central blue (long-dashed blue line), and central red (short-dashed red line) galaxies. The blue and red *GBMF*s were calculated from the corresponding *GSMF*s and adding to $M_{\rm s}$ the respective gas mass, $M_{\rm g}$ (see § 2.1). The total *GBMF* is the sum of both of them. The error in $M_{\rm b}$ was calculated as the sum in quadrature of the errors in $M_{\rm s}$ and $M_{\rm g}$. This error, together with the intrinsic scatter in $M_{\rm s}$ (see § 2.2), both propagated to the $M_{\rm b}$–$M_{\rm h}$ relation, account for an uncertainty (standard deviation) of ∼0.23 dex in log$M_{\rm b}$ at all masses (grey curves connected by vertical lines in Figure 5).

The baryonic mass fraction, $f_{\rm b}$, for blue galaxies is larger than the corresponding stellar one, $f_{\rm s}$, in particular at smaller halo masses. At $M_{\rm h} \approx 10^{11}\ M_{\odot}$, $f_{\rm b}$ is a factor 2.4 times higher than $f_{\rm s}$, while the peak of $f_{\rm b} = 0.028^{+0.018}_{-0.011}$ (at $M_{\rm h} = 10^{12.0}\ M_{\odot}$) is only 1.3 times larger than the peak of $f_{\rm s}$ (at $M_{\rm h} = 10^{12.0}\ M_{\odot}$). For larger masses, the difference between $f_{\rm b}$ and $f_{\rm s}$ decreases, while for smaller masses, the lower is $M_{\rm h}$, the larger is $f_{\rm b}$ compared to $f_{\rm s}$. For red galaxies, $f_{\rm s}$ and $f_{\rm b}$ are very similar, some differences being observed only at the lowest masses.

For masses larger (smaller) than $M_{\rm h} \approx 10^{11.6}\ M_{\odot}$, the differences between the $M_{\rm b}$–$M_{\rm h}$ ($f_{\rm b}$–$M_{\rm h}$) relation of blue and red galaxies become smaller (larger) than in the case of stellar masses (see § 3.2 and left panels of Figure 5). In general, the $f_{\rm b}$ bell-shaped curve for red galaxies is more peaked and narrower than the one for blue galaxies.

For blue galaxies, roughly $f_{\rm b} \propto {M_{\rm h}}^{0.7}$ (${M_{\rm b}}^{0.4}$) at the low-mass end, and $f_{\rm b} \propto {M_{\rm h}}^{-0.5}$ (${M_{\rm b}}^{-0.8}$) at the high-mass end. For red galaxies, roughly $f_{\rm b} \propto {M_{\rm h}}^{2.9}$ (${M_{\rm b}}^{0.8}$) at the low-mass end, and $f_{\rm b} \propto {M_{\rm h}}^{-0.6}$ (${M_{\rm b}}^{-1.5}$) at the high-mass end. For halos of masses $M_{\rm h} \approx 10^{11.0}\ M_{\odot}$ and $M_{\rm h} \approx 10^{13.2}\ M_{\odot}$, the baryon fraction for blue (red) galaxies decreases to values $f_{\rm b} \approx 0.004$ and 0.0085 ($f_{\rm b} \approx 0.0031$ and 0.0071), respectively. Therefore, for all masses, $f_{\rm b} \ll f_U$, where $f_U \equiv \Omega_b/\Omega_M$ is the universal baryon mass fraction; for the cosmology used here, $f_U = 0.167$.

4. DISCUSSION

4.1. *Comparison with other work*

As discussed in § 3.1 (see Figure 4), our inference of the local overall $M_{\rm s}$–$M_{\rm h}$ relation is in general in good agreement with several recent works that make use of the AMT (e.g., Baldry et al. 2008; Guo et al. 2010; Moster et al. 2010; BCW10). The aim in this paper is to estimate the $M_{\rm s}$–$M_{\rm h}$ and $M_{\rm b}$–$M_{\rm h}$ relations for blue (late-type) and red (early-type) central galaxies separately. We found that the differences between the means of the obtained relations for blue and red galaxies are within the 1σ uncertainty (see Figure 5). In more detail, the mean stellar and baryonic mass fractions ($f_{\rm s}$ and $f_{\rm b}$) as a function of $M_{\rm h}$ for red galaxies are narrower and more peaked than those for blue galaxies in such a way that for a given mass range (11.5–13.0 and 11.5–12.5 in $\log(M_{\rm h}/M_{\odot})$ for the stellar and baryonic cases, respectively) the former are higher than the latter, and outside these ranges the trend is inverted, especially at the low-mass side.

There are only a few previous attempts to infer the halo masses of central galaxies as a function of mass (luminosity) *and* galaxy type (Mandelbaum et al. 2006; More et al. 2011). These works use direct techniques (see Introduction), which are, however, limited by low signal-to-noise ratios, especially for less massive systems, so that the halo mass determinations are reliable only for galaxies with $M_{\rm s} \gtrsim 10^{10}\ M_{\odot}$. These techniques are galaxy-galaxy weak lensing and kinematics of satellite galaxies around central galaxies. In order to overcome the issue of low signal-to-noise ratios in the current measures, large samples of galaxies are stacked together in bins of similar properties (e.g., luminosity, $M_{\rm s}$, galaxy type) obtaining in this way higher (statistically averaged) signals of the corresponding measures (the tangential shear in the case of lensing and the weighted satellite velocity dispersion in the case of satellite kinematics). Besides, estimates of $M_{\rm h}$ with these sophisticated techniques are subject to several assumptions, among them, those related to the internal halo mass distribution. It is usual to assume the Navarro, Frenk, & White (1997) density profile with the mean concentration for a given mass as measured in N-body cosmological simulations.

It is not easy to achieve a fair comparison of the results obtained with the AM formalism and those with the direct methods. We have inferred the mean (and scatter) of log$M_{\rm s}$ as a function of $M_{\rm h}$, while the weak lensing and satellite kinematics techniques constrain $M_{\rm h}$ as a function of $M_{\rm s}$ (see e.g., More et al. 2011); besides, the former calculates the mean of $M_{\rm h}$ (and its scatter) in a linear scale instead of a logarithmic one. These different ways of defining the relationship between stellar and halo masses, depending on the shapes and scatters of the corresponding relations, diverge less or more among them. In BCW10 (see their Figure 10), it was shown that at low masses ($\log(M_{\rm h}/M_{\odot}) \lesssim 12$, $\log(M_{\rm s}/M_{\odot}) \lesssim 10.5$), averaging log$M_{\rm s}$ as a function of $M_{\rm h}$ or log$M_{\rm h}$ as a function of $M_{\rm s}$ give equivalent results for the AMT, but at high masses, where the $M_{\rm s}$–$M_{\rm h}$ relation becomes much