Contribution Titles are With Capitals

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Abstract Each contribution should be preceded by an abstract (10–15 lines long) that summarizes the content. The abstract will appear *online* at www.SpringerLink.com and be available with unrestricted access. This allows unregistered users to read the abstract as a teaser for the complete contribution. Please use the 'starred' version of the new Springer `abstract` command for typesetting the text of the online abstracts (cf. source file of this chapter template `abstract`) and include them with the source files of your manuscript. Use the plain `abstract` command if the abstract is also to appear in the printed version of the book.

1 Section Headings are With Capitals

We give some sample text for illustrative purposes. Note that you have to write `\qed` at the end of a proof explicitly. Furthermore there is no `\qedhere` command so it is best to end your proofs with a sentence. The sample text comes from [1].

Blah blah blah... We use $\mathbb{1}$ as the indicator function. This is a hat $\hat{x}$ and this is a wide hat $\widehat{x}$. This is a check $\check{x}$ and this is a wide check $\widecheck{x}$. The optimization problem becomes

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$$\begin{aligned}
\underset{Q_{\bullet k}\in\mathbb{R}^{2m}}{\text{maximize}} \quad & \left(\left.\frac{\partial f}{\partial z_k}\right|_{z=\hat{z}_k} \right)^2 \\
\text{subject to} \quad & \|Q_{\bullet k}\| = 1, \\
& \langle Q^*_{\bullet j}, Q_{\bullet k}\rangle = 0, \quad j = 1,\dots,k-1.
\end{aligned} \tag{1}$$

Similar to [4], to find the partial derivatives $\partial \hat{S}_m/\partial z_i$ needed for the optimization algorithm, we obtain the recursive relations (with initial conditions $\partial \log \hat{S}_0/\partial z_i = 0$ and $\partial \hat{V}_0/\partial z_i = 0$)

$$\frac{\partial \log \hat{S}_{k+1}}{\partial z_i} = \frac{\partial \log \hat{S}_k}{\partial z_i} + \frac{\partial \hat{V}_k}{\partial z_i} f_k^1 + \left(\rho q_{2k+1,i} + \sqrt{1-\rho^2} q_{2k+2,i} \right) f_k^2, \tag{2}$$

$$\frac{\partial \hat{V}_{k+1}}{\partial z_i} = \frac{\partial \hat{V}_k}{\partial z_i} f_k^3 + q_{2k+1,i} f_k^4, \tag{3}$$

where k goes from 0 to $m-1$. The chain rule is used to obtain

$$\frac{\partial \hat{S}_m}{\partial z_i} = \hat{S}_m \frac{\partial \log \hat{S}_m}{\partial z_i}.$$

We will use the following lemma to calculate the transformation matrix.

Lemma 1. *The recursion*

$$\begin{aligned}
F_{k+1} &= a_k F_k + b_k q_k, \\
G_{k+1} &= c_k G_k + d_k q_k + e_k F_k,
\end{aligned}$$

with initial values $F_0 = G_0 = 0$ can be written at index $k+1$ as a linear combination of the q_ℓ, $\ell = 0,\dots,k$, as follows

$$\begin{aligned}
F_{k+1} &= \sum_{\ell=0}^{k} q_\ell b_\ell \prod_{j=\ell+1}^{k} a_j, \\
G_{k+1} &= \sum_{\ell=0}^{k} q_\ell \left(d_\ell \prod_{j=\ell+1}^{k} c_j + b_\ell \sum_{t=\ell+1}^{k} e_t \prod_{v=t+1}^{k} c_v \prod_{v=\ell+1}^{t-1} a_v \right).
\end{aligned}$$

Proof. The formula for F_{k+1} follows immediately by induction. For the expansion of G_{k+1} we first rewrite this formula in a more explicit recursive form

$$\begin{aligned}
G_{k+1} &= \sum_{\ell=0}^{k} q_\ell d_\ell \prod_{j=\ell+1}^{k} c_j + \sum_{\ell=0}^{k-1} q_\ell b_\ell \sum_{t=\ell+1}^{k} e_t \prod_{v=t+1}^{k} c_v \prod_{v=\ell+1}^{t-1} a_v \\
&= \sum_{\ell=0}^{k} q_\ell d_\ell \prod_{j=\ell+1}^{k} c_j + \sum_{t=1}^{k} e_t \prod_{v=t+1}^{k} c_v \left(\sum_{\ell=0}^{t-1} q_\ell b_\ell \prod_{v=\ell+1}^{t-1} a_v \right).
\end{aligned}$$

The part in-between the braces equals F_t and the proof now follows by induction on k. □
□

Proposition 1. *The column vector $Q_{\bullet k}$ that solves the optimization problem* (1) *for a call option under the Heston model is given by $Q_{\bullet k} = \pm \boldsymbol{v}/\|\boldsymbol{v}\|$ where*

$$v_{2\ell+1} = \hat{S}_m f_\ell^2 \rho + \hat{S}_m f_\ell^4 \sum_{t=\ell+1}^{m-1} f_t^1 \prod_{v=\ell+1}^{t-1} f_v^3,$$
$$v_{2\ell+2} = \hat{S}_m f_\ell^2 \sqrt{1-\rho^2},$$

for $\ell = 0, \dots, m-1$.

Proof. By [4, Theorem 1] the solution to the optimization problem (1) is given by

$$Q_{\bullet k} = \pm \frac{\boldsymbol{v}}{\|\boldsymbol{v}\|},$$

where $\boldsymbol{v}$ is determined from

$$Q'_{\bullet k}\boldsymbol{v} = \frac{\partial \hat{S}_m}{\partial z_k} = \hat{S}_m \frac{\partial \log \hat{S}_m}{\partial z_k}.$$

With the help of Lemma 1 we find from (2) and (3)

$$\frac{\partial \log \hat{S}_m}{\partial z_k} = \sum_{\ell=0}^{m-1} q_{2\ell+1,k} \left(\rho f_\ell^2 + f_\ell^4 \sum_{t=\ell+1}^{m-1} f_t^1 \prod_{v=\ell+1}^{t-1} f_v^3 \right) + \sum_{\ell=0}^{m-1} q_{2\ell+2,k} \sqrt{1-\rho^2} f_\ell^2,$$

from which the result now follows. □
□

Remark 1. This is a remark.

$$A \neq B$$
$$A \neq B$$
$$a \leq b$$
$$a \leq b$$
$$a \ll b.$$

2 Section Heading

This section could be similar to Section 1 but we decided to include a table here. Please see Table 1.

Table 1 Please write your table caption here

Classes	Subclass	Length	Action Mechanism
Translation	mRNA[a]	22 (19–25)	Translation repression, mRNA cleavage
Translation	mRNA cleavage	21	mRNA cleavage
Translation	mRNA	21–22	mRNA cleavage
Translation	mRNA	24–26	Histone and DNA Modification

[a] Table foot note (with superscript)

Acknowledgements To include acknowledgements use the `acknowledgement` environment.

References

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