Mathematics > Probability

Asymptotics of stationary solutions of multivariate stochastic recursions with heavy tailed inputs and related limit theorems

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Let Φ_n be an i.i.d. sequence of Lipschitz mappings of $\R^d$. We study the Markov chain $\{X_n^x\}_{n=0}^\8$ on $\R^d$ defined by the recursion $X_n^x = \Phi_n(X^x_{n-1})$, $n\ge 0$, $X_0=x\in\R^d$. We assume that $\Phi_n(x)=\Phi(A_n x,B_n(x))$ for a continuous function $\Phi:\R^d\times \R^d\to\R^d$, commuting with dilations and i.i.d random pairs (A_n,B_n), where $A_n\in {\rm End}\R^d$ and B_n is a continuous mapping of $\R^d$. Moreover, B_n is $\a$-regularly varying and A_n has a faster decay at infinity than B_n. We prove that the stationary measure ν of the Markov chain $\{X_n^x\}$ is $\a$-regularly varying. Using this result we show that, if $\a<2$, the partial sums $S_n^x=\sum_{k=1}^n X_k^x$, appropriately normalized, converge to an $\a$-stable random variable. In particular, we obtain new results concerning the multidimensional autoregressive process $X_n = A_n X_{n-1}+B_n$.

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