Pseudo-spin of orbital-ordered hybridized $e_g$-states in manganites\footnote{Work supported by DOE} WEI KU, WEI-GUO YIN, D. VOLJA, Physics Department, Brookhaven National Laboratory, Upton, NY 11973 — The physics of orbital-ordered $e_g$-states in manganites can be conveniently described with quantum pseudo-spin. In order to properly account for the strong hybridization in real materials, energy-resolved Wannier functions are constructed from first-principles to rigorously define the pseudo-spin in LaMnO$_3$ and MnF$_3$. Our quantitative results show that the orientation of the pseudo-spin (mixing of the hybridized $e_g$-states) deviates significantly from what is expected with the lattice distortion, revealing the important role of electron-electron interaction (super-exchange) that competes with the conventional Jahn-Teller effect in determining the orientation. This conclusion can be experimentally verified (e.g.: soft X-ray or NMR), and enables further understanding directly accessible with future measurements.