```
Exit[]

PrependTo[$Path, "D:\\Users\\Johannes\\Promotion\\SVN Rep\\Mathematica\\Packages"];
<< JoFin`

n = 3;
dS[i_] := r S[i] dt + σ[i] S[i] dB[i];
Q[i_] := q[i] P / S[i];
dP = Expand[Sum[Q[i] dS[i], {i, 1, n}] + (P - Sum[Q[i] S[i], {i, 1, n}]) y dt]
coef = CoefficientArrays[dP, Prepend[Table[dB[i], {i, n + 1}], dt]][[2]];
S[n + 1] := P;
mm = MMc[{coef[[1]]}, {coef[[2 ;; n + 2]]}];
Print["Resulting system of SDEs:", MatrixForm /@ mm];
mmd = MMdisc[mm];
dfk = Simplify[DFK[V, mmd]]
```

$$\mathrm{dt}\,P\,y + \mathrm{dt}\,P\,r\,q[1] - \mathrm{dt}\,P\,y\,q[1] + \mathrm{dt}\,P\,r\,q[2] - \mathrm{dt}\,P\,y\,q[2] + \mathrm{dt}\,P\,r\,q[3] - \mathrm{dt}\,P\,y\,q[3] + P\,\mathrm{dB}[1]\,q[1]\,\sigma[1] + P\,\mathrm{dB}[2]\,q[2]\,\sigma[2] + P\,\mathrm{dB}[3]\,q[3]\,\sigma[3]$$

Resulting system of SDEs: $\left\{\begin{pmatrix} r\,S[1] \\ r\,S[2] \\ r\,S[3] \\ P\,y + P\,r\,q[1] - P\,y\,q[1] + P\,r\,q[2] - P\,y\,q[2] + P\,r\,q[3] - P\,y\,q[3] \end{pmatrix},\right.$

$$\left.\begin{pmatrix} S[1]\,\sigma[1] & 0 & 0 & 0 \\ 0 & S[2]\,\sigma[2] & 0 & 0 \\ 0 & 0 & S[3]\,\sigma[3] & 0 \\ P\,q[1]\,\sigma[1] & P\,q[2]\,\sigma[2] & P\,q[3]\,\sigma[3] & 0 \end{pmatrix}, \begin{pmatrix} 1 & \rho[1,2] & \rho[1,3] & 0 \\ \rho[1,2] & 1 & \rho[2,3] & 0 \\ \rho[1,3] & \rho[2,3] & 1 & 0 \\ 0 & 0 & 0 & 1 \end{pmatrix}\right\}$$

The resulting system of SDEs: $\left\{\begin{pmatrix} 0 \\ 0 \\ 0 \\ P\,(r - y)\,(-1 + q[1] + q[2] + q[3]) \end{pmatrix},\right.$

$$\left.\begin{pmatrix} S[1]\,\sigma[1] & 0 & 0 & 0 \\ 0 & S[2]\,\sigma[2] & 0 & 0 \\ 0 & 0 & S[3]\,\sigma[3] & 0 \\ P\,q[1]\,\sigma[1] & P\,q[2]\,\sigma[2] & P\,q[3]\,\sigma[3] & 0 \end{pmatrix}, \begin{pmatrix} 1 & \rho[1,2] & \rho[1,3] & 0 \\ \rho[1,2] & 1 & \rho[2,3] & 0 \\ \rho[1,3] & \rho[2,3] & 1 & 0 \\ 0 & 0 & 0 & 1 \end{pmatrix}\right\}$$

