FROM WATER TO WAR

WATER SCARCITY AND POLITICAL BEHAVIOR AT THE MICRO-LEVEL

Master Thesis

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Abstract

Environmental scarcity scholars believe that the scarcity of renewable resources an important contributor to violence and conflict in states belonging to the global south. Water scarcity is becoming increasingly problematic, especially in less developed states. Existing literature has mostly focused on the macro-level and has overlooked the individual's experience of water scarcity. Existing literature mostly focuses on armed conflict and fails to address the impact water scarcity on different types of political behavior. Investigating the individual level can be more concise in explaining the likelihood of political participation. Using the theoretical concept of relative deprivation and quantitative analysis, the relation between water scarcity and individual violent political behavior is investigated in the African continent using disaggregated data from the Afrobarometer. The impact of relative water scarcity is measured to determine whether water scarcity contributes to the propensity of an individual to use violence instead of other means of political participation. No evidence is found that relative water scarcity impacts voting behavior. Both the propensity of demonstration behavior and the propensity of using violence are negatively impacted by relative water scarcity. Therefore, no evidence is found that water scarcity increases the propensity of individuals using violence instead of other political means.

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Introduction

Prominent figures have urged global policymakers in recent years to pay attention to the problems that can arise when clean water becomes scarce. For instance, former United Nations secretary-general Kofi Annan urged the world to pay utmost attention to sustainable access to water and stated that "pressing water scarcity would increase competing demands and conflict'' (Annan, 2018). Water is the only scarce resource for which there is no substitute (Wolf, 2000), and combined with increasing demographic stress, this scarcity can lead to problematic situations. Numbers support the alluded urgency, as today already 2.2. billion people live without access to safe water (United Nations, 2021). The expectation is that by 2030, almost half of the world's population will suffer from water scarcity issues, with the most pressing situations occurring in less developed states (Michel, 2009). Moreover, only 3% of total water resources are freshwater, and 90% of this freshwater is used for agricultural purposes (Gerbens-Leenes, Mekonnen & Hoekstra, 2013). The limited presence of freshwater makes economies that are highly reliant on agriculture, which is, for instance, the case in the African continent, increasingly vulnerable to environmental stress and water variability (e.g., Hendrix & Salehyan, 2012; Salehyan, 2008). Furthermore, Eckstein (2009) argues that the variability of water access caused by climatic abnormalities, such as excessive rainfall or drought, could make it even more difficult for policymakers to anticipate future policy goals, as water scarcity will complicate international coordination in future water and food security planning.

Besides this concern about future policy-related water issues, the increasing depletion of essential resources poses a threat to the livelihoods of people worldwide, and previous research shows connections between water scarcity and conflict (e.g., Eckstein, 2009; Hendrix & Salehyan). As Eckstein (2009) argues, water is essential to human life, and a lack of water can increase competition and tensions in society. Although a war directly caused by a lack of water may be an improbable scenario due to the indirect links in the relation between water

scarcity and conflict (Homer-Dixon, 2010), environmental scarcity scholars believe that water scarcity can contribute to factors that increase the risk of social conflict (e.g., Eckstein, 2009, Homer-Dixon, 1998). Social conflict can entail protests, riots, strikes, and types of violent behavior (Hendrix & Salehyan, 2012). Indeed, some research points to environmental resource scarcity as a contributing factor to the use of violence (e.g., Eckstein, 2009; Homer-Dixon, 1998). Others, however, contest this relation (e.g., Bell & Keys, 2018; Postel & Wolf, 2001). This raises the question of what the impact of water scarcity might be on different types, both non-violent and violent, of political participation. The African continent is one of the most vulnerable continents for climate change (Busby, Smith & Krishnan, 2014), and water scarcity in the continent is increasing (Falkenmark, 1989). This makes it relevant to study the relationship between water scarcity and political participation in the African continent. The following question is addressed in this thesis: 'To what extent does a lack of access to clean drinking water impact non-violent and violent political behavior?' The goal of this thesis is to study the impact of water scarcity on different types of political behavior and to investigate whether a lack of water has an impact on the propensity of the individual to use violence instead of other means.

Previous studies (e.g., Bell & Keys, 2018; Postel & Wolf, 2001; Raleigh & Kniveton, 2012; Scheffran et al., 2012) focused on macro- or country-level data and overlooked the micro-level. Therefore, I challenge existing literature (e.g., Bell & Keys, 2018, Raleigh & Kniveton, 2012) because they do not consider the individual level. Furthermore, previous studies focused primarily on conflicts at the country level and ignored a broader definition of social conflict or political behavior (e.g., Raleigh & Kniveton, 2012; Theisen, 2008). By a broader investigation of political behavior, instead of solely focussing on conflict, the relation between scarcity issues and political behavior may be further understood.

Although an absolute definition of water scarcity exists (less than 1,000 cubic meters of clean water per person per year) according to the Food and Agriculture Organization of the United Nations (2012), it is more relevant to use the concept of relative scarcity as experienced by the individual, as the relative individual experience reflects the person's discontent or frustration that might lead to violent types of political behavior. Therefore, to investigate relative water scarcity, the concept of relative deprivation is used.

