Social Choice Models for Consumer Spending

We have already published a paper on employee shift choice using a social choice model in which employee shift/pay preferences are amalgamated to come up with a distribution that maximizes employee utility or satisfaction. This paper concerns the problem of distribution of consumer items according to consumer preferences for products or commodity bundles and price. The problem is to maximize total or social consumer utility over all individual consumer utilities. An overall model was proposed by Kenneth Arrow in which each producer/consumer ordered all social states where a social state was defined in terms of the amount of labor supplied and the amount of each type of commodity received as well as various types of collective activity. Just considering the labor given and commodity bundles received in order to simplify the process, it is possible to imagine a process by which each individual inputs his or her preferences over all possible labor/consumption packages. However, in order to simplify and make the whole production/consumption process more realistic, we delink the production and consumption processes. We assume that worker/producer preferences over various work/pay choices are amalgamated and distributed in some optimal manner as was considered in my paper, "Algorithm for Cooperative Employee Shift Choice." In this paper we consider the problem of consumption. The two spheres of production and consumption are linked together by money as the intermediary between them. Employees or workers are paid in money, and consumers buy products with money. Delinking is necessary in order that a social choice economic model be realistic and viable.

First let us consider a very simple model in which there are a number of consumers indicated by N. There are a number of commodity bundles indicated by B, and B = N. Each consumer indicates his or her ratings by a real number between 0 and 1 for each commodity bundle with 1 being most preferred and 0 being least preferred. The social choice algorithm then considers all distributions of commodity bundles to consumers and picks that distribution which maximizes the total of the preference ratings or utility over all consumers. For example, let's assume there are 3 consumers: i, j and k and 3 commodity bundles A, B and C. Here are the preference ratings:

i: .7 for A, .5 for B and .2 for C
j: .5 for A, .9 for B and .4 for C
k: .3 for A, .5 for B and .9 for C

Here are the possible distributions and the total utility for each distribution.

i gets A, j gets B, k gets C. Social Utility = SU = .7 + .9 + .9 = 2.5
i gets A, j gets C, k gets B. SU = .7 + .4 + .5 = 1.6
i gets B, j gets A, k gets C. SU = .5 + .5 + .9 = 1.9
i gets B, j gets C, k gets A. SU = .5 + .4 + .3 = 1.2
i gets C, j gets A, k gets B. SU = .2 + .5 + .5 = 1.2
i gets C, j gets B, k gets A. SU = .2 + .9 + .3 = 1.4

It can be seen that the best distribution is (i,A), (j,B), (k,C), where (i,A) indicates that consumer i gets commodity bundle A.

Now we consider consumer strategy in rating the various commodity bundles. Could it be that by misrepresenting his or her preferences a consumer could gain an advantage in getting his or her more preferred bundles? Previous work has shown that in the political problem of voting for one of several candidates, the best solution is range/approval hybrid voting in which the candidates are initially rated according to their utility by each voter. They are each given a rating from 0 to 1.Then the voting system calculates a threshold for each voter and converts each candidate rating above the threshold to a vote of "1" and each rating below the threshold to a vote of "0". This maximizes the effectiveness of each vote while not giving any particular voter an advantage. The candidate with the most votes wins and there is one and only one winner who presides over all voters. This way of picking the winner may not maximize social utility if every voter voted sincerely, and the winner was picked as the candidate that maximized social utility, but it insures that no voter can gain a strategic advantage.

Now consider the problem at hand with consumers picking commodity bundles. The problems are similar but not identical. In the political case there are several candidates which is analogous to the several commodity bundles. However, in the political case, there is one winner who applies to all voters. In the economic case there are several commodity bundles and those bundles may apply to different consumers. The analogous political problem would be if there were several candidates and the outcome of the election was such that each voter had a different candidate governing him/her which is the same as saying that the result of the election would automatically divide the voters into several different constituencies. So how would strategic considerations differ in the two cases? Obviously, each consumer would want to rate his/her most preferred commodity bundles with the highest possible rating and his/her least preferred with the lowest possible rating. But would a threshold with all ratings above the mean being converted to the highest rating and all ratings below the mean converted to the lowest possible rating be appropriate? I don't think so. The price to be paid in terms of lowered social utility would be too great. Since as B = N became large, there would be a large number of second, third and lower order preferences which would be indistinguishable from the most preferred preference for some choices while for others there would be a number of choices of higher order than least preferred all thrown together with the least preferred choice which would also be indistinguishable so that the assignments of commodity bundles to consumers would be almost on a random basis. An assignment of a commodity bundle to a consumer might result in a much lower degree of utility than otherwise possible if the ratings were indeed sincere ratings. In an extreme example in which certain commodity bundles had multiple "1" ratings and others had all "0" ratings, only one consumer could be assigned a commodity bundle which had several "1" ratings, and the remaining consumers would have to be assigned other commodity bundles on a ransom basis.

From an individual perspective a strategic consumer might well improve his/her average utility over a great many iterations by rating all commodity bundles above his mean as "1" and all below his mean as "0". However, he/she will tend to be assigned that commodity bundle which is least popular or the one that the fewest other consumers have rated a "1". That would offset his/her strategic rating and make it more likely that he/she would vote sincerely.

Now let's consider the next more complex model in which there are N consumers and B bundles, B > N. Some of these available bundles may be identical so it would be possible for many consumers to wind up with the same bundle. Also, of course, unlike in the previous example, some bundles could go unclaimed. The aggregate consumer ratings would indicate demand for consumer bundles and would tell the production process which consumer bundles to actually produce and which relatively speaking, to be left unproduced. Again bundles would be assigned in such a way as to maximize social utility. However, with this model, it must be assumed that not everyone could have his/her first choice. That would be trivial. Again strategic considerations would be undercut because an individual consumer could expect to get closer to his/her first choice by rating bundles sincerely than by giving every bundle with a sincere rating greater than his mean a "1". In fact the threshold could be raised as the number of bindles increased which would result in the consumer getting awarded a bundle closer to his/her first choice than if the threshold were held to the mean.

Now consider a model in which each commodity bundle could be custom designed by each consumer and consist of identifiable components. Again due to supply restrictions it might not be possible for every consumer to have his/her first choice bundle, but, if time is not of the essence, certain components might be able to be ordered with later delivery. In such a complex situation it is hard to see how any rational consumer would be able to figure out how to rate different bundles strategically so that there would be an inherent incentive to rate sincerely.

Finally, let's consider a more real world model in which not only are there commodity bundles to be rated but there is a pricing component. So each consumer would rate the commodity bundle as a function of its self-designed components and a self-assigned price. He/she might rate commodity bundle A at a price of x dollars as a .9 for example. He/she might then rate the same bundle with a price of y dollars as a .7 where y > x. The system would then have to figure out how to assign not only commodity bundles but prices according to available supply and in such a way as to maximize total utility. Supply would increase or decrease according to demand and according to willingness of labor and capital to produce given consumer willingness to pay. If aggregate consumer demand for a product at a certain price point was deemed profitable enough to fulfill that demand by labor and capital, consumer demand would be fulfilled. Else consumer demand would go unfulfilled.

A companion paper, "POLITONOMICS: A Meta-Theory Encompassing Political and Economic Decision Making", elaborates on the procedure for raising the threshold as the number of possible realized alternatives increases. An optimal procedure is developed for precisely placing the threshold given an individual's utility ratings over the alternatives. This represents a meta-theory which applies to both political and economic decision making. The theory shows that, as the number of possible realized alternatives increases, the individual voter's satisfaction or utility with respect to the result of the decision making process will increase.