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## Group D Proof of SD Formula

joeguirg · 8/21/15

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J

joeguirg



Joined: 5/31/10  
Messages: 95  
Points: 138

8/21/15

#1

@APalley @Pavlos Sakoglou

Hi, I was unsure of the derivation of the SD formula. In order to really understand and retain this formula, I proved it in the attached and hope it can be of help to others. Thanks.

### Attachments



Proof S^2.pdf

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Camille.li, Avsy, Anqi Shi and 7 others

A

APalley

Joined: 12/10/09  
Messages: 52,327  
Points: 1,273

8/21/15

#2

joeguirg said:

@APalley @Pavlos Sakoglou

Hi, I was unsure of the derivation of the SD formula. In order to really understand and retain this formula, I proved it in the attached and hope it can be of help to others. Thanks.

This is excellent, thank you.

(A minor typo at the end, where you did not square the first  $C_{T_j}$ )



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carlossouza

8/21/15

joeguirk said:

@APalley @Pavlos Sakoglou


Hi, I was unsure of the derivation of the SD formula. In order to really understand and retain this formula, I proved it in the attached and hope it can be of help to others. Thanks.

Great job



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Pavlos Sakoglou



Joined: 11/18/14

Messages: 3,827

Points: 523

8/21/15

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#4

@APalley @Pavlos Sakoglou

Thanks for pointing out the missing square on the  $C_{T_j}$  term. Attached is an updated version.

Attachments



Proof of  $s^2$ .pdf

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MikeLawrence, convex, Xin Yue REN and 9 others

J

joeguirk



Joined: 5/31/10

Messages: 95

Points: 138

5/17/16

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#5

@Pavlos Sakoglou @APalley

I do think Jeoguirk did a really great job that makes me very clear about the formula on the material. But the only difference between Joeguirk's proof and the formula on material is that, Joeguirk's proof shows (M-1) should be inside of the square root when the material shows (M-1) is out of the square root. Which one is more accurate?

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L

Li Lu



Joined: 1/9/16

Messages: 74

Points: 118

https://quantnet.com/threads/proof-of-sd-formula.21494/

2/7

J

Jason Tan

★

Joined:

5/17/16

Messages:

24

Points:

113

8/16/16

#6

Should be inside of the root! Jeoguirg's version is right~

Li Lu said: ↗

@Pavlos Sakoglou @APalley

I do think Jeoguirg did a really great job that makes me very clear about the formula on the material. But the only difference between Joeguirg's proof and the formula on material is that, Joeguirg's proof shows  $(M-1)$  should be inside of the square root when the material shows  $(M-1)$  is out of the square root. Which one is more accurate?

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jpjananraja

J

Jack Song

★

Joined:

6/2/17

Messages:

102

Points:

128

8/31/17

#7

Wow..this proof is really great.

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APalley

D

Dai Jie

★

Joined:

9/9/18

Messages:

24

Points:

113

12/27/18

#8

Thanks very much! I just did the proof this night. Yours is better!

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Yulin CHEN and APalley



S

snowywsh

Joined: 3/7/19

Messages: 115

Points: 128

6/1/19

joeguirg said:

@APalley @Pavlos Sakoglou

Thanks for pointing out the missing square on the  $C_{T_j}$  term. Attached is an updated version.

In the line "Next... ", is there another square for the first  $C_{T_j}$  missing?

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GONG CHEN

Joined: 9/11/15

Messages: 3,799

Points: 523

6/1/19

snowywsh said:

In the line "Next... ", is there another square for the first  $C_{T_j}$  missing?

yes

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Q

qiuyuw

Joined: 11/14/18

Messages: 25

Points: 263

6/27/19

Thanks so much!

Report

Like

Reply

U

Udbhav A

Joined: 4/30/20

Messages: 95

Points: 128

8/5/20

joeguirg said:

@APalley @Pavlos Sakoglou

Thanks for pointing out the missing square on the  $C_{T_j}$  term. Attached is an updated version.

Nice !

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dimthom



Joined: 6/24/21  
Messages: 38  
Points: 268

10/7/21

#13

Just to confirm in this formula  $C_{T_j}$  is the undiscounted payoff at expiry of path  $j$ ? @APalley @GONG CHEN

Report

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GONG CHEN



Joined: 9/11/15  
Messages: 3,799  
Points: 523

10/7/21

#14

dimthom said:

Just to confirm in this formula  $C_{T_j}$  is the undiscounted payoff at expiry of path  $j$ ?  
@APalley @GONG CHEN

I think you are right. Also see the definition in Group D description.

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dimthom



Joined: 6/24/21  
Messages: 38  
Points: 268

10/7/21

#15

The homework describes it as call output price.. since you agree I'll assume it's the payoff at expiry as is without any discounting. Thanks!

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K

khanhld



Joined: 6/28/22  
Messages: 135  
Points: 288

10/15/22

#16

To future students: the SD formula in the question is a direct application of this variation of the sample standard deviation

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$$\sqrt{\frac{\sum x^2 - (\sum x)^2/n}{(n - 1)}}$$



Eric Kopen



Joined:3/15/23

Messages:51

Points:168

khanhld said:

To future students: the SD formula in the question is a direct application of this variation of the sample standard deviation

[View attachment 45775](#)

Since what we want is the sample standard deviation of the call prices, X is the call prices, i.e. discounted call prices (current prices). Since the given formula in the question uses undiscounted call prices (in the future), we have  $X = C_{T,j} * \exp(-rT)$ . This explains why we have  $\exp(-rT)$  at the end of the formula.  
I hope this is a short and simple explanation of the formula.

This clarification really helped me understand this concept better, thank you for sharing.

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khanhld

K

khanhld



Joined:6/28/22

Messages:135

Points:288

8/20/23

#18

Eric Kopen said:

This clarification really helped me understand this concept better, thank you for sharing.

You're most welcome!

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C

convex

Joined: 6/19/23  
Messages: 28  
Points: 103

8/23/23

#19

I was wondering if the SD model used in the assignment is computationally more advantageous Vs the classic  $\text{SQRT}((x - \mu)^2/(n-1))$  which excel uses. I understand that they produce exactly similar results. Just wondering about the computational benefit of one Vs the other. @APalley @khanhld

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F

B I T f(x) : ☰ ¶ ≡ :

GIF : ↶ ↷ ✂ :

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