This thesis is structured as follows: first, the conventional knowledge of the relationship between water scarcity and different types of political behavior is briefly presented. Second, the theoretical concept of relative deprivation is presented, using a lack of water as an example of testing this concept. With this, the underlying mechanisms are discussed that determine different types of political behavior. Third, the methodology and data are presented. In this research, disaggregated survey data from the Afrobarometer Merged Round Five (Afrobarometer Data, 2015) is used. Logistic regression is conducted to investigate the impact of relative water scarcity on voting participation. Ordinal logit regression analyses are conducted to measure the relationship between water scarcity and political violence. No evidence is found that water scarcity has an impact on voting behavior. Contrary to the expectation that relative deprivation increases the likelihood of demonstration and violent behavior, the propensity of both demonstration and violent behavior decreases based on the ordinal regression results.

Literature review: the impact of water scarcity on political behavior

In this research, the focus lies on a specific type of resource scarcity that is crucial to people’s livelihoods: water scarcity. Because water is an indispensable ecological resource for human life, a lack of access to clean drinking water is classified as a form of environmental scarcity (Bond, Burrows, Kennard & Bunn, 2019). Scholars that link water scarcity to conflict

problems focus primarily on violent behavior and armed conflict (e.g., Homer-Dixon, 1994; Theisen, 2017; Raleigh & Kniveton, 2012). Here, they focus on the most extreme form of political behavior: violence. In turn, the impact of water scarcity on other types of political participation, such as conventional and non-violent behavior, has a less prominent focus. Also, existing literature (e.g., Raleigh & Kniveton, 2012; Hendrix & Salehyan, 2012) recognizes that the relationship between scarcity and conflict is often indirect and contains many steppingstones. As Homer-Dixon (1994) argues, scarcity almost always interacts with other societal factors such as migration and economic deterioration. Therefore, linking water scarcity to specific types of political behavior is complex. Because of these indirect and often intertwined links between scarcity and conflict, it is relevant to study other aspects besides violent participation. Therefore, non-violent types of political participation are taken into account in this thesis.

This literature section is divided into three parts. In the first part, a selection of relevant literature is presented to illustrate that the relationship between water scarcity and conflict contains many steps and indirect links. In the second part, existing research on water scarcity and different types of political behavior is presented. Finally, in the third part, the relevance of this thesis is discussed, arguing that because of the focus on macro-level in existing literature (e.g., Bell & Keys, 2018; Postel & Wolf, 2001), the micro-level is primarily overlooked. Therefore, I argue that water scarcity and political behavior must be studied at the individual level.

Existing literature offers a plethora of possible reasons why water scarcity can lead to violence or conflict. Scholars often emphasize that the causal pathways are indirect (e.g., Hendrix & Salehyan, 2012; Homer-Dixon, 1994). I identify two prominent strands in existing literature that present reasons why water scarcity can lead to conflict. The first strand of literature entails the idea that problems of scarcity intensify existing societal problems. For

example, because of water scarcity issues caused by extensive drought periods, agricultural production drops (Hendrix & Salehyan, 2012). In turn, this can lead to a loss of economic output and an increase in food pricing (Koubi, 2019). Consequently, economic deterioration and increased food pricing may lead to social unrest and conflict (Hendrix & Salehyan, 2012). Another link is often made between environmental scarcity and migration issues (e.g., Homer-Dixon, 1994; Percival & Homer–Dixon, 1998). Hendrix & Salehyan (2012) argue that water scarcity issues contribute to the deterioration of livelihoods. As a result, this increases migration flows of people from rural to urban areas, where scarcity issues in urban areas are worsened (Homer-Dixon, 1994). In turn, the tensions that result from the population strain and increase in competition can lead to an increase in violence (Homer-Dixon, 1994). The above-mentioned intermediary mechanisms are why water scarcity is often referred to as a risk multiplier and is fuelling already existing societal problems or existing conflict (e.g., Froese & Schilling, 2019; Theisen, 2019). However, it is the second, more direct pathway that I am interested in because I study political behavior.

The second strand presents more direct pathways and entails the idea that water scarcity can lead to certain types of violent behavior or conflict directly resulting from water scarcity. For instance, according to Homer-Dixon (1994), violence increases due to the increase of water scarcity (Homer-Dixon, 1994). Furthermore, as Hendrix & Salehyan (2012) argue, because water consumers are affected mainly by water scarcity issues, a lack of access to water can increase conflict between consumers. Thus, although water scarcity issues are often not the sole determinant of violence or conflict (Raleigh & Kniveton, 2012), a lack of water can indeed directly contribute to the deterioration of living conditions and increase competition, thereby increasing the risk of social conflict or violent conflict (Salehyan, 2008).