$$
\begin{aligned}
&P\,(r-y)\,(-1+q[1]+q[2]+q[3])\,V^{(0,0,0,0,1)}[t,S[1],S[2],S[3],P]+\\
&\frac{1}{2}\,P^2\,\Big(q[1]^2\,\sigma[1]^2+q[2]^2\,\sigma[2]^2+2\,q[2]\,q[3]\,\rho[2,3]\,\sigma[2]\,\sigma[3]+\\
&\quad q[3]^2\,\sigma[3]^2+2\,q[1]\,\sigma[1]\,(q[2]\,\rho[1,2]\,\sigma[2]+q[3]\,\rho[1,3]\,\sigma[3])\Big)\\
&\;V^{(0,0,0,0,2)}[t,S[1],S[2],S[3],P]+P\,S[3]\,\sigma[3]\\
&\;(q[1]\,\rho[1,3]\,\sigma[1]+q[2]\,\rho[2,3]\,\sigma[2]+q[3]\,\sigma[3])\,V^{(0,0,0,1,1)}[t,S[1],S[2],S[3],P]+\\
&\frac{1}{2}\,S[3]^2\,\sigma[3]^2\,V^{(0,0,0,2,0)}[t,S[1],S[2],S[3],P]+\\
&P\,q[1]\,S[2]\,\rho[1,2]\,\sigma[1]\,\sigma[2]\,V^{(0,0,1,0,1)}[t,S[1],S[2],S[3],P]+\\
&P\,q[2]\,S[2]\,\sigma[2]^2\,V^{(0,0,1,0,1)}[t,S[1],S[2],S[3],P]+\\
&P\,q[3]\,S[2]\,\rho[2,3]\,\sigma[2]\,\sigma[3]\,V^{(0,0,1,0,1)}[t,S[1],S[2],S[3],P]+\\
&S[2]\,S[3]\,\rho[2,3]\,\sigma[2]\,\sigma[3]\,V^{(0,0,1,1,0)}[t,S[1],S[2],S[3],P]+\\
&\frac{1}{2}\,S[2]^2\,\sigma[2]^2\,V^{(0,0,2,0,0)}[t,S[1],S[2],S[3],P]+\\
&P\,q[1]\,S[1]\,\sigma[1]^2\,V^{(0,1,0,0,1)}[t,S[1],S[2],S[3],P]+\\
&P\,q[2]\,S[1]\,\rho[1,2]\,\sigma[1]\,\sigma[2]\,V^{(0,1,0,0,1)}[t,S[1],S[2],S[3],P]+\\
&P\,q[3]\,S[1]\,\rho[1,3]\,\sigma[1]\,\sigma[3]\,V^{(0,1,0,0,1)}[t,S[1],S[2],S[3],P]+\\
&S[1]\,S[3]\,\rho[1,3]\,\sigma[1]\,\sigma[3]\,V^{(0,1,0,1,0)}[t,S[1],S[2],S[3],P]+\\
&S[1]\,S[2]\,\rho[1,2]\,\sigma[1]\,\sigma[2]\,V^{(0,1,1,0,0)}[t,S[1],S[2],S[3],P]+\\
&\frac{1}{2}\,S[1]^2\,\sigma[1]^2\,V^{(0,2,0,0,0)}[t,S[1],S[2],S[3],P]+V^{(1,0,0,0,0)}[t,S[1],S[2],S[3],P]
\end{aligned}
$$

```
MatrixForm /@ CoefficientArrays[dfk, Table[q[i], {i, n}], Symmetric → True]
```

$$
\begin{aligned}
\Big\{&-P\,(r-y)\,V^{(0,0,0,0,1)}[t,S[1],S[2],S[3],P]+\\
&\frac{1}{2}\,S[3]^2\,\sigma[3]^2\,V^{(0,0,0,2,0)}[t,S[1],S[2],S[3],P]+\\
&S[2]\,S[3]\,\rho[2,3]\,\sigma[2]\,\sigma[3]\,V^{(0,0,1,1,0)}[t,S[1],S[2],S[3],P]+\\
&\frac{1}{2}\,S[2]^2\,\sigma[2]^2\,V^{(0,0,2,0,0)}[t,S[1],S[2],S[3],P]+\\
&S[1]\,S[3]\,\rho[1,3]\,\sigma[1]\,\sigma[3]\,V^{(0,1,0,1,0)}[t,S[1],S[2],S[3],P]+\\
&S[1]\,S[2]\,\rho[1,2]\,\sigma[1]\,\sigma[2]\,V^{(0,1,1,0,0)}[t,S[1],S[2],S[3],P]+\\
&\frac{1}{2}\,S[1]^2\,\sigma[1]^2\,V^{(0,2,0,0,0)}[t,S[1],S[2],S[3],P]+\\
&V^{(1,0,0,0,0)}[t,S[1],S[2],S[3],P],\;
\begin{pmatrix}
P\,(r-y)\,V^{(0,0,0,0,1)}[t,S[1],S[2],S[3],P]+P\,S[3]\,\ldots\\
P\,(r-y)\,V^{(0,0,0,0,1)}[t,S[1],S[2],S[3],P]+P\,S[3]\,\ldots\\
P\,(r-y)\,V^{(0,0,0,0,1)}[t,S[1],S[2],S[3],P]+P\,S[3]\,\ldots
\end{pmatrix}
\end{aligned}
$$

constant volatility

The option value will be independent of the asset prices, as can be veryfied by the absence of S terms in the following equation:

```
V2 := ToExpression[StringJoin["V[#1,#", ToString[n + 2], "]&"]];
dfkC = Simplify[DFK[V2, mmd]]
```

$$P\,(r-y)\,(-1+q[1])\,V^{(0,1)}[t,P]+\frac{1}{2}\,P^2\,q[1]^2\,\sigma[1]^2\,V^{(0,2)}[t,P]+V^{(1,0)}[t,P]$$

```
coef = CoefficientArrays[dfkC, Table[q[i], {i, n}], Symmetric → True]; MatrixForm /@ coef
```

$$\left\{-P\,(r-y)\,V^{(0,1)}[t,P]+V^{(1,0)}[t,P],\ \left(P\,(r-y)\,V^{(0,1)}[t,P]\right),\ \left(\tfrac{1}{2}\,P^2\,\sigma[1]^2\,V^{(0,2)}[t,P]\right)\right\}$$