In the literature there are chemical abundance determinations from recombination lines of Galactic H II regions only for $6 < r(\mathrm{kpc}) < 11$. At present, the evidence for the flattening of the Galactic gradients is not conclusive: Vílchez & Esteban (1996) based on H II regions found a flat O/H gradient for $r > 14$ kpc, while more recent work based on Cepheids did not confirm this result, see Mattsson (2010). Additional observations of high quality obtained with the same method are needed to establish the behavior of the gradients for $r > 11$ kpc. With an inside-out scenario without dynamical effects it is difficult to reproduce a possible flattening of the O/H gradient, see Mattsson (2010). Cescutti et al. (2007) in an inside-out scenario reproduce the flattening of radial gradients shown by Cepheids for $r > 7$ kpc assuming a constant surface density for the halo. In our models this is equivalent to adopting a constant $A(r)$, which means that the volumetric density of the halo increases towards the outer parts of the Galaxy, a density distribution that we consider unlikely. According to Roskar et al. (2008) and Sánchez-Blázquez et al. (2009), the flattening is a consequence of stellar migration and of a break in the star formation rate at large radii. A third possibility is that the formation of the Galaxy had a modest stellar formation episode previous to the inside-out scenario. Support for this idea comes from the increase of the average age of the stars at large galactocentric distances (Vlajić, Bland-Hawthorn, & Freeman 2011, and references therein).

In Figure 2 we show the evolution of C/O-O/H, C/Fe-Fe/H, O/Fe-Fe/H, and time-Fe/H relations, predicted by the HWY and LWY models for $r = 8$ kpc. The time vs Fe/H plot is a representation equivalent to the known age-Z relation of the solar vicinity.

For Figure 2 we have chosen observational constraints that represent the chemical history of the solar vicinity. We have taken dwarf stars of the Galactic halo by Akerman et al. (2004), as representative of the first Gyr of the evolution, and dwarf stars of the Galactic thick and thin disk by Bensby & Feltzing (2006), as representative of the last 12 Gyr of the evolution. Also in Figure 2 we show the mean ages and Fe/H values of disk stars with better determined ages presented by Nordström et al. (2004) in the lower part of their Figure 28. Moreover, we have assumed the protosolar abundances by Asplund et al. (2009) as representative of $t = 8.5$ Gyr.

We converted the chemical abundances determined by Bensby & Feltzing (2006) to abundance ratios by number assuming their own solar abundances, see their paper for references. Also, we normalized the stellar ages by Nordström et al. (2004) to the age of the model (13.0 Gyr).

Based on Figure 2, it can be noted that both models produce a reasonable fit to the C/O-O/H, C/Fe-Fe/H, and O/Fe-Fe/H trends in the solar vicinity. From the C/O-O/H and C/Fe-Fe/H relations it can be seen that the HWY model predicts more C than observed in metal rich disk stars, while the LWY model predicts less than the HWY. Alternatively, both models predict a C/Fe plateau for Fe/H higher than solar, while metal rich stars of the thin disk show a C/Fe decrease. This observed trend could be explained if massive stars of $Z > Z_{\odot}$ are less efficient in producing C than massive stars of solar metallicity. Stellar yields of MS and LIMS for $Z > Z_{\odot}$ are needed to obtain a complete picture of the evolution at high Z (Carigi 2008).

Cescutti et al. (2009) and Romano et al. (2010) focused on the C/O-O/H relation shown by thin disk stars of the solar vicinity and found that the C/O rise at high O/H values can be explained partially with metallicity-dependent stellar winds in massive stars (Maeder 1992; Meynet & Maeder 2002). This result is in agreement with our previous conclusions (Carigi 1994, 1996, 2000; Carigi et al. 2005, and Paper I), and with those by Prantzos et al. (1994).

The fit of our models to the time-Fe/H relation shown by disk stars of the solar vicinity is reasonable for $4 < t(\mathrm{Gyr}) < 13$, but our models cannot reproduce the mean behavior of older stars of the Galactic disk. Probably the reason is that some of these stars originated closer to the center of the Galaxy and migrated outwards, or belonged to satellite galaxies with different chemical histories that were captured by our galaxy. Most of the stars of the sample have ages lower than 9 Gyr, corresponding to $t > 4$ Gyr, and the internal dispersion in Fe/H of old disk stars is higher than that of young stars. Both models fit the Fe/H values of the halo stars with ages between 12 and 13 Gyr in the $t < 1$ Gyr range.

The main difference between the HWY and the LWY sets is due to the stellar yields assumed for massive stars at $Z = 0.02$. The HWY assume a relatively high mass-loss rate for massive stars with $Z = 0.02$ (yields by Maeder 1992), while the LWY assume a relatively low mass-loss rate for massive stars with the same Z (yields by Hirschi et al. 2005). Since the mass loss rate is proportional to the stellar metallicity, the efficiency of this rate increases with metallicity and becomes important at $Z \sim Z_{\odot}$. According to Hirschi et al. (2005) mass loss rates are a key ingredient for the yields of massive stars and the