ABSTRACT. Consider the partition function $S_\mu^q(\epsilon)$ associated in the theory of Rényi dimension to a finite Borel measure μ on Euclidean d-space. This partition function $S_\mu^q(\epsilon)$ is the sum of the q-th powers of the measure applied to a partition of d-space into d-cubes of width ϵ. We further Guérin's investigation of the relation between this partition function and the Lebesgue L^p norm (L^q norm) of the convolution of μ against an approximate identity of Gaussians. We prove a Lipschitz-type estimate on the partition function. This bound on the partition function leads to results regarding the computation of Rényi dimension. It also shows that the partition function is of O-regular variation.

We find situations where one can or cannot replace the partition function by a discrete version. We discover that the slopes of the least-square best fit linear approximations to the partition function cannot always be used to calculate upper and lower Rényi dimension.