Discrete Dividends

Consider the case of a European call with strike $K$ and expiration date $T$ on an asset that pays a dividend of $\delta_1 S$ at time $t_1 < T$. By notes in class, we have that the value $V(S, t)$ is given by

$$V_-(S, t) = (1 - \delta_1)C\left(S, t; \frac{K}{1 - \delta_1}\right), \quad 0 < t < t_1,$$

$$V_+(S, t) = C(S, t; K), \quad t_1 < t < T,$$

where $C(S, t; \cdot)$ is the price of a European call with strike $\cdot$ and expiration $T$.

Graph of $V$ vs. $S$ for $K = 3$, $\sigma = 0.2$, $T = 1$, $r = 0.05$, $t_1 = 2/3$, $\delta_1 = 0.1$.

Solid curve: $V_-(S, t_1^-; K)$. Dashed curve: $V_+(S, t_1^+; K)$. Dash-dot curve: payoff function.

Dotted curve: payoff function for option holding in $[0, t_1]$.

This diagram shows how the value of the option changes from the solid curve to the dashed curve at the dividend date.