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## Understanding dynamic behavior of swing voters during election campaign period using Agent-Based Simulation

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### Abstract

Election is the ultimate event in which people express themselves to get the most appropriate leader based on majority interest. Among the campaign period, the interactions between swing voters make the election's result unpredictable. This paper aims to measure the dynamic behavior among swing voters which is affected by the influence from people around the individual, the electability level of a candidate, and the loyalty threshold of a candidate's voters. The purpose of this paper is to provide a simulation that accommodates all changes in continuous time, so the election result can be predicted dynamically. The influence factors and several additional settings will be analyzed carefully to provide a comprehensive simulation. Furthermore, the proposed setting will be used to test two hypotheses which are commonly known among election analysts. Moreover, the result will give a dynamic simulation which brings a new approach to understand the impact of applied campaign strategy. In other hand, this study also throws brighter understanding to the dynamic behavior of voters and gives feedback for campaign teams to develop a better strategy for increasing their candidates' competitiveness.

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## 1. Introduction

General election (election) is a common way for selecting the leader in a democracy-based community. The result of an election is described as the picture of the aspirations of voting-right holders which is collectively gathered to get the winner based on majority rule. The voters consist of individuals, every member of a community which conducts the election. The type of voter is divided into two types, namely non-partisan and partisan. Partisan is voters who are already strongly committed their choice on one candidate, they are usually incorporated in the campaign team. While the non-partisan consist of floating masses/swing voters -both sympathetic and abstain voters- but can suddenly change their choice when they meet certain conditions (Firmansyah, 2007). Indobarometer noted that greater number of swing voters is caused by the increasing level of voters' critical attitude to candidates (Media Indonesia, 2008). For example, since May 2007 until June 2008 the number of floating masses increases from 18% to 30%. With the large number of floating masses, campaign teams should capture swing voters to win election.

Election which is conducted to choose two or more candidates is a very dynamic conditions. The dynamics are more difficult to be predicted when there are interactions among the swing voters. Due to many limitations, those interactions are difficult to be controlled by candidates because each voter has a unique trend. However, it is more predictable in more modest group level, so campaign analysts generally prefer the two-candidates election (Adams, *et al.*, 2009). Furthermore, swing voters who have trend to choose one side tend to move or remain in their present choice. Dynamic choice of each individual can be influenced by variety of reasons. Literatures (Kiefer, 2003; Taylor, 2007; Tomz & Van Houweling, 2009; Hansford & Gomez, 2010) stated that the high level of electability is not necessarily determine the victory of a candidate unless it is supported by strong voters loyalty. Then, these two things can not ensure the victory if candidates fail to attract as many voters. In short, the main key to win the election is how a candidate and their campaign team can attract as many voters and retain the loyalty of obtained voters.

During campaign period, campaign teams usually take surveys to predict the amount of voters who choose each candidate. However, it has not been able to measure the choice dynamic of each individual due to random interactions. Swing voters who tend to choose on candidate can change their choice because of dynamics environment. Electability level of each candidate and loyalty threshold of the voters play the most important role. Thus, this study aims to answer the following research questions:

**RQ1** How does the candidate's electability during campaign period can ensure the election victory?

**RQ2** How does the voters loyalty of each candidate during campaign period can ensure the victory?

Then, in order to show a more tangible level, the simulation will also test two hypotheses:

**H0<sub>1</sub>** Candidate with high electability level must win

**H0<sub>2</sub>** Candidate with high loyalty level (low threshold) of swing voters tends to win the election

## 2. Research Methodology

This study focuses on measuring the dynamic behavior of choice of swing voters among campaign period in an election with two candidates. As explained before, there are three types of agents: A's voters, B's voters, and Abstain. These agents have several attributes, they are "Agent numbers," "To' threshold, and "From' threshold." Number of votes obtained by each candidate is calculated only from the number of valid votes, so:

$$\text{Abstain} \rightarrow \text{abs-nums} = \dots\% \quad (1)$$

$$\text{A's voters} \rightarrow \text{a-nums} = (\dots\% \times (100 - \text{abs-numbers})) \quad (2)$$

$$\text{B's voters} \rightarrow \text{b-nums} = ((100 - \text{a-numbers}) \times (100 - \text{abs-numbers}))\% \quad (3)$$