As becomes clear from the literature, water scarcity can impact intermediary societal factors that can lead to violence or conflict. To better understand this impact, I want to

understand the impact that water scarcity might have on different types of political behavior, namely on both non-violent and violent types of political participation. The specific link between water scarcity and conventional, non-violent means of political participation is not yet prominent in existing literature. However, existing literature addresses the impact of environmental scarcity and climate change issues in relation to voting behavior (e.g., Herrnstadt & Muehlegger, 2013; Engels, Hüther, Schäfer & Held, 2012). Herrnstadt & Muehlegger (2013) argue that more people lean towards environmental issues in their voting behavior when they experience extreme weather conditions. Besides the change in voting preference, environmental issues also seem to influence voter participation, according to Engels et al. (2012), because voting participation increases when people's concern about environmental issues increases.

Regarding the impact of water scarcity on political behavior specifically, literature is more focused on unconventional types of participation, and a prominent strand in existing literature links water scarcity to social conflict, i.e., protests, strikes, or demonstrations (Hendrix & Salehyan, 2012). For instance, water scarcity issues can spark protest behavior according to existing literature (e.g., Assies, 2013; Nganyanyuka et al., 2018; Olivera & Lewis, 2004; Scheffran et al., 2012). An example of this protest mechanism was seen in Tanzania, where water pricing spiked while water access and quality were still unassured. As the people saw no alternative to retrieving access to clean water, this was a reason for citizens to protest (Nganyanyuka, Martinez, Lungo & Georgiadou, 2018). Another example where water issues led to protests was seen in Bolivia. Referred to as the 'Cochabamba Water War', (e.g., Assies, 2013; Olivera & Lewis, 2004), the privatization of water, which increased prices, in the Bolivian city of Cochabamba in 2000 lead to a series of protests and, eventually, violent riots and even the death of a citizen.

The Cochabamba Water War is an example where water scarcity-related protest behavior ultimately leads to violent behavior. Indeed, the impact of water scarcity on violence is a

common focus in existing literature (e.g., Hendrix & Salehyan, 2012). However, findings on the impact of water scarcity and violence are inconsistent. On the one hand, scholars argue that water scarcity can be a contributing factor to violence or conflict. Others (e.g., Bell & Keys, 2018; Brown, 2010) contest this relationship. For example, Vestby (2019) argues that an environmentally induced deterioration of living conditions, the propensity of the individual to use violence, is positively affected. On the other hand, sometimes referred to as 'water war skeptics', scholars are hesitant in linking water scarcity to conflict. For instance, research by Bell & Keys (2018) shows no link between droughts and the increase in civil conflict. Bernauer & Böhmelt (2014) concluded that although tensions over water sources may be present, water scarcity does not directly increase the likelihood of conflict as tensions also present opportunities for cooperation. Despite the possible coordination over water issues, cooperation in the future is not self-evident, as increasing scarcity will trouble coordination and distribution (Eckstein, 2008).

As becomes clear from the studies mentioned above, there is no consensus on the relation between water scarcity and conflict. To contribute to this debate, I present the relevance of my thesis, which is threefold. First, what becomes apparent from the literature, is that most studies on water scarcity focus on the most violent type of political behavior. Despite the broader definition of social conflict, Hendrix & Salehyan (2012), who present other non-conventional types of political into account, failed to consider conventional political behavior. Therefore, I want to contribute by filling this gap by including the impact of water scarcity on conventional political behavior. Secondly, most studies (e.g., Bell & Keys, 2018; Postel & Wolf, 2001; Raleigh & Kniveton, 2012; Scheffran et al., 2012) focus on collective political violence or on conflict between states. As these studies mainly focus on macro-level and country-level data, they largely overlooked the micro-level. Meanwhile, scholars argue for the importance of studying links between scarcity and conflict at the disaggregated level and to pay attention to

micro-level dynamics of individual behavior. (e. g., Kalyvas, 2008; Vestby, 2019). For instance, Kalyvas (2008) argues that country-level analysis often incorrectly identifies the causal relations and patterns that link individual behavior to conflict. Because of this focus on the macro-level, the link between water scarcity and different types of political behavior is not precise enough. Therefore, I distinguish different types of political behavior and study this behavior at the disaggregated level. Third, existing literature focuses on precipitation data or droughts to indicate water scarcity issues (e.g., Vestby, 2019). Because of the focus on climate variability, the individual experience of water scarcity has not been addressed. Therefore, I aim to contribute to this shortcoming by including data on water scarcity experienced by the individual. In the next theoretical section, I distinguish between the three different types of political behavior and identify the causal mechanisms why water scarcity may lead to certain types of behavior.

Theory: Water scarcity and political behavior

To investigate to what extent water scarcity shapes political behavior, different insights into political behavior are combined in this thesis. This way, the possible use of violence can be studied in relation to other forms of political participation. Based on the common distinguishing in existing literature (Hague, Harrop & McCormick, 2016), the distinction is made between conventional and unconventional political behavior in this thesis. A further distinction is made within unconventional participation, between non-violent and violent political behavior. Table 1 shows a schematic classification of the types of political behavior used in this thesis. Here, voting is classified as conventional behavior, attending demonstrations or protests as unconventional and non-violent behavior. Finally, political violence is classified as unconventional and violent behavior.

