**Table 5.1** Common EDMs, showing their variance function $V(\mu)$, cumulant function $\kappa(\theta)$, canonical parameter $\theta$, dispersion parameter $\phi$, unit deviance $d(y,\mu)$, support $S$ (the permissible values of $y$), domain $\Omega$ for $\mu$ and domain $\Theta$ for $\theta$. For the Tweedie distributions, the case $\xi = 2$ is the gamma distribution, and $\xi = 1$ with $\phi = 1$ is the Poisson distribution. $\mathbb{R}$ refers to the real line; $\mathbb{N}$ refers to the natural numbers $1, 2, \ldots$; superscript $+$ means positive values only; superscript $-$ means negative values only; subscript 0 means zero is included in the space (Sect. 5.3.5)

| EDM | $V(\mu)$ | $\kappa(\theta)$ | $\theta$ | $\phi$ | $d(y,\mu)$ | $S$ | $\Omega$ | $\Theta$ | Reference |
|---|---|---|---|---|---|---|---|---|---|
| Normal | $1$ | $\theta^2/2$ | $\mu$ | $\sigma^2$ | $(y-\mu)^2$ | $\mathbb{R}$ | $\mathbb{R}$ | $\mathbb{R}$ | Chaps. 2 and 3 |
| Binomial | $\mu(1-\mu)$ | $\dfrac{\exp\theta}{1+\exp\theta}$ | $\log\dfrac{\mu}{1-\mu}$ | $\dfrac{1}{m}$ | $2\left\{y\log\dfrac{y}{\mu}+(1-y)\log\dfrac{1-y}{1-\mu}\right\}$ | $\dfrac{0,1,\ldots m}{m}$ | $(0,1)$ | $\mathbb{R}$ | Chap. 9 |
| Negative binomial | $\mu+\dfrac{\mu^2}{k}$ | $-\log(1-\exp\theta)$ | $\log\dfrac{\mu}{\mu+k}$ | $1$ | $2\left\{y\log\dfrac{y}{\mu}-(y+k)\log\dfrac{y+k}{\mu+k}\right\}$ | $\mathbb{N}_0$ | $\mathbb{R}^+$ | $\mathbb{R}^-$ | Chap. 10 |
| Poisson | $\mu$ | $\exp\theta$ | $\log\mu$ | $1$ | $2\left\{y\log\dfrac{y}{\mu}-(y-\mu)\right\}$ | $\mathbb{N}_0$ | $\mathbb{R}^+$ | $\mathbb{R}$ | Chap. 10 |
| Gamma | $\mu^2$ | $-\log(-\theta)$ | $-\dfrac{1}{\mu}$ | $\phi$ | $2\left\{-\log\dfrac{y}{\mu}+\dfrac{y-\mu}{\mu}\right\}$ | $\mathbb{R}^+$ | $\mathbb{R}^+$ | $\mathbb{R}$ | Chap. 11 |
| Inverse Gaussian | $\mu^3$ | $-\sqrt{-2\theta}$ | $-\dfrac{1}{2\mu^2}$ | $\phi$ | $\dfrac{(y-\mu)^2}{\mu^2 y}$ | $\mathbb{R}^+$ | $\mathbb{R}^+$ | $\mathbb{R}^-_0$ | Chap. 11 |
| Tweedie ($\xi \le 0$ or $\xi \ge 1$) | $\mu^\xi$ | $\dfrac{\{(1-\xi)\theta\}^{(2-\xi)/(1-\xi)}}{2-\xi}$ | $\dfrac{\mu^{1-\xi}}{1-\xi}$ | $\phi$ | $2\left\{\dfrac{\max(y,0)^{2-\xi}}{(1-\xi)(2-\xi)}-\right.$ | $\xi<0$: $\mathbb{R}$ | $\mathbb{R}^+$ | $\mathbb{R}^+_0$ | Chap. 12 |
| | | for $\xi \ne 2$ | for $\xi \ne 1$ | | $\left.\dfrac{y\mu^{1-\xi}}{1-\xi}+\dfrac{\mu^{2-\xi}}{2-\xi}\right\}$ | $1<\xi<2$: $\mathbb{R}^+_0$ | $\mathbb{R}^+$ | $\mathbb{R}^-$ | |
| | | | | | for $\xi \ne 1, 2$ | $\xi>2$: $\mathbb{R}^+$ | $\mathbb{R}^+$ | $\mathbb{R}^-_0$ | |