On the higher derivative truncation of unimodular asymptotically safe quantum gravity

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Unimodular gravity is classically equivalent to standard Einstein gravity. This equivalence naturally extends to Lagrangians which are functions of the curvature scalar. At the quantum level, the dynamics could differ. The conformal factor is non-dynamical and the gauge symmetry consists of transverse diffeomorphisms. Furthermore, the cosmological constant is not a coupling in the unimodular action, thus it is not renormalized, providing a new way of addressing the cosmological constant fine-tuning problem. In this work we study the extension of the classical equivalence and consider a quantum theory based on the asymptotic safety scenario and investigate the UV-completion for a higher derivative Lagrangian of the general form $f(R, R_{\mu\nu} R^{\mu\nu})$, on a maximally symmetric background. We study the fixed points and its properties, and also investigate the effect of dynamical matter degrees of freedom on the beta functions of the gravitational couplings.