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**Title of the Project:**Exploring voting and preferences with behavioral agents

**Project Category : 3**

**Targeted deliverables : Term paper**

## **Final Report**

### **# Abstract :**

- This report basically aims to explain the behavior of the choice makers which is boundedly rational and various related concepts.
- It also discusses in brief about various concepts of individual choice making notably fallback bargaining solution and Political Economy like the Median Voter theorem along with some worked out examples.

### **# Pre-requisites :**

- Basics about a fallback bargaining solution and some of its well known properties like regularity. Elementary level knowledge about few mathematical concepts namely contour sets, set theory, completeness and transitivity of a set.

- Basic knowledge about various Terminology related to Political economy and the Median Voter theorem.

## **# Introduction :**

- We often face difficulty in choosing one option since there is no single criterion for evaluating these options and thus as individuals, we find it difficult to resolve how different trade-offs spin in and out of different alternatives.
- For example, we want to buy a new house and there are 2 apartments A,B that satisfy our requirements. Apartment A is closer to Office than apartment B and in turn, apartment-B is closer to School than apartment-A. Since both houses have their own superiority in their respective dimension, it is difficult for a person to choose between the two because there is no single criteria for evaluating which house is better.
- From a given set of options, the choice maker first makes a preference list using 2 criteria/dimension and then compares the top most element from both lists. If a unique element is found, it is selected as our bargaining solution. Else, we consider the top two elements of each set and take the intersection of it. Still if we don't find any unique element, we go for the best three elements and take their intersection and so on.
- Using this method, there is always a chance that we don't find any unique element even after considering all possible iterations of both the sets and thus to get a unique answer we set priorities among the given dimension which violates the property of regularity of a fallback bargaining solution.

- We also look at the Notion of Nash Equilibrium which is very critical for decision making in several business fronts. We also throw some insights on the Median Voter theorem and its implications on political decision making.

### # **Various anomalies faced (attraction-compromise effects) :**

- The attraction effect refers to the ability of an asymmetrically dominated or relatively inferior alternative, when added to a set, to increase the choice probability of the dominating alternative.
- The compromise effect refers to the ability of an “extreme” (but not inferior) alternative, when added to a set, to increase the choice probability of an “intermediate” alternative.
- The Compromise effect is of special interest in business and marketing strategy because what compromise effect states is that an option that is a “middle solution” or a “compromising solution” between the 2 extremes is the most chosen by consumers.
- Consider a company X selling a product Y with 2 variations say A and B. A-type is having low price and low performance features and type-B which is a target product for the company is made with superior quality and is priced high. Now since type-B is target product for the company, it wants to increase the sales of type-B so a good strategy for this is to launch another type-C product with some more added features to type-B with price higher than this.
- The effect that this product will have is that it will cause a product-B to suffer from compromise effect and thus making it

the best possible bargaining product/best compromising solution for consumers in turn sales for this company's target product will increase. Thus, Brands/Products tend to gain market share when they become a "compromise alternative" among peers.

### **# In this section we demonstrate the concepts of Nash equilibrium and Median Voter Theorem through examples :**

- **Nash Equilibrium** : The Nash equilibrium is a concept of game theory where the optimal outcome of a game is one where no player has an incentive to deviate from their chosen strategy after considering an opponent's choice.
- **Median Voter Theorem** : Whenever the distribution of voters has a unique median in all directions, and voters rank candidates in order of proximity, the election will be won by the candidate who is closest to the median voter.

### **# Examples to demonstrate above concepts :**

**Example-1** :- Consider election time in a certain region and there are 2 political parties contesting in the election. As a part of their election agenda, they need to propose their preferred tax rates for people they would implement after winning elections. Also for simplification of calculation let us track 5 voters. Also let us assume that their effective attention span is 15% on both extremes of their preferred tax rate.

Let the political parties be P1 and P2. Let the voters be V1,V2,V3,V4,V5.

Here we basically try to find what should be the optimal tax rate that should be proposed by parties to attract maximum number of voters.

