

# Online Appendix

## Crime Aggregation, Deterrence, and Witness Credibility

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### A Derivation of $\pi_{\min}(\bar{\pi})$

Recall the expression for the fraction of wrongful convictions under DPP, which equals  $\bar{\pi}$  under the proposed  $\pi^{**}$ , we have

$$\bar{\pi} = \frac{(1 - \pi^{**})^2 R}{(1 - \pi^{**})R + \pi^{**}}, \quad (\text{A.1})$$

which solves

$$\pi^{**} = \frac{2R\bar{l} + R + 1 - \sqrt{(R+1)^2 + 4R\bar{l}}}{2R(\bar{l} + 1)}. \quad (\text{A.2})$$

where  $\bar{l} \equiv \frac{1-\bar{\pi}}{\bar{\pi}}$ . The remainder of the proof computes the expected number of crimes, which is

$$\frac{2\pi^{**}}{(1 - \pi^{**})R + \pi^{**}} = \frac{(1 - \pi^{**})^2 R}{(1 - \pi^{**})R + \pi^{**}} \cdot \frac{2\pi^{**}}{(1 - \pi^{**})^2 R} = (1 - \bar{\pi}) \frac{2\pi^{**}}{(1 - \pi^{**})^2 R}. \quad (\text{A.3})$$

Plugging in (A.2), we have

$$\begin{aligned} (1 - \pi^{**})^2 R &= \frac{\left(R - 1 + \sqrt{(R+1)^2 + 4R\bar{l}}\right)^2}{4R(\bar{l} + 1)^2} = \frac{\left(R - 1 + \sqrt{(R+1)^2 + 4R\bar{l}}\right)^2 \left(R - 1 - \sqrt{(R+1)^2 + 4R\bar{l}}\right)^2}{4R(\bar{l} + 1)^2 \left(R - 1 - \sqrt{(R+1)^2 + 4R\bar{l}}\right)^2} \\ &= \frac{\left((R-1)^2 - (R+1)^2 - 4R\bar{l}\right)^2}{4R(\bar{l} + 1)^2 \left(R - 1 - \sqrt{(R+1)^2 + 4R\bar{l}}\right)^2} = \frac{16R^2(\bar{l} + 1)^2}{4R(\bar{l} + 1)^2 \left(R - 1 - \sqrt{(R+1)^2 + 4R\bar{l}}\right)^2}, \end{aligned} \quad (\text{A.4})$$

as well as

$$2\pi^{**} = \frac{2R\bar{l} + R + 1 - \sqrt{(R+1)^2 + 4R\bar{l}}}{R(\bar{l} + 1)}.$$

Therefore,

$$\begin{aligned}
\frac{2\pi^{**}}{(1-\pi^{**})^2 R} &= \frac{1}{4R^2(\bar{l}+1)} \left(2R\bar{l} + R + 1 - \sqrt{(R+1)^2 + 4R\bar{l}}\right) \left(R - 1 - \sqrt{(R+1)^2 + 4R\bar{l}}\right)^2. \\
&= \frac{1}{4R^2(\bar{l}+1)} \left(2R\bar{l} + R + 1 - \sqrt{(R+1)^2 + 4R\bar{l}}\right) \left((R-1)^2 + (R+1)^2 + 4R\bar{l} - 2(R-1)\sqrt{(R+1)^2 + 4R\bar{l}}\right) \\
&= \frac{1}{2R^2(\bar{l}+1)} \left(2R\bar{l} + R + 1 - \sqrt{(R+1)^2 + 4R\bar{l}}\right) \left(2R\bar{l} + R^2 + 1 - (R-1)\sqrt{(R+1)^2 + 4R\bar{l}}\right) \\
&= \frac{1}{2R^2(\bar{l}+1)} \left( (2R\bar{l}+R+1)(2R\bar{l}+R^2+1) + (R-1)[(R+1)^2+4R\bar{l}] - [(R-1)(2R\bar{l}+R+1)+2R\bar{l}+R^2+1]\sqrt{(R+1)^2+4R\bar{l}} \right) \\
&= 2\bar{l} + R + 1 - \sqrt{(R+1)^2 + 4R\bar{l}}
\end{aligned}$$

Since  $\bar{\pi} = \frac{1}{1+\bar{l}}$ , we have

$$\frac{2\pi^{**}}{(1-\pi^{**})R + \pi^{**}} = \frac{2\bar{l} + R + 1 - \sqrt{(R+1)^2 + 4R\bar{l}}}{1 + \bar{l}}.$$