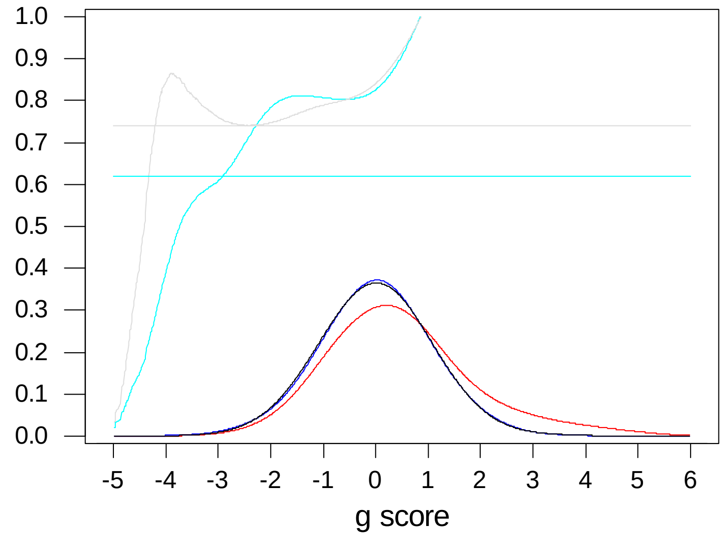
Since our neut_g is a standardized quantity (mean ~ 0, var 1), we want to determine the dof parameter r that would make a standardized t-distribution as close as possible to the empirical distribution of neut_g. Matching firstand second moments does not help, because of the standardization, so I adopted the very pragmatic approach of matching quartiles (note the empirical distribution of neut_g does not have a median of exactly 0, and its quartiles are not exactly symmetric about the median either, at leas on my random sample of 8000 windows – but it seems to me that the approximation to a distribution symmetric about 0 is quite good)

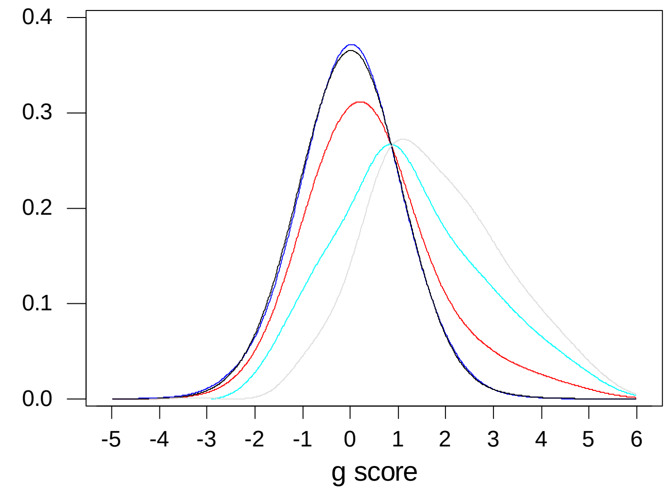
Quantiles of

	T5/sd(T5)	T6/sd(T6)	T7/sd(T7)	T8/sd(T8)	T15/sd(T15)	T(16)/sd(T16)	**neut_g**
0.25	-0.562889	-0.585884	-0.601024	-0.611749	-0.643469	-0.645560	**-0.6640**
0.50	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	**0.0030**
0.75	0.562889	0.585884	0.601024	0.611749	0.643469	0.645560	**0.6484**

Where, for a t-distribution with dof=r, one has sd(Tr)= sqrt(r/(r-2)). The quartile matching seems to indicate a dof estimate of ~16, instead of ~5. Thus, I will use as reference distribution a T16 rescaled by the factor 1/1.069=0.9354. You can repeat the analysis using a T5 rescaled by the factor 1/1.2909=0.7746. And of course I am sure there are more rigorous methods to produce the dof estimate (maybe you used one such methods, or maybe the difference in dof estimate depends on the fact that you used the entire neutral data instead of a sample from it). I decided to neglect translating the center all together (also here, you can repeat the analysis translating and rescaling the T).

As can be seen in the following plots, although the match of a standardized T16 to the empirical neutral distribution seems very good, modeling with the t-distribution induces enough “small scale” differences in the left tail as to make the ratio of overall to neutral density behave differently. As a consequence of this, and of subsequent different choices of p_o, the selection densities and the curves representing the probability of being under selection do look different.





Gray: f_sel(g) = (f_all(g) – 0.74 f_neut(g)) / (1-0.74)
Light blue: f_sel(g) = (f_all(g) – 0.62 f_t(g)) / (1-0.62)

Red: kernel smoothed empirical density of all g, f_all(g), from a random sample of 8000 windows

Black: kernel smoothed empirical density of neutral g, f_neut(g), from a random sample of 8000 neutral windows

Blue: approximate density of a standardized T16, f_t(g), obtained smoothing the empirical density of a random sample of size 8000 from such distribution

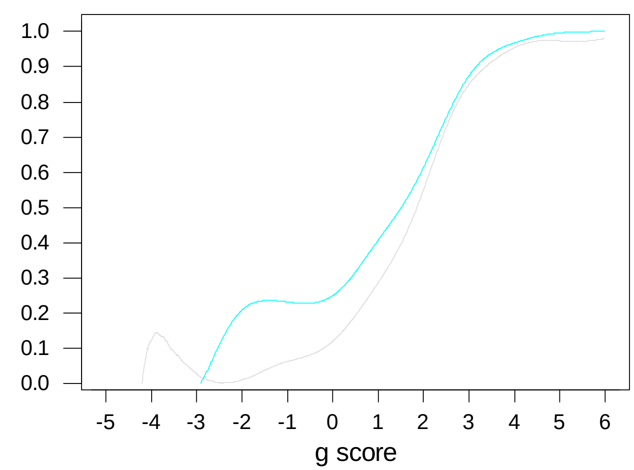
Width parameter for the smoothing=2 in all cases.

Gray: ratio f_all(g) / f_neut(g)

0.74 = min for the gray curve below 1, where f_neut(g)>0.001

Light blue: ratio f_all(g) / f_t(g)

0.62: first quartile for the light blue curve below 1, where f_t(g)>0.001



Gray: p(sel | g) = 1– 0.74 (f_neut(g)) / f_all(g))
Light blue: p(sel | g) = 1 – 0.62 (f_t(g)) / f_all(g))