One dimensional Zero range Processes with ergodic site-wise disorder-Convergence to critical measure from supercritical initial profile

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We study nearest neighbor asymmetric zero range processes on $\mathbf{Z}$ with site-wise disorder given by a random variable at each site which multiplies the rate. Let $\alpha(x), x \in \mathbf{Z}$ be an ergodic sequence taking values in $(c, 1]$ where $c > 0$. We assume that $\alpha(x)$ has no atom at c. The generator of the process is given below.

$$L^{\alpha} f(\eta) = \sum_{x,y \in \mathbf{Z}} \alpha(x) p(y-x) g(\eta(x)) \left[f\left(\eta^{x,y}\right) - f(\eta) \right]$$

$g(k)$ denotes the rate at which a particle jumps from a site with occupation number k. We take g to be increasing with $\lim_{k\to\infty} g(k) = 1$. p is a nearest neighbor jump kernel. In earlier work of Benjamini, Ferrari and Landim it was shown that there was a critical density ρ_c above which no product invariant measures existed and a hydrodynamic limit below the critical density was established. Andjel, Ferrari, Landim and Guiol considered the totally asymmetric case with $g = 1$ and showed that all invariant measures are in the convex hull of product invariant measures with density lower than or equal to the critical density. They further showed that starting from a configuration with lower asymptotic empirical density at $-\infty$ greater than ρ_c the process converges to the maximal invariant measure with density ρ_c. Their approach exploited the total asymmetry. We extend their result to the asymmetric case and general g. Ideas on general Euler hydrodynamics of attractive one dimensional systems, results on convergence to local equilibrium and hydrodynamics of semi-infinite system with sources/sinks are used to obtain our result. We also show that the condition on initial profile is necessary and give a counter example to show that the the result may not hold without the nearest neighbor assumption. (This is joint work with Christophe Bahadoran, Thomas Mountford and Ellen Saada)