"To" describes the electability level of each candidate or the probability of swing voters to be abstain. In order to do a decision changing, an agent must have enough influences from the destination group to

move from its group. In voting cases, an election winner is decided by using highest number of voters among people who decide to join the election, so the “abstain” threshold will be separated from candidates’ electability level. Furthermore, each candidate’s electability level is derived from that group, and have a reverse linear correlation.

$$Abstain \rightarrow to-abs-th = \dots\% \tag{4}$$

$$A \text{ candidate} \rightarrow to-a-th = \dots\% \tag{5}$$

$$B \text{ candidate} \rightarrow to-b-th = (100 - to-a-th)\% \tag{6}$$

“From” describes the loyalty threshold of each type of swing voters to retain in their choice. This is the level in which an agent will ensure its choice because enough influences from its neighbors. In fact, loyalty threshold is developed by each group separately. While abstain group tend to retain its choice by influences among its members, loyalty threshold of a candidate’s voters is maintained by each candidate’s campaign team.

$$Abstain \rightarrow fr-abs-th = \dots\% \tag{7}$$

$$A \text{ 's voters} \rightarrow fr-a-th = \dots\% \tag{8}$$

$$B \text{ 's voters} \rightarrow fr-b-th = \dots\% \tag{9}$$

In the prediction of election results, survey institutions such as LSI determined that the minimum number of respondents was 400 persons (LSI, 2006), while empirical calculations show that the increase in the number of respondents is proportional with the decrease of error margin (Deteksi.info, 2009). Thus, some campaign consultants such as SSI determine the adequacy of the number of respondents is exist at around 1250 respondents (SSI, 2009), which will result in Margin of Sampling Error (MOSE) +/- 3%. This study also uses that standard as the basic assumption, by determining the number of samples in the programming of 35x36 cells which is equivalent to 1260 respondents. In addition, when the interactions happen in the campaign period, there is no limitation to the thresholds for each agent anywhere and against anyone he interacts, so the environment will produce a donut-like small wrap world (Fig. 1a).

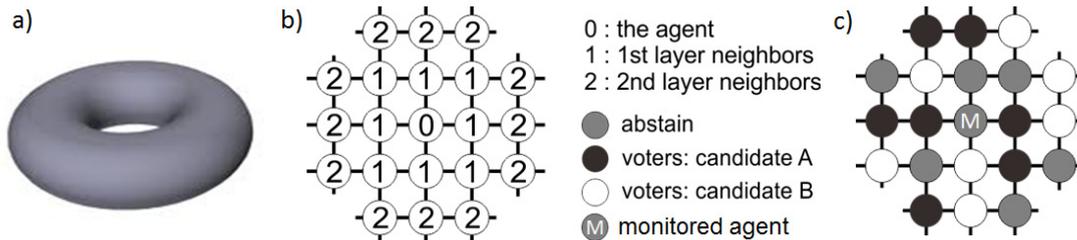


Fig. 1. (a) Donut-like; (b) Two layers of influences; (c) Neighbors

In the campaign period, influences which occur among swing voters exist in two layers (Fig. 1b). The first tier is the direct effect of the interaction of each individual to swing voters around, when neighbors around a monitored agent ask the agent to make choices based on internal considerations stemming of the neighbors. The second tier is the indirect effect which is given from the neighbors, such as invitation to make decision with consideration given or derived from samples of individuals who are not directly related to the monitored agent.

In an interaction, there will be a hesitancy of the monitored agent (a swing voter). Initially, the agency will determine whether he/she will follow the election or not. The decision is influenced by the number of neighbors (Fig. 1c) around who choose to abstain (abs-num) and the threshold of the abstention option. If the initial condition is abstain, the agent will follow *to-abs-th* rule, but if the initial condition is not join the election, teh agent will follow *fr-abs-th* rule. Furthermore, if the agent decide to follow the election, then the agent will continue to interact with neighbors to make choice, whether the neighbors are more likely to candidate A (*a-num*) or B (*b-num*). Each candidate has its electability (*to-a-th* and *to-b-th*)

compared to rival, and each type of swing voters have their loyalty (*fr-a-th* and *fr-b-th*) which are maintained by the campaign team of each candidate.

