curve to model is critical to finding the correct stability region. As noted in §2.2, the theoretical asymmetric drift (Eq. 3) is much larger than the difference between the gas and stellar rotation curves. We have conducted separate MCMC runs in which we fit both the gas rotation curve as a tracer of the circular velocity *and* the stellar velocity. This only yields models with $Q < 1$, because of the very low asymmetric drift implied by the nearly coincident rotation curves. Such models, when simulated, display sharp instabilities including disc fragmentation and cannot reproduce the observed properties of the galaxy. Our preference for fitting the stellar rotation curve and finding that gas cannot be assumed to trace to circular velocity is corroborated by Pizzella et al. (2008). They analyse rotation curves of LSB galaxies and find that stellar rotation curves are much more regular and amenable to modelling than gas curves, which suffer from numerous issues including noncircular and vertical motions that affect their speeds relative to the circular velocity.

The impact on the cusp value is notable because, if gas does not trace the gravitational potential, the circular velocity is steeper in the centre than the slope of the gas rotation. Assuming that the gas traces the gravitational potential will therefore lower the inferred cusp value. This is a possible source of error in early work assessing the observed cusp value in LSB galaxies, as small changes in central slope can lead to large changes in the cusp value or possibly imply a cored halo ($\gamma = 0$). We avoid this problem by using a model that follows the stellar kinematics with asymmetric drift incorporated self-consistently. Once the gas asymmetric drift is properly accounted for by including a full treatment of noncircular motions and turbulence, gas rotation curves should be as reliable as stellar rotation curves. Detailed measurements of the H I dispersion in spiral galaxies are becoming more common and will aid the modelling of gas kinematics. For example, Boomsma et al. (2008) obtain the high resolution H I velocity map for NGC 6946, finding dispersions of $\sim 6 - 13$ km s^{-1}, high velocity H I clumps that lag the disc rotation, and hundreds of "holes" in the H I distribution which are likely due to star formation. We surmise that modelling these phenomena and determining the impact on derived galaxy parameters is a nontrivial exercise. However, while easier to model than the gas asymmetric drift, the stellar asymmetric drift is also subject to several complications, a few of which we now address.

Eq. 3 is derived assuming an exponential disc, cylindrical alignment of the velocity ellipsoid and $R_d = R_\sigma$. With an inner truncated disc and $R_d \neq R_\sigma$, the asymmetric drift becomes

$$v_a = \frac{\sigma_R^2}{2v_c}\left[\frac{R}{R_d} + \frac{R}{R_\sigma} + \frac{1}{2}\left(\frac{R}{v_s}\frac{\partial v_s}{\partial R} + 1\right) - 1 - \alpha\left(\frac{R_h}{R}\right)^\alpha\right]. \tag{24}$$

If we now assume that the velocity ellipsoid is spherically aligned, we obtain

$$v_a = \frac{\sigma_R^2}{2v_c}\left[\frac{R}{R_d} + \frac{R}{R_\sigma} + \frac{1}{2}\left(\frac{R}{v_s}\frac{\partial v_s}{\partial R} + 1\right) - \alpha\left(\frac{R_h}{R}\right)^\alpha - 2 + \frac{\sigma_z^2}{\sigma_R^2}\right]. \tag{25}$$