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Asymptotic behaviour of first passage time distributions for Lévy processes

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Let X be a real valued L\'evy process that is in the domain of attraction of a stable law without centering with norming function $c.$ As an analogue of the random walk results in \cite{vw} and \cite{rad} we study the local behaviour of the distribution of the lifetime ζ under the characteristic measure $\underline{n}$ of excursions away from 0 of the process X reflected in its past infimum, and of the first passage time of X below $0,$ $T_{0}=\inf \{t>0:X_{t}<0\},$ under $\mathbb{P}_{x}(\cdot),$ for $x>0,$ in two different regimes for $x,$ viz. $x=o(c(\cdot))$ and $x>D\,c(\cdot),$ for some $D>0.$ We sharpen our estimates by distinguishing between two types of path behaviour, viz. continuous passage at T_{0} and discontinuous passage. In the way to prove our main results we establish some sharp local estimates for the entrance law of the excursion process associated to X reflected in its past infimum.

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