- **Case-1** : Let the proposed tax rate by P1 : 30% and P2 : 60%

Let the preferred tax rates by voters be :

V1 : 15% V2 : 30% V3 : 45% V4 : 60% V5 : 75%

Now since the attention span for voters is 15% we conclude with the results :

- Voters V1,V2,V3 voted for party P1 and voters V3,V4,V5 will vote for party P2.

- **Conclusion for case-1** : As evident from results, we can see that this is a situation of Nash equilibrium as for both the parties this is the best they could perform. Also as discussed in the median voter theorem, we observe that the median voter V3 is having a preference with both the parties.

- **Case-2** : Preferred tax rates by P1 : 45% and P2 : 45%

Let the preferred tax rates by voters be :

V1 : 15% V2 : 30% V3 : 45% V4 : 60% V5 : 75%

- Voters V4,V2,V3 voted for party P1 and voters V3,V4,V2 will vote for party P2.

- **Conclusion for case-2** : From the results, we can see that this is a situation of Nash equilibrium as for both the parties this is the best they could perform. Also the median voter V3 is again preferred by both parties.

**Example-2** : Again consider election times and parties have to propose their preferred reservation rates in government jobs for backward and related classes. Consider 5 different voters C1,C2,C3,C4,C5. Also consider the interest span of 5% on both extremes for all castes.

Let the preferred reservation rates by individuals be as follows:  
C1: 10%, C2: 20% , C3: 20%, C4: 37%, C5: 40%

Thus the net attention span of each voters for individual parties is as follows :

C1 : [5%,15%]

C2 : [15%,25%]

C3 : [15%,25%]

C4 : [32%,42%]

C5 : [35%,45%]

- Now since both parties want to attract maximum voters from all castes, we can see from the attention span intervals above that the most optimal choice where Nash equilibrium can be achieved is when both parties proposing % rates around 25%.

### **# Limitation of the Median Voter Theorem :**

- As stated above, median voter theorem says that the median of the distribution gets the maximum priority to be selected in all cases. This property gets violated sometimes (when we look for scoring on absolute terms and not in probabilistic terms) in case of non uniform distribution when we consider attention span of the voters under observation. In case of no attention span this always holds true.

- **Example** : Consider 5 voters V1,V2,V3,V4,V5 under observation with their attention span of 5% and favored policy % as 10%,15%, 50%, 85%,90%.
- In such a case, if the parties prefer to choose the approximate median range as their preferred policy rates(50%), then they would suffer and in turn the model won't Nash equilibrium since data is not distributed uniformly and has voters with fixed attention. Instead parties can choose to prefer policy rates in one of the extremes, say 12% or 87% for optimal results.

### **# Different Models to predict parties forming coalitions :**

- **Example** : Consider 3 political parties P1,P2,P3 contesting for regional elections and need a vote count of 60% to secure a majority. Let's say they propose income tax rates should be as 25%,30% and 55% respectively.

Let's say the election results are announced and following is the vote distribution among the three :

P1 : 40%

P2 : 25%

P3 : 30%

- As evident from the results, no party holds a clear majority. The cost of the re-election campaign is high. Instead we can observe from data that party P1 and P2 have nearly the same thoughts about tax rates laid on people(25% and 30%). Also if they form a coalition, they get above the majority mark.

- Thus, there will be high possibilities of both the parties forming a coalition and forming a combined government.
- Note that forming a coalition by different parties is only possible when they have similar ideologies about various key factors like income tax rates or % reservation in jobs which is the case here.

## **# References :**

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**# Declaration :** I declare that no part of this report is copied from other sources. All the references are properly cited in this report.



Rubi Sonal

**Signature of student:**

**Signature of Instructor:**

**Supervisor's Recommendation for the Evaluation**

\*Please tick any one of the following :

- ✓ 1. The work done is satisfactory, and sufficient time has been spent by the student. The submission by the student should be evaluated in this term.
- 2. The work is not complete. Continuity Grade should be given to the student. The student would need to be evaluated in the next semester for the same Design Project with me.
- 3. The work is not satisfactory. There is no need for evaluation. The students should look for another Design Credit Project for the next semester.
- 4. [Other Comment, if 1-3 are not valid] \_\_\_\_\_

Rubi Sonal

**Signature of the Supervisor**