Table 1. Classification political behavior*

	Conventional	Unconventional
Non-violent	Voting	Protest and demonstration
Violent		Political violence

**Based on Hague et al. (2016)*

To understand the impact of scarcity on the different types of political behavior, I use the concept of relative deprivation. According to Gurr (1970), relative deprivation entails the idea that there is a difference between the goods and circumstances that an individual believes to be entitled to and the actual realization of these goods and circumstances. The more significant the difference between the current situation and the desired situation, the more dissatisfied the individual is (Gurr, 1970). A further distinction is made by Asingo (2018) between *intra-personal* relative deprivation and *inter-personal* relative deprivation. Intra-personal relative deprivation is the discrepancy between a current situation and a previous or fictional situation and applies to one individual at a time. The idea of inter-personal relative deprivation entails the perceived deprivation of an individual compared to the surroundings (i.e., others). Here, the concept of inter-personal relative deprivation is used to investigate the impact of the experienced water scarcity of the individual in comparison to others. In the next section, this concept is discussed in relation to the three types of political behavior used in this thesis.

Conventional behavior

Conventional political participation is a form of political participation whereby individuals influence the governing body, and participation activity occurs within formal politics or the law (Hague et al., 2016). These activities often take place within the electoral arena (Verba & Nie, 1972). Indeed, voting is the most conventional form of political participation (Stockemer, 2014). However, according to Asingo (2018), applying inter-personal relative deprivation to voter participation decreases the likelihood that the individual will vote. According to Asingo

(2018), individuals are not expected to participate in conventional participation and vote in national elections when they are relatively deprived. He argues that it is not logical to vote when an individual feels relatively worse about his situation compared to others who have better living conditions under the same government. Also, for an individual, the utility of participating in voting is close to zero as a single vote is not likely to influence the election outcome (Blais, 2000). According to Asingo (2018), people who feel relatively deprived do not trust their incumbent government to resolve their scarcity. Thus, if the individual believes that voting is not likely to change anything about the scarce situation, and the costs outweigh the benefits, the individual will be less likely to vote. Instead of voting, relatively deprived individuals will turn to other types of political participation (Asingo, 2018). This is discussed below. Based on the arguments mentioned above, it is expected that an individual who is relatively deprived of water will turn to less conventional methods and will be less likely to participate in voting. This is reflected in the following assumption:

H1: The more an individual experiences relative water deprivation, the less likely an individual will participate in voting.

Unconventional, non-violent political behavior

Contrary to conventional behavior, unconventional behavior occurs outside the formal political sphere, in non-institutionalized areas (Van der Meer & van Ingen, 2009). Moreover, unconventional political participation such as protest, or demonstration does not entail deliberate physical force or violence. Instead, it is a non-violent type of political participation (Stockemer, 2014). As becomes apparent from the literature, water scarcity issues are reasons the individual will attend to unconventional political participation strategies, such as demonstrations or protests (e.g., Assies, 2013; Nganyanyuka et al., 2018; Olivera & Lewis,

2004; Scheffran et al., 2012). A reason why an individual resorts to protest or demonstration can be the result of an attempt to remedy specific local grievances (Mason, 2004). However, when individuals feel that their grievances cannot be adequately expressed through conventional participation, individuals will turn to unconventional participation to address their issues and impact their environment more directly (Tilly & Tarrow, 2015). Considering the concept of relative deprivation and protest behavior, individuals are more likely to resort to protest than people who do not feel deprived, according to Asingo (2018). He argues that relative deprivation leads to discontent, which in turn sparks protest. The expectation that follows is:

H2: The more an individual experiences relative water deprivation, the more likely an individual will participate in a demonstration or protest.

Violent behavior

Existing literature paid extensive attention to the causal factors why people resort to violence (e.g., Gurr, 1970; Humpreys & Weinstein, 2008). Possible explanations for the use of violence emerge from discontent or grievances (e.g., Humpreys & Weinstein, 2008; Collier & Hoeffler, 2004). Nonetheless, the discontent or grievances must be severe enough for people to want to engage in violence (Collier & Hoeffler, 2004). The underlying causal mechanisms that explain why a situation of discontent turns into violence are explained by Gurr (1970), who argues that relative deprivation can lead to violence when discontent is combined with anger and resentment. Here, Gurr (1970) uses the frustration-aggression mechanism that entails the idea that frustration turns into a situation of discontent because of relative deprivation. In turn, when this discontent is accompanied by aggression and the inability to express grievances adequately, this situation can turn into the use of violence (Gurr, 1970).

Considering this mechanism in regard to water scarcity, a situation of frustration occurs when individuals experience a difference between the welfare they currently have and the welfare they believe they deserve. According to Gurr (1970), crucial welfare values are values that directly contribute to physical well-being and self-realization, and he classifies physical goods such as shelter and food to be essential to personal development and well-being. Because water is essential to human life (Eckstein, 2009), I classify this as a crucial welfare. Consequently, being relatively deprived of water can turn into a situation of discontent. Furthermore, Wedge (1969) argues that an individual violent response can arise when a threat is presented that directly threatens values that are crucial to life. The above-described theoretical arguments lead to the following assumption:

H3: The more an individual experiences relative water deprivation, the more likely an individual will use violence.

