Appendix IV
First-order stochastic dominance

Beyond consistency, we ask whether choices can be reconciled with a utility function with some normatively appealing properties. In decision-making under uncertainty, it is natural to ask whether choices are also consistent with the *dominance principle* in the sense of Hadar and Russell (1969)– that is, the requirement that an allocation should be preferred to another, regardless of subjects' risk attitudes, if it yields unambiguously higher monetary payoff. The dominance principle is compelling and generally accepted in decision theory. To test whether choice behavior satisfies stochastic dominance, we combine the actual data from the experiment and the mirror-image data, compute the CCEI for this combined data set, and compare that number to the CCEI for the actual data. This measures the extent of GARP violations *and* violations of stochastic dominance (for a given subject).

A simple violation of dominance is illustrated in Figure 1 below. The budget line is defined by the straight line AE and the axes measure the value of a possible allocation in each of the two states. The point B, which lies on the 45 degree line, corresponds to an allocation with a certain outcome. The individual chooses allocation x (position along AB), but could have chosen any allocation x' (position along CD) such that $F_{x'} \leq F_x$ where $F_{x'}$ and F_x are the resulting payoff distributions. If this individual only cares about the distribution of monetary payoffs, then he will be willing to pay a positive price for a lottery yielding $F_{x'} - F_x$, which has only nonpositive payoffs (that is, for a lottery in which each account had an equal probability of being chosen).[1] Notice that any decision to allocate fewer points to the cheaper account (that is, corresponding to a position along AB) violates dominance but need not involve a violation of GARP, whereas any decision to allocate more points to the cheaper account (that is, corresponding to a position along BE) never violates dominance.

[Figure 1 here]

We use expected payoff calculations to assess how closely individual choice behavior complies with dominance. Suppose that we observe an individual choosing allocation x at prices p where $F_{x'} \leq F_x$ for some x' such that $p \cdot x' = 1$. The extent to which allocation x violates dominance can be measured by its expected return as a fraction of the *maximal* expected return that could be achieved by choosing an allocation x'. The construction of this violation index is also illustrated in Figure 1 above. The point D corresponds to the allocation x' with the highest expected return, yielding the largest upward probabilistic shift (referring to Figure 1, the outcome "α points" is shifted up to "γ points" and the outcome "β points" in unchanged). This suggests the following approach. For each observation (p^i, x^i), if no feasible allocation dominates the chosen allocation, then it has the highest value possible of one. Otherwise, it has a value less than one; specifically $(\alpha+\beta)/(\gamma+\beta)$, as illustrated in Figure 3. Since a single number is desired for each subject, we average this violation index across all decision problems. Table 1 below reports summary statistics and percentile values. We report the statistics for all subjects, as well as the statistics by socioeconomic categories.

[Table 1 here]

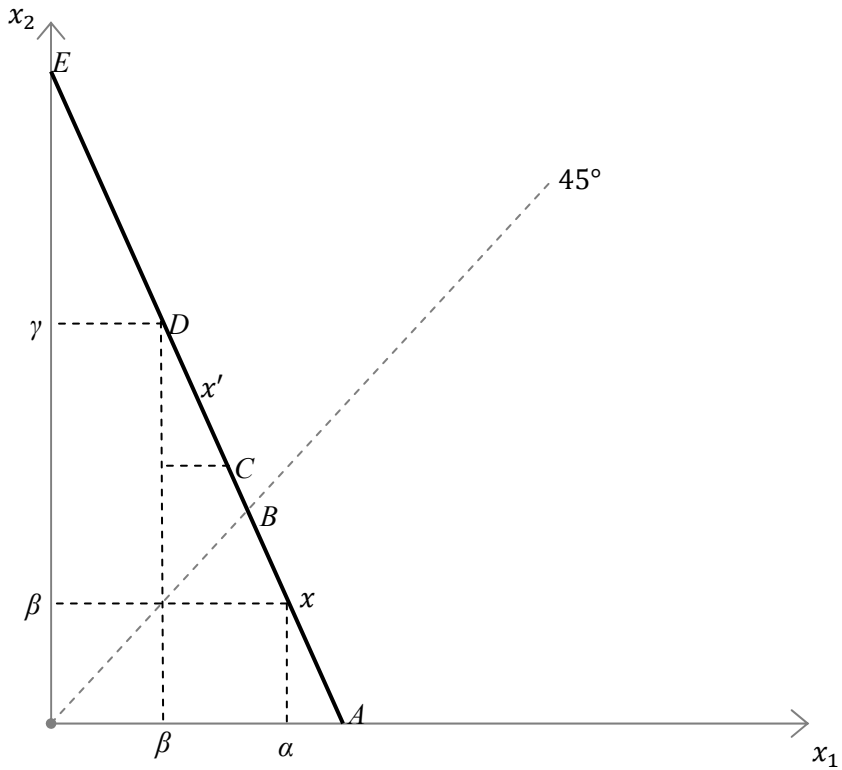
Over all subjects, the stochastic dominance scores averaged 0.959. Out of the 1,182 subjects, 1,057 subjects, (89.4 percent) have first-order stochastic dominance scores above 0.90, and of those,

