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A functional equation arising from the utility of gambling

In joint work with D. Luce and A. A. J. Marley, on the utility of gambling, an attempt was made to extend the approach of J. R. Meginniss. A functional equation we came across is

$$f(\alpha(r)x) + f(\alpha(1-r)x) = xm(r) + f(x) \quad (r, x \in [0, 1])$$

for some function $m \colon [0, 1] \to \mathbb{R}$. Here α is a homeomorphism on $[0, 1]$ and we seek its continuous solution f. We show the application of a uniqueness theorem with which the equation is solved.