Research design

The African continent is one of the most vulnerable continents for climate change (Busby, Smith & Krishnan, 2014), and water scarcity is already increasing at an accelerating rate (Falkenmark, 1989). Given the reliance of many African economies on agriculture, Africa is particularly vulnerable to water scarcity issues (Hendrix & Salehyan, 2012). Therefore, the focus of this thesis lies on the impact of water scarcity in the African continent. To investigate whether a lack of water explains the variance in different types of political behavior at the micro-level, disaggregated data is needed. One important source of such data for the African continent is the Afrobarometer. It collects information from individuals from different countries across time. In this thesis, data from the Afrobarometer Round 5 (2011-2013) is used because this dataset contains both data on the lack of water as experienced by the individual and data on

individual political participation. The advantage of using the Afrobarometer is that this dataset includes large-scale empirical survey data, making it possible to study patterns of individual political behavior. This round covers survey data from 34 African countries, divided into 417 different regions. The unit of analysis is the individual respondent.

Dependent variables

In the first analysis, the dependent variable is *voter participation.* This variable is based on the survey item '*Voted in the last national election'* in the Afrobarometer. This was a nominal variable and contained answer options that indicated if and why someone voted or not in the last national elections. This variable is transformed into a dichotomous variable, indicating whether someone voted (coded as 1) or not (coded as 0). All answer options that contained a statement that people did not vote, being not eligible to vote excluded, are considered 'not voted'. This variable contains 51,093 observations. Of the respondents, 20.6 percent of individuals did not vote, and 72.7 percent voted in the last national elections.

In the second analysis, the dependent variable is *demonstration or protest behavior*. This variable is based on the survey item '*Please tell me whether you, personally, have done any of these things during the past year. If not, would you do this if you had the chance: Attended a demonstration or protest march?'* The answer options are 'no would never do this', 'no but would if I had the chance', 'yes, once, or twice', 'yes, several times' and 'yes, often' (Afrobarometer, 2015). This variable is coded from one to five (1 = no would never do this, 5 = yes, often). The dependent variable *demonstration and protest behavior* contains 50,287 observations, of which 69.6 percent of the respondents indicate to have never attended a demonstration of a protest march, 19.6 percent indicated to have never attended but would if necessary. 4.6 percent of respondents attended a demonstration of protest once or twice, 2.9 percent several times, and 1.4 percent often.

In the third analysis, the dependent variable is *violent behavior*. This variable is based on the survey item *'Please tell me whether you, personally, have done any of these things during the past year. If not, would you do this if you had the chance: Used force or violence for a political cause'* The answer options are 'no would never do this', 'no but would if I had the chance', 'Yes, once or twice', 'yes, several times' and 'yes, often' (Afrobarometer, 2015). These answers are coded from one to five (1 = no would never do this, 5 = yes, often). This dependent variable *violent behavior*, contains a number of observations of 45,747, of which 88.7 percent of respondents indicate not to have used violence and would also never do this, 6.6 percent of respondents indicate that they never used violence, however, they would if necessary. 1.4 percent of respondents indicated to have used violence once or twice, 0.9 percent several times, and 1.5 percent often used violence. Table 2 shows the descriptive statistics of the dependent variables.

Independent variable

The independent variable in all analyses is *relative water deprivation.* Considering that in this thesis, the impact of water scarcity on individual political behavior is investigated using the concept of relative deprivation, a variable was created that represents the experienced relative water scarcity by the individual. To investigate relative deprivation, the difference between the situation of the individual and the situation of others must be noticeable in order for it to be compared (Asingo, 2018). Therefore, the perception of water scarcity of the individual respondent is compared to the average value of all the individual respondents within the region. This is the operationalization of the concept of inter-personal relative deprivation presented by Asingo (2018). I use the region to compare the individual to others, as this is the available data that gives some information about the proximity of the individual to others. However, the region only gives a rough indication of the surroundings of the individual, and regions can vary in geographical size. Because of this, the direct surroundings of the individual might not be

accounted for. Therefore, interpreting the results on relative deprivation must be done with caution. Accordingly, the difference between the perceived water scarcity and the average water scarcity in the region reflects the perceived relative water deprivation.

To investigate relative water scarcity, I computed a new variable. First, the variable representing the lack of water as experienced by the individual was an ordered ratio variable and is based on the survey item ‘*’Over the past year, how often, if ever, have you or anyone in your family gone without: Enough clean water for home use?*’’ This variable ranged from 1 to 5, with a higher value corresponding to more water scarcity (i.e., less water available, 1 = never scarcity, 5 = always scarcity). Second, this existing variable was computed into a variable representing the average water scarcity value for each individual. Third, the average value of water scarcity value per region was determined by combining the values of *individual average water scarcity* and the regional codes. Next, this value was merged with the data of the experienced water scarcity of the individual respondent. This resulted in a variable of *regional average water* scarcity. This variable had a minimum of 1,0, a maximum of 4.1, and an average of 2.13. Finally, a variable was computed by subtracting *individual average water* scarcity from *regional average water scarcity,* resulting in new variable *relative water deprivation* representing the difference between the experienced water scarcity of the individual and the average experienced water scarcity of the region. Finally, the variable *water deprivation variable* now represents the experienced relative water scarcity of the individual compare to the region. This variable ranges between -3.93 and 3.04 and has a mean of 0,00. A negative value means that the individual experiences more water scarcity than others in the region. A positive value reflects that the individual experiences less water scarcity than others in the region. This variable is treated as an interval variable.

