Results

Figure 1 plots the estimated number of food and social reinforcements (lines) and the observed number of times each operandum chosen (points) for each session in Condition 1, with the estimated (lines) and actual (points) number of the effective total number of food and social responses plotted in Figure 2. The ZBEn model provided a good fit to the food demand curve (), and food consumption decreased as a function of the price of food (), with an average essential value of 52.1 and an average Pmax of 13.44. Besides, when the food price increased while the social price remained constant, rats increased their social consumption. This pattern is reflected by a statistically significant positive linear cross-price elasticity (, p = .002) and a statistically negative exponential cross-price elasticity (, p < .001), indicating a substitution relationship between food and social reinforcements. Both linear () and exponential cross-price elasticity models () fitted the demand for fixed-price social reinforcement well.

Figure 3 plots the estimated number of food and social reinforcements and the observed number of times each operandum chosen (points) for each session in Condition 2, with the corresponding estimated (lines) and actual (points) number of the effective total number of food and social responses plotted in Figure 4. The ZBEn model fitted to the social demand curve well, with an of .969, and food consumption decreased as a function of the price of food (), with an average essential value of 2.41 and an average Pmax of 3.60. Besides, when the social price increased while the food price remained constant, food choices did not display consistent patterns across subjects, happening at similar rates across sessions. Neither linear nor the exponential cross-price elasticity models provided a good fit for individual subjects’ demand for fixed-price food reinforcement: only two subject’s linear and exponential models obtained higher than .50. However, both linear and the exponential cross-price elasticity models fitted the demand for fixed-price food reinforcement well for the mean of the four subjects, with of .915 and .965, respectively. When the social price increased while the food price remained constant, the linear model for the mean of subjects showed rats increased their food consumption (, p = .003), consistent with the finding in Condition 1 that food and social reinforcement have a substitution relationship. On the other hand, the exponential model showed rats maintained similar levels of food consumption (, as the social price increased while the food price remained constant.

Figure 5 plots the estimated number of food and social reinforcements (lines) and the observed number of times each operandum chosen (points) for each session in Condition 3, with the estimated (lines) and actual (points) number of the effective total number of food and social responses plotted in Figure 6. The ZBEn model fitted both the food and social demand curves well, with of 1.000 and .990, respectively. Both food and social consumption decreased as a function of the price of each commodity (), with average essential values of 113 and 4.40 and average Pmax of 37.94 and 5.42, respectively.

Figure 7 plots the estimated and observed number of food reinforcements for each session in Conditions 1 and 4. Examination of the own-price elasticities (α) in Fig. 2 indicated that the presence of social reinforcement increased the elasticity of food reinforcement (), with decreases in essential values from 127 to 64 and Pmax from 29.93 to 14.22. These results reﬂected a substitution relationship between consumptions of food and social reinforcements.