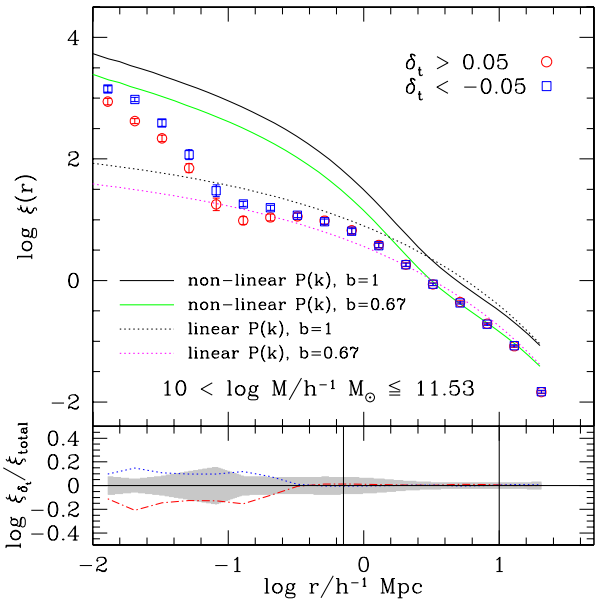

Fig. 1. Correlation functions for old (red circles) and young (blue squares) objects selected by using the radius parametrization in equation (1) given by the best-fitting parameters $a = 0$ and $b = -0.07$. The vertical lines in the lower box mark the range in which the reduced $\chi^2_{\xi(r)}$ is calculated. Note that the assembly bias is not present at large scales ($r > 1\ h^{-1}$ Mpc). For smaller scales, the differences in the clustering amplitude between old and young populations are typically below a factor of 2.

sembly bias effect (Lacerna & Padilla 2011). This will be equivalent to a new definition of "halo". We parametrize the radius of each galaxy as a function of both virial mass, $M_{\rm vir}$, and relative stellar age, δ_t. We then measure the masses inside spheres defined by this radius and calculate their relative ages with respect to this mass.

The radius for each galaxy is parametrized as

$$r = a\delta_t + b\ \log\left(\frac{M_{\rm vir}}{M_{\rm nl}}\right)\ , \qquad (1)$$

where $M_{\rm nl}$ is the non-linear mass defined by Seljak & Warren (2004) with $\log(M_{\rm nl}/h^{-1}\ M_\odot) = 13.38$ for our choice of cosmological parameters. The free parameters are a and b. It is assumed that if r is smaller than the virial radius $r_{\rm vir}$ or if M is smaller than the virial mass, then $M = M_{\rm vir}$. The correlation functions for a best-fitting parameter set is shown in Figure 1, where at scales $r > 1\ h^{-1}$ Mpc the amplitude of clustering is similar for old and young galaxies.

We obtain similar results for the case $a = 0.2$ and $b = -0.02$, although with slight amplitude differences. However, the mass function changes only slightly with respect to that of the virial mass when using this second-best fitting values. None of the two parametrizations change the mass function at $M \geq 10^{12}\ h^{-1}\ M_\odot$, and therefore in this range their mass functions and the one resulting from the virial mass are all consistent with the Sheth, Mo, & Tormen (2001) model.

4. CONCLUSIONS

Our method consisted in redefining the overdensity that characterizes each galaxy using the information of its virial mass and the relative stellar age. This new definition is proposed as a better alternative than the virial mass to account for the assembly bias effect. Galaxies do not show significant differences in the two-halo regime for objects of a given mass range but different age using this formalism.

The best parameters are those that yield median sphere radii in the range of 1–4$r_{\rm vir}$. Neighbouring massive haloes that are out to these distances are probably responsible for these effects. These could disrupt the normal growth of small objects and, therefore, affect their ages.

To summarize, we stress the apparent fact that particularly for low-mass objects, the *virial* mass is not an adequate proxy for peak height in the standard picture, because equal virial mass objects can actually belong to initial density peaks of very different amplitude. It is necessary to include a more global environmental component, i.e. the mass of the region that effectively characterizes the peak height.

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