Control variables

To control for confounding relations, several control variables are added in analysis. In the first analysis of the determinants for voting inclination, a variable *freedom to vote* is added, as I expect that respondents who feel free to vote will be more likely to go voting. Freedom to vote is a categorical variable that is coded from one to five (1 = not at all free, 5 = completely free). Voting can also be impacted by trust in parliament. Based on research by Grönlund and Setälä (2007), I expect that respondents who trust their parliament or national assembly will be more likely to vote. Therefore, a categorical *trust in parliament* variable is added. This is a categorical variable coded with four categories (0= not at all, 3 = a lot). Also, gender has an impact on voting participation, as Schlozman, Burns, Verba, & Donahue (1996) argue that men are more likely to vote than women. Therefore, I expect that gender has a predictive effect on people's inclination to vote and a *gender* variable is added analysis. This variable is dichotomous with 'zero' for male and 'one' for female. To control for age, as a higher age is positively related to the inclination of voting (Grönlund and Setälä, 2007), a ratio variable that ranges from 18 to 105 is included. Finally, according to Grönlund and Setälä (2007), having a higher education is positively related to the inclination to vote. A variable *education* is added in analysis to control for this, and it is treated as a ratio variable with values ranging from zero to nine (0 = no formal schooling, 9 = postgraduate).

In the second analysis of the impact of relative water scarcity on demonstration or protest behavior, the same control variables as in the voting analysis are added. Both the freedom to vote and trust in parliament are likely to impact demonstration or protest behavior. The *freedom to vote* is expected to negatively impact protest behavior, as people who feel less free to vote are more likely to express their opinion in unconventional political participation (Stockemer, 2014). Contrary to voting behavior, where trust in parliament is positively related to voting, *trust in parliament* is likely to be negatively related to protest behavior (Dalton, van

Sickle & Weldon, 2010). In this analysis, *income* is also included as it is expected to positively relate to protest participation (Schussman & Soule, 2005). As according to Stockemer (2014), higher education is positively related to the propensity of participating in protests, *education is* added in analysis. Also, *gender* is added in analysis because it is expected that women are less likely to participate in protests than men (Schussman & Soule, 2005). Finally, research by Stockemer (2014) shows that *age* impacts political participation as younger people are more involved in protests.

In the third analysis of the impact of relative water scarcity on violent behavior, the same control variables as in the previous analyses are added. For violent behavior, it is also important to control for factors that represent whether an individual is free to express her/himself because the inability to be able to express grievances adequately can turn into the use of violence (Gurr, 1970). Therefore, the variable *freedom to vote* is added. Similarly, it is expected that people who have no trust in parliament are more likely to use violence (Gurr, 1970). Again, *education* is added because it is expected that a lower education contributed to the likelihood of using violence (Humphreys and Weinstein, 2008). Also, *income* is included here as it is expected that a lack of income is likely to be positively related to participation in violence. Regarding *gender*, the expectation is that men are more likely to engage in unconventional and illegal political participation (Humphreys and Weinstein, 2008). In addition, a control variable is added that reflects whether a respondent believes that violence is justified or not. *Violence is justified* is a dichotomous variable and takes on the value of '1' if the respondent believes it is justified and 0 if not. Finally, *age* is added because younger people are expected to be involved in unconventional political participation (Stockemer, 2014).

Table 2 shows the descriptive statistics of all the variables used in the analysis.

Table 2. Descriptive statistics of the dependent and independent variables in the logistic model of water scarcity and the propensity of voting, demonstration, and violent behavior.

	N	Mean	Std. Deviation	Minimum	Maximum
Relative water deprivation	51.197	0.00	1.26	-3.93	3.04
Voted	51.093	0.73	0.44	0	1
Demonstration behavior	50.287	0.44	0.83	1	5
Violent behavior	50.344	1.15	0.53	1	5
Freedom to vote	50.181	3.63	0.73	1	5
Trust in Parliament	50.064	1.62	1.07	1	4
No income	50.087	2.02	1.43	1	5
Violence is justified	48.338	0.19	0.39	0	1
Female	51.287	0.50	0.50	0	1
Age	50.849	37.18	14.59	18	105
Education	51.161	3.28	2.13	0	9

Analysis

The first analysis is conducted to investigate whether there is an effect of relative water scarcity on people's inclination to vote. Logistic regression analysis is conducted as the dependent variable *voter participation* is dichotomous. Table 3 shows the logistic regression results of the inclination of the individual to vote. Logistic analysis was used to test the hypotheses of whether people who experience relative water deprivation are less inclined to vote.

