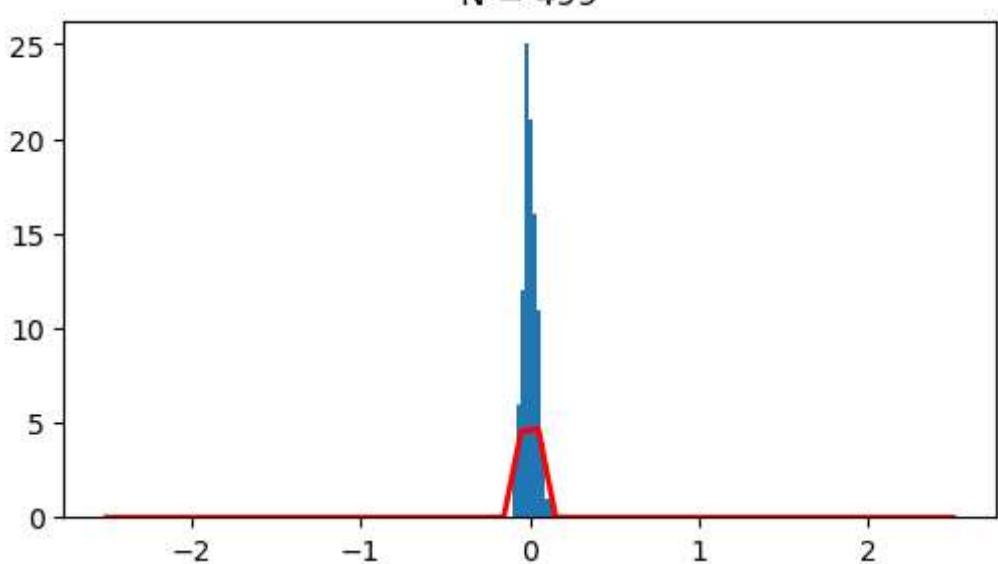


N = 499

Média = 0.000599243065824394

Variância = 0.0018717219466616827

N = 499

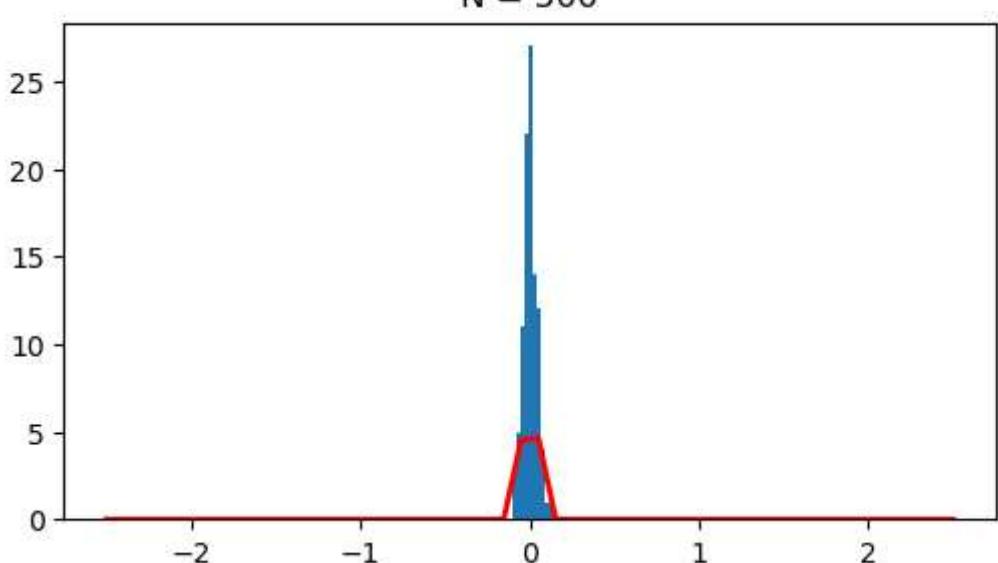


N = 500

Média = 0.0005531170003593097

Variância = 0.0018380246586151925

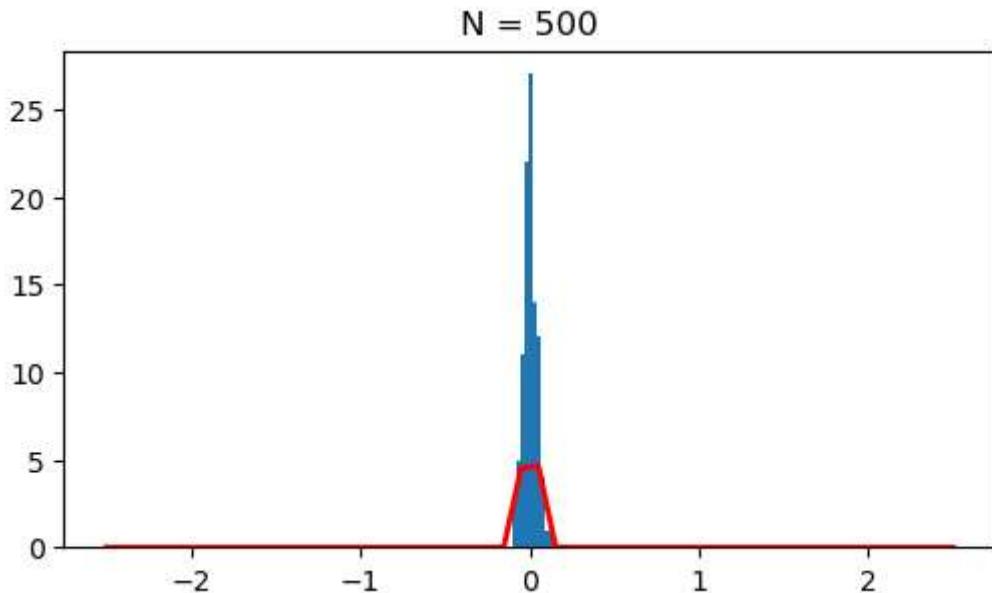
N = 500



```
In [11]: #Histograma final
print('N = ', i+1, '    Média = ', mu, '    Variância = ', var)
fig, axs = plt.subplots(1, 1, figsize=(5, 3), layout='constrained')
axs.hist(Vt/(i+1), bins = 10) #média
axs.plot(x, (1/np.sqrt(2 * np.pi * var)) * np.exp((-x - mu)**2) / (2 * var)), li
axs.set_title("N = "+ str(i+1))

plt.show()
```

N = 500 Média = 0.0005531170003593097 Variância = 0.0018380246586151925



Conclusão: Conforme N aumenta o histograma fina cada vez mais estreito em torno do valor da média correta.