```
Exit[]

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

n = 1;
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}]) r 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];
mmlogd = MMdisc[mm];
dfk = Simplify[DFK[V, mmlogd]]
```

dt P r + P dB[1] q[1] σ[1]

Resulting system of SDEs: $\left\{\begin{pmatrix} r\,S[1] \\ P\,r \end{pmatrix}, \begin{pmatrix} S[1]\,\sigma[1] & 0 \\ P\,q[1]\,\sigma[1] & 0 \end{pmatrix}, \begin{pmatrix} 1 & 0 \\ 0 & 1 \end{pmatrix}\right\}$

The resulting system of SDEs: $\left\{\begin{pmatrix} 0 \\ 0 \end{pmatrix}, \begin{pmatrix} S[1]\,\sigma[1] & 0 \\ P\,q[1]\,\sigma[1] & 0 \end{pmatrix}, \begin{pmatrix} 1 & 0 \\ 0 & 1 \end{pmatrix}\right\}$

$$\frac{1}{2}\sigma[1]^2\left(P^2 q[1]^2 V^{(0,0,2)}[t, S[1], P] + S[1]\left(2 P q[1] V^{(0,1,1)}[t, S[1], P] + S[1] V^{(0,2,0)}[t, S[1], P]\right)\right) + V^{(1,0,0)}[t, S[1], P]$$

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

$$\left\{\frac{1}{2} S[1]^2 \sigma[1]^2 V^{(0,2,0)}[t, S[1], P] + V^{(1,0,0)}[t, S[1], P], \left(P\,S[1]\,\sigma[1]^2 V^{(0,1,1)}[t, S[1], P]\right), \left(\frac{1}{2} P^2 \sigma[1]^2 V^{(0,0,2)}[t, S[1], P]\right)\right\}$$

---

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, mmlogd]]
```

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

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

$$\left\{V^{(1,0)}[t, P], (0), \left(\frac{1}{2} P^2 \sigma[1]^2 V^{(0,2)}[t, P]\right)\right\}$$

autonomous volatility

```
S[1] = P; S[2] = σ;
```

```
coefSDE = {{0, a}, {{P σ q, 0}, {0, b}}, {{1, ρ}, {ρ, 1}}}; MatrixForm /@ coefSDE
dfkA = DFK[V, coefSDE]
```

$$\left\{\begin{pmatrix}0\\a\end{pmatrix}, \begin{pmatrix}P\,q\,\sigma & 0\\0 & b\end{pmatrix}, \begin{pmatrix}1 & \rho\\\rho & 1\end{pmatrix}\right\}$$

$$a\,V^{(0,0,1)}[t,P,\sigma]+\frac{1}{2}\left(b^2 V^{(0,0,2)}[t,P,\sigma]+2\,b\,P\,q\,\rho\,\sigma\,V^{(0,1,1)}[t,P,\sigma]+P^2 q^2 \sigma^2 V^{(0,2,0)}[t,P,\sigma]\right)+V^{(1,0,0)}[t,P,\sigma]$$

```
coef = CoefficientArrays[dfkA, q, Symmetric → True]; MatrixForm /@ coef
```

$$\left\{a\,V^{(0,0,1)}[t,P,\sigma]+\frac{1}{2}b^2 V^{(0,0,2)}[t,P,\sigma]+V^{(1,0,0)}[t,P,\sigma],\ \left(b\,P\,\rho\,\sigma\,V^{(0,1,1)}[t,P,\sigma]\right), \left(\tfrac{1}{2}P^2\sigma^2 V^{(0,2,0)}[t,P,\sigma]\right)\right\}$$

passport

```
S[1] = P; S[2] = S
```

```
coefSDE = {{0, 0}, {{S σ q, 0}, {σ S, 0}}, {{1, 0}, {0, 0}}}; MatrixForm /@ coefSDE
dfkA = DFK[V, coefSDE]
```

$$\left\{\begin{pmatrix}0\\0\end{pmatrix}, \begin{pmatrix}q\,S\,\sigma & 0\\S\,\sigma & 0\end{pmatrix}, \begin{pmatrix}1 & 0\\0 & 0\end{pmatrix}\right\}$$

$$\frac{1}{2}\left(S^2\sigma^2 V^{(0,0,2)}[t,P,\sigma]+2\,q\,S^2\sigma^2 V^{(0,1,1)}[t,P,\sigma]+q^2 S^2\sigma^2 V^{(0,2,0)}[t,P,\sigma]\right)+V^{(1,0,0)}[t,P,\sigma]$$

```
coef = CoefficientArrays[dfkA, q, Symmetric → True]; MatrixForm /@ coef
```

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

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