[Table on following page]

Table 3. Logistic regression analysis of the probability of individuals voting

		Model 1
Relative water deprivation		0.01 (0.01)
Age		0.03*** (0.00)
Education		-0.01 (0.01)
Gender	(Ref. = male)	
	Female	-0.13*** (0.02)
Freedom to vote	(Ref. = not at all free)	
	Not very free	0.21 (0.07)
	Somewhat free	0.40*** (0.06)
	Completely free	0.70*** (0.06)
Trust parliament	(Ref. = not at all)	
	Just a little	0.22*** (0.03)
	Somewhat	0.41*** (0.04)
	A lot	0.59*** (0.04)
Gone without income	(Ref. = Never)	
	Just once or twice	-0.02 (0.04)
	Several times	0.13*** (0.04)
	Many times,	0.18*** (0.06)
	Always	0.24*** (0.04)
(Constant)		-0.77** * (0.08)
-2LL		44959.89
Cox and Snell's R2		0.05
Nagelkerke's R2		0.07
N		45.237

Note: binary logistic regression coefficients with standard errors in brackets.
****p < 0.001, **p < 0.01, *p < 0.05*

The logistic analysis result shows a positive relationship between more water scarcity and the likelihood of someone voting. However, this result is not statistically significant. This result yields no evidence to support the first hypothesis. The controls generally behave as expected. *Age* is significant, indicating that someone who is older is more likely to vote. *Education* is

negatively related to the inclination of someone to vote. However, this result is not significant. Women are less likely to vote, and this result is significant. The results of the impact of the *freedom to vote* on the propensity to vote are indecisive. For instance, someone who feels not very free is more likely to vote compared to someone that is not at all free (reference category), and someone who is a lot free is also more likely to vote compared to someone who is not at all free. *Trust in parliament* is positively related to voting, and this result is significant. A loss of income is positively related to people voting. People who have gone without income several times, many times, and always are more likely to vote than people who never have to go without income. These results are significant.

Based on the regression analysis result, I find that relative water scarcity does not seem to impact voting participation. Other variables such as *trust in parliament, income,* and gender are better at predicting voter participation. Reasons why voting might not be impacted by water scarcity, could be that water scarcity is not an issue that is decisive for people to participate in voting. When people do not feel like their vote will make a difference, they are less likely to participate in voting, which would be in line with existing literature (Blais, 2000). Also, regarding relative deprivation specifically, Asingo (2018) argues that individuals who do not have trust in the party or opposition whom they believe to be responsible for their situation of deprivation are not likely to participate in voting. However, as I do not find a result that water scarcity impacts voting, perhaps individuals are indifferent and do not think water scarcity is a reason to change their voting behavior.

In the second analysis, ordinal logistic regression is conducted to predict the ordinal dependent variable *demonstration and protest behavior.* Because of the ordered ranking of the dependent variables in both models, ordinal regression is the most suitable method to assess whether the propensity for people to demonstrate or protest differs at different levels of severity of experienced relative deprivation (Brant, 1990). The number of observations is 45.237 in the

model of the impact of relative water scarcity on demonstration behavior. A remark must be made here regarding the assumption of proportional odds. Specifically, the test of parallel lines in the ordinal regression shows a significant result, which means that the relationships are not holding across the ranks on the dependent variables, and the assumption of proportional odds is violated. The fact that the relations often do not hold is because the sample size is large (Allison, 1999). This is likely to be the case because I have a sample size of 45.237. Furthermore, this assumption can be violated due to a continuous explanatory variable in the model (Allison, 199). According to Brant (1990), the proportionated odds assumption is an anti-conservative test. Therefore, the results of the ordinal regression might not be valid due to the violation of this assumption. A solution to circumvent this problem would be to conduct multinomial logistic regression as this allows to avoid the issue of the ordering of the dependent variable. However, due to the inclusion of the multiple categorical variables included in analysis, this is not feasible regarding the scope of this thesis. Because this assumption is violated, the results must be interpreted conservatively.

Table 4 shows the ordered logit estimation results of the impact of the *relative water scarcity* on *demonstration behavior*. The likelihood ratio chi-square test shows that the full model is a significant improvement over the null model ($x^2(16)$=1771,44, p< 0,001). The significant predictors in the model are *relative water deprivation*, respondents who do not have trust in parliament at all, respondents who do not feel very free to vote, respondents who never had to go without income, respondents who had to go without income many times, *education*, *gender*, and *age*.

[Table on following page]

Table 4: ordered logit estimation results of the impact of relative water scarcity on demonstration behavior

		Model 1
Relative water deprivation		-0.03**
		(0.00)
Trust in Parliament	(Ref = A lot)	
	Not at all	0.01**
		(0.03)
	Just a little	0.02
		(0.03)
	Somewhat	0.01
		(0,03)
Freedom to vote	(Ref = Completely free)	
	Not at all	0.10
		(0.06)
	Not very	0.26***
		(0.04)
	Somewhat	0.05
		(0,03)
Gone without income	(Ref = Always without)	
	Never	-0.30***
		(0.03)
	Just once	-0.01
		(0.04)
	Several times	-0.05
		(0.03)
	Many times,	-0.09***
		(0.03)
Education		0.11***
		(0.00)
Female		-0.36***
		(0.02)
Age		-0.01***
		(0.00)
Nagelkerke		0.035
Observations		45,392
Log-likelihood		-39396.72

Notes: the estimates represent ordered log-odds regression coefficients. ***, **, * *indicate significance at 1%, 5% and 10% respectively.*

The estimate of *relative water scarcity* shows a negative relation. A higher level of relative deprivation means that an individual is less likely to demonstrate. Thus, the more an individual

feels deprived, the propensity to demonstrate decreases. This effect is significant with Wald x^2 (1) = 13.0, p = 0,001.