[1] More precisely, we can identify an allocation with the resulting probability distribution over payoffs if preferences satisfy the *reduction principle*; that is, $(x_1, x_2) \sim (x_2, x_1)$ because they generate the same payoff distribution.

839 subjects (70.1 percent) have scores above 0.95. The mean first-order stochastic dominance score for a random sample of 25,000 simulated subjects is 0.920, but only 73.5 percent and 18.6 percent of the random simulated subjects' first-order stochastic dominance scores were above the 0.90 and 0.95 thresholds, respectively (each of the simulated subjects makes 25 choices from randomly generated budget lines in the same way as the human subjects do).

Overall, the choices made by subjects in our experiment also show low rates of stochastic dominance violations, which decrease with education level and increase with age. There is also some heterogeneity in the stochastic dominance scores within and across categories. We also note that there is considerable heterogeneity in the CCEI and stochastic dominance, and that their values are positively correlated ($\rho = 0.446$). We obtain very similar econometric results when we replace the CCEI score for the combined data set with this stochastic dominance measure in our regression analysis. In particular, if we replace the combined CCEI score with this first-order stochastic dominance measure in specification (1) of Table 6, the estimated coefficient on the CCEI is 1.335 with a standard error of 0.624 (p-value = 0.032). The estimated coefficient on the stochastic dominance measure is 0.111 with a standard error of 1.601 (p-value = 0.945).

Figure 1. A violation of first-order stochastic dominance



The individual can choose any allocation x' (position along CD) but prefers allocation x (position along AB) such that $F_{x'} \leq F_x$ where $F_{x'}$ and F_x are the resulting payoff distributions.

Table 1. First-order stochastic dominance scores

			Percentiles					
	Mean	Std. Dev.	10	25	50	75	90	# of obs.
All	0.959	0.951	0.998	0.992	0.977	0.944	0.897	1182
Female	0.961	0.957	0.998	0.991	0.977	0.945	0.905	537
Age								
16-34	0.966	0.951	1.000	0.997	0.986	0.953	0.904	219
35-49	0.969	0.958	0.999	0.995	0.985	0.963	0.910	309
50-64	0.953	0.949	0.996	0.988	0.967	0.937	0.896	421
65+	0.949	0.948	0.995	0.988	0.965	0.926	0.874	233
Education								
Low	0.953	0.951	0.996	0.989	0.969	0.936	0.886	397
Medium	0.961	0.956	0.998	0.991	0.977	0.948	0.906	351
High	0.963	0.947	1.000	0.995	0.984	0.948	0.901	430
Household monthly incoı								
€0-2499	0.955	0.953	0.996	0.988	0.972	0.937	0.888	269
€2500-3499	0.960	0.953	0.997	0.991	0.977	0.948	0.909	302
€3500-4999	0.958	0.948	0.999	0.993	0.978	0.941	0.892	345
€5000+	0.962	0.948	0.999	0.994	0.982	0.953	0.897	266
Occupation								
Paid work	0.964	0.954	0.999	0.993	0.982	0.949	0.907	628
House work	0.957	0.952	0.999	0.991	0.976	0.941	0.888	137
Retired	0.948	0.948	0.995	0.986	0.963	0.928	0.876	247
Others	0.957	0.944	0.999	0.992	0.978	0.946	0.887	170
Household composition								
Partnered	0.958	0.951	0.998	0.992	0.977	0.942	0.896	956
Children	0.962	0.951	0.999	0.993	0.982	0.952	0.901	490