Olivine-structured LiMPO$_4$ materials (M = Mn, Fe, Co, Ni, or mixtures) exhibit higher redox potentials than their layer oxide counterparts. This is due to the so-called inductive effect in the former, where the inner P–O bonds in the phosphate units make the M–O bond weaker than in the latter. A strategy to further increase the redox potentials in the olivines is to mix two metals. Along these lines, Kobayashi et al. have shown experimentally that Mn$^{2+}$–Mn$^{3+}$ and Fe$^{2+}$–Fe$^{3+}$ redox potentials approximately shift 0.1 V upon full substitution of Fe by Mn in Li$_x$Mn$_y$Fe$_{1-y}$PO$_4$. Here, through density functional theory calculations, we found that the average metal–oxygen bond lengths (M = Mn, Fe) increase with increasing Mn content, resulting in a decrease in the covalency of the transition-metal–oxygen interaction. The decrease in the covalency can be linked with good qualitative agreement to the experimentally observed M$^{2+}$–M$^{3+}$ voltage-plateau positive shift. Finally, the impact of the Mn-content-dependent voltage plateaus and unit-cell volume on the energy densities of the active compound is discussed.