### 3. Results and Findings

In order to test the influence of electability level in a changing campaign environment, several simulations should be done by changing the electability level of two candidates. Because the electability level is intercorrelated between two candidates, the simulation will be focused only in one side/candidate. The electability level of candidate A will be set in 0.1, 0.2, 0.3, and 0.4, it means that candidate B's electability level is in the inverse level ( $1 - \text{Electability}_A$ ). For example, electability level 0.1 means that an agent only need 10% of neighbor agents who choose A to decide that he/she will probably choose candidate A. The number of abstain will be set in same level with A and B, 33.3%. To prevent cross-influence from loyalty threshold of each group, the voters' loyalty will be fixed in same level. The simulation will be ran in very fast speed and stopped if the percentage of all groups reach constant levels.

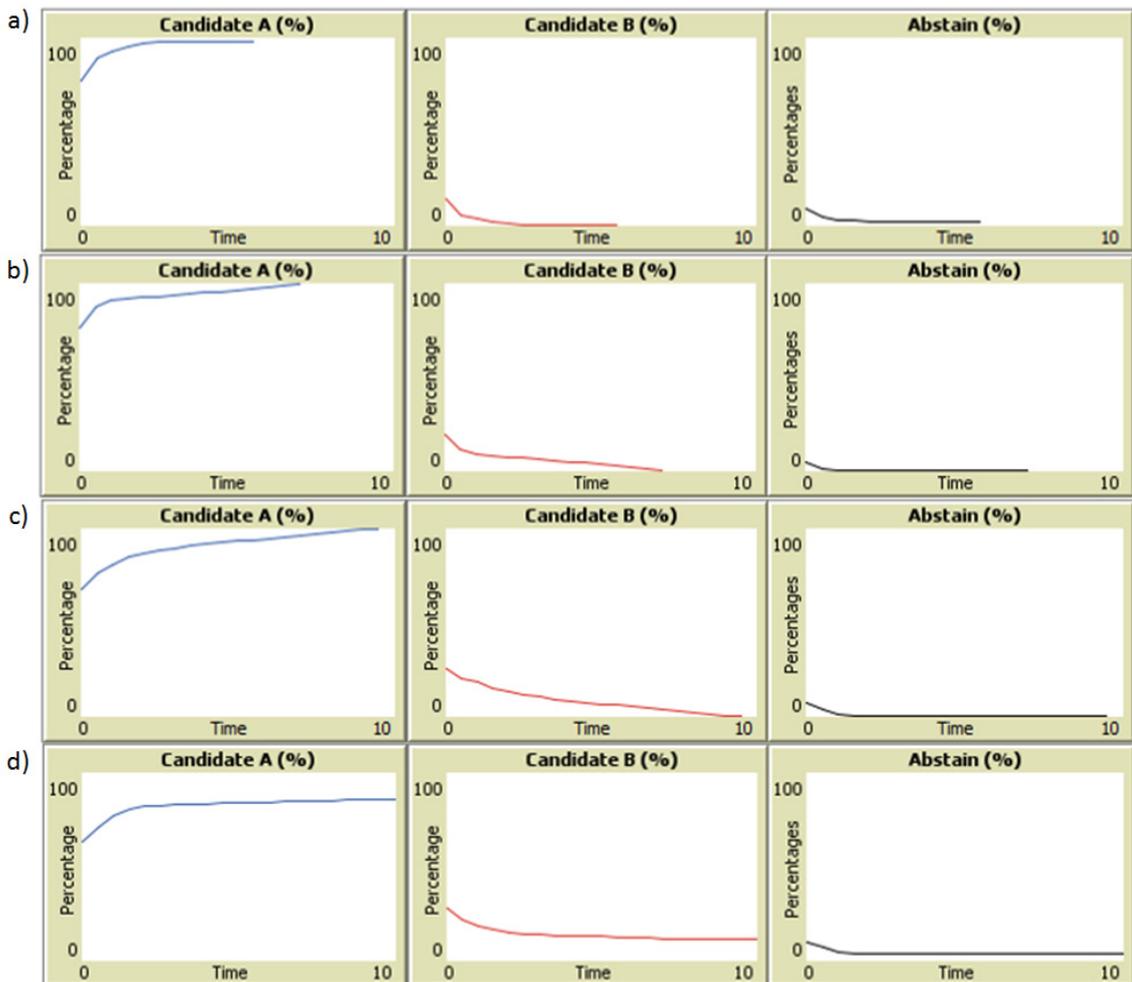


Fig. 2. (a)  $t\text{-}a\text{-}th/t\text{-}b\text{-}th = 0.1/0.9$  ; (b)  $t\text{-}a\text{-}th/t\text{-}b\text{-}th = 0.2/0.8$  ; (c)  $t\text{-}a\text{-}th/t\text{-}b\text{-}th = 0.3/0.7$  ; (d)  $t\text{-}a\text{-}th/t\text{-}b\text{-}th = 0.4/0.6$

In this test, simulations should be done by changing the loyalty threshold of each candidate. Because the loyalty threshold of each candidate's voters, the level will be set separately. However, this test will be conducted with intercorrelated loyalty threshold in simulation setting –not in simulation algorithm– to get good result comparison with electability level test. So, the simulation will run in several settings of loyalty threshold of candidate A's voters/loyalty threshold of candidate B's voters: 0.1/0.9, 0.2/0.8, 0.3/0.7, 0.4/0.6. For example, loyalty thresholds 0.1/0.9 mean that swing voters of candidate A need 10% influence from its two-layer neighbors with same choice with him/her to decide that he/she will remain in their choice (choose candidate A), and swing voters of candidate B need 90% two-layer neighbors with B choice to decide that he/she will remain to choose candidate B. The number of abstain will be set in same level with A and B, 33.3%. The candidates' electability and to-be-abstain threshold will be fixed in same level in order to prevent cross-influence from electability level from all groups. The simulation will be ran in very fast speed and stopped if the percentage of all groups reach constant levels.

