$$q_1^* \cdot (-c_1) + q_2^* \cdot (-c_2) = E_I^* - \frac{(c_1 - a_1)(1-\beta_1) \cdot (c_2 - a_2)(1-\beta_2)}{(c_1 - a_1)(1-\beta_1) + (c_2 - a_2)(1-\beta_2)},$$

so the inequality is equivalent to

$$1 \geq \int_0^{\varepsilon} \left[\frac{1-\beta_1(\varepsilon_1)}{1-\beta_1} + \frac{1-\beta_2(\varepsilon - \varepsilon_1)}{1-\beta_2} \right] dF(\varepsilon_1)$$

for all F. Furthermore, because of (3.8), (3.9), and (3.10), the function

$$G(\varepsilon_1) = \frac{1-\beta_1(\varepsilon_1)}{1-\beta_1} + \frac{1-\beta_2(\varepsilon - \varepsilon_1)}{1-\beta_2} \quad \text{for } 0 \leq \varepsilon_1 \leq \varepsilon$$

satisfies

$$G(0) = G(\varepsilon) = 1$$

and is strictly convex in ε_1 for $0 \leq \varepsilon_1 \leq \varepsilon$. Therefore, the inequality is true for all F.

■

Part (i) of Theorem 3.1 defines necessary and sufficient conditions for all violation to be deterred, similar to Theorem 2.1(i). To illustrate, suppose that $b_1 = b_2 = b > 0$, and assume $d_1 > d_2$ and

$$d_1 - d_2 \leq (b + d_1) \cdot (1-\beta_1) \, \forall \, b \geq 0, \text{ i.e. } d_2 \geq d_1 \cdot \beta_1.$$

Then, according to (3.21), p^* is a function of b given by

$$p^* = \frac{d_1 - d_2 + (b + d_2)(1-\beta_2)}{(b + d_1)(1-\beta_1) + (b + d_2)(1-\beta_2)}$$

for $0 \leq b \leq b^*$, where b^* is defined by

$$\frac{d_1}{b^* + d_1} \cdot \frac{1}{1-\beta_2} + \frac{d_2}{b^* + d_2} \cdot \frac{1}{1-\beta_2} = 1. \tag{3.25}$$

Furthermore, p^* satisfies (2.9), i.e.

$$\frac{d_1}{b + d_1} \cdot \frac{1}{1-\beta_2} \leq p^* \leq 1 - \frac{d_2}{b + d_2} \cdot \frac{1}{1-\beta_2}$$

whenever $b \geq b^*$. These calculations show that the optimal distribution of inspection effort achieves deterrence whenever deterrence is possible, as illustrated in Figure A3. Note also that, in general, p^* is determined only by the state's payoffs. For given "technical" parameters $1-\beta_1$ and $1-\beta_2$, and given values of d_1 and d_2, the common punishment given by (3.25), $b^* = b_1^* = b_2^*$, represents the minimum punishment level necessary to induce the state to behave legally.