The Strain Derivatives of $T_c$ in HgBa$_2$CuO$_{4+\delta}$: CuO$_2$ Plane Alone Is Not Enough SHIBING WANG, Stanford University, JIANBO ZHANG, South China University of Technology, XIAO-JIA CHEN, VIKTOR STRUZHKIN, Geophysical Laboratory, WOJCIECH TABIS, NEVEN BARISIC, MUN CHAN, CHELSEY DOROW, XUDONG ZHAO, MARTIN GREVEN, University of Minnesota, WENDY MAO, TED GEBALLE, Stanford University — The strain derivatives of $T_c$ along the $a$ and $c$ axes have been determined for HgBa$_2$CuO$_{4+\delta}$ (Hg1201), the simplest monolayer cuprate with the highest $T_c$ of all monolayer cuprates ($T_c = 97$ K at optimal doping). The underdoped compound with the initial $T_c$ of 65 K has been studied as a function of pressure up to 20 GPa by magnetic susceptibility and X-ray diffraction (XRD). The observed linear increase in $T_c$ with pressure is the same as previously been found for the optimally-doped compound. The above results have enabled the investigation of the origins of the significantly different $T_c$ values of optimally doped Hg1201 and the well-studied compound La$_{2-x}$Sr$_x$CuO$_4$ (LSCO), the latter value of $T_c = 40$ K being only about 40% of the former. Hg1201 can have almost identical CuO$_6$ octahedra as LSCO if specifically strained. When the apical and in-plane CuO$_2$ distances are the same for the two compounds, a large discrepancy in their $T_c$ remains. Differences in crystal structures and interactions involving the Hg-O charge reservoir layers of Hg1201 may be responsible for the different $T_c$ values exhibited by the two compounds.