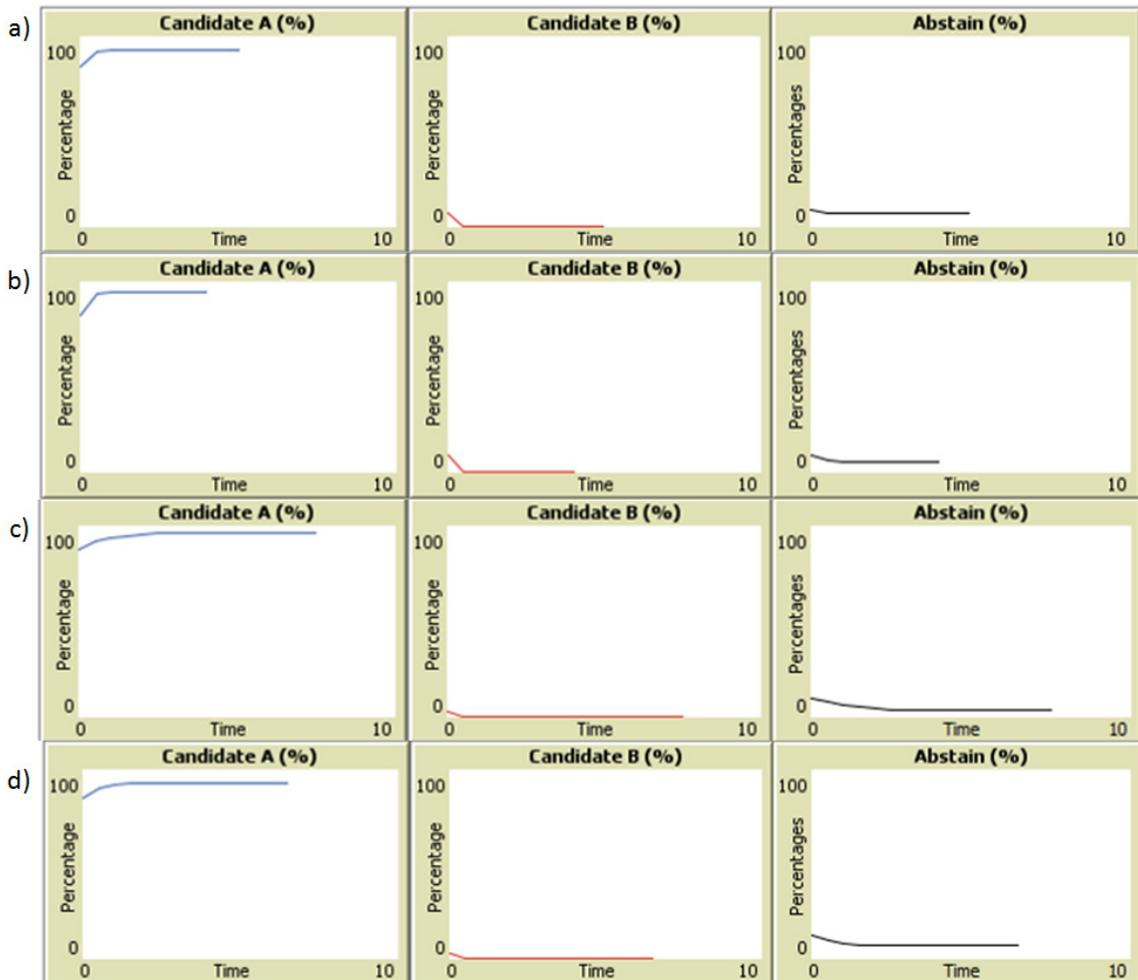


Fig. 3. (a)  $fr-a-th/fr-b-th = 0.1/0.9$  ; (b)  $fr-a-th/fr-b-th = 0.2/0.8$  ; (c)  $fr-a-th/fr-b-th = 0.3/0.7$  (d)  $fr-a-th/fr-b-th = 0.4/0.6$

Two tests above show several interesting phenomenas. In electability testing, the increase of electability level results in the longer time a candidate will reach a percentage stability of voters. However, deviations of voters percentage from initial to stable condition are relatively same. On the other hand, the increase of loyalty threshold results in shorter time a candidate will reach stability of voters percentage. Deviations are also stretched together with the increase of loyalty threshold. Higher threshold means a candidate will gather more new voters, but stable percentage is relatively lower than low loyalty threshold. These two contradictive results mean that the influence of electability level to the increase of voters percentage is lower than the influence of loyalty threshold. The influence of electability level tend to decrease over time significantly, but the influence of loyalty threshold remain longer to bring stability of voters percentage. When the percentage of all groups are constant, the influence will also be constant.

#### 4. Conclusion

Dynamic behavior of swing voters during election campaign period is a very interesting phenomenon. Different electability level of each candidate and the loyalty level of a candidate's swing voters make the campaign team need to measure the dynamic condition, the condition which is influenced by interactions among swing voters. From the simulations, there are three propositions which can be understood:

- P1** Loyalty threshold was very influential in the simulations. It means that during the campaign period, the campaign team should be able to maintain the loyalty of swing voters who support their candidate. This level tend to fastly ensure the stability of a candidate's voters percentage.
- P2** Electability level of a candidate have a strong influence on the initial cycle of simulation and tend to decline over time. The increase of electability level results in longer time to reach percentage stability, which indicates that it only affect swing voters in less significant influence.
- P3** The absolute winning condition happens when a candidate has high electability level and low loyalty threshold (high loyalty level), it means that voters from other groups easily decide to choose the candidate, and the candidate's voters are difficult to move to other groups. However, a candidate with high electability level needs longer time to ensure his/her winning condition than a candidate with higher voters' loyalty level (lower loyalty threshold).

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