S1 Text. Demographic normalization

Let us describe the normalization procedure used to account for demographic discrepancies between cities. The idea is to compare the observed value of a given parameter with its theoretical expected one (computed using the city demographic profile). Let \((p_c)_{c \in C}\) be the measured parameter where \(C\) denotes the entire set of customers, \(C_X\) the subset containing only customers from city X and \(C_{g,a}\) the customers of gender g and age a. The average quantity for a given gender g and age a and for a given city X are

\[
Q_{g,a} = \frac{\sum_{c \in C_{g,a}} p_c}{|C_{g,a}|}, \quad Q_X = \frac{\sum_{c \in C_X} p_c}{|C_X|}.
\]

The expected value of the parameter based on the demography of city X is

\[
E_X = \frac{\sum_{g,a} |C_X \cap C_{g,a}| Q_{g,a}}{|C_X|}.
\]

In the end, the normalized value used as a measure of city X economic behavior is \(\frac{Q_X}{E_X}\).