The controls generally behave as expected. Respondents who have no trust in their parliament are more likely to demonstrate compared to individuals who have a lot of trust, and this result is significant at p<0.01. Respondents who do not feel free to vote are more likely to demonstrate or protest, and this result is significant at p<0.001. The impact of a lack of income on the propensity of demonstration behavior has mixed results, as both individuals who never had a lack of income, and individuals who had to go without income many times, are less likely to demonstrate or protest. Both these results are significant at p<0.001. *Education* is positively related to the likelihood of someone participating in protest or demonstration. Being female is predictive of a decreased likelihood participating in demonstration or protest. *Age* also is predictive of a decreased likelihood of demonstration. *Education,* being female, and *age* are all significant at p<0.001. Based on this result, I can not confirm the second hypothesis. This result is in line with existing literature that argues that deprived individuals might not participate in protest, because they lack the resources to effectively participate in protest activity (Dalton et al., 2010). A further reason why relatively deprived individuals might not participate in protest is that the costs of participation in protest are higher compared to participation in conventional behavior (Asingo, 2018).

In the third analysis, ordinal logistic regression is used to predict the ordinal dependent variable *violent behavior*. Table 5 shows the ordered logit estimation results of the impact of relative water scarcity on the propensity of violent behavior. In the model of the impact of relative water scarcity and violent behavior, the number of observations is 43.263. The likelihood ratio chi-square test shows that the full model is a significant improvement over the null model ($x^2(10)$=354,83, p< 0,001). The significant predictors in the model are *relative water deprivation*, respondents who do not trust their parliament at all, respondents who never,

just once and many times had to go without income, respondents who believe violence is justified, education, being female, and age.

Table 5: ordered logit estimation results of the impact of relative water scarcity on violent behavior

		Model 1
Relative water deprivation		-0.05***
		(0.01)
Trust in Parliament	(Ref = A lot)	
	Not at all	0.14*
		(0.05)
	Just a little	0.02
		(0.05)
	Somewhat	-0.08
		(0.05)
Freedom to vote	(Ref = Completely free)	
	Not at all	0.70
		(0.08)
	Not very	0.71
		(0.06)
	Somewhat	0.33
		(0.04)
	(Ref = Always without)	
Gone without income		
	Never	-0.18***
		(0.06)
	Just once	0.21***
		(0.06)
	Several times	-0.06
		(0.05)
	Many times	-0.16***
		(0.05)
Violence is justified		0.91***
		(0.04)
Education		-0.02**
		(0.01)
Female		-0.28***
		(0.03)
Age		-0.01***
		(0,00)
Nagelkerke		0.035
Observations		45.392
Log-likelihood		-39396.72

Notes: the estimates represent ordered log-odds regression coefficients. ***, **, * *indicate significance at 1%, 5% and 10% respectively.*

The estimate of *relative water scarcity* is negative. This means that a higher level of relative deprivation means the likelihood of falling in a higher-level propensity category of violent behavior decreases. Thus, the more an individual feels deprived, the propensity to use violence decreases. This effect is significant with Wald x^2 (1) = 13.0, p = 0,001. Based on this result, I can not confirm the third hypothesis.

The controls generally behave as expected. Individuals who have less trust in their parliament are more likely to use violence. This result is significant at $p<0.01$. Respondents who do not feel free to vote are more likely to use violence, however, this result is not significant. The impact of a lack of income on the propensity of violent behavior has mixed results, as both individuals who never had a lack of income, and individuals who had to go without income many times, are less likely to use violence compared to someone who always has a lack of income. All these results are significant at $p<0.001$, except the 'several times' category. *Education* has a negative coefficient, meaning that a higher education is predictive of a decreased likelihood of someone using violence. Being female is predictive of a decreased likelihood of using violence. *Age* also is predictive of a decreased likelihood of using violence. Education, being female, and age are all significant at $p<0.001$.

This negative result would be in line with existing literature, as Hendrix & Salehyan (2012) argue that individuals might not be busy fighting, because they are busy surviving. Reasons for the negative relation between water scarcity and violent behavior might be similar to the reasons why individuals do not participate in protest. For instance, individuals might not have sufficient resources to resort to violent means (Dalton et al., 2010). Also, as Collier & Hoeffler (2004) argue, grievances must be severe enough for people to resort to violence. Thus, if the grievances caused by relative water scarcity are not severe enough, the individual will not resort to violence.

Discussion

Evaluating the research process, some limitations have to be addressed. This section presents a brief overview of methodological and theoretical limitations and implications for future research. As mentioned, due to the violation of the proportionated odds assumption, the results must be interpreted with caution. This is a reason why the methodology was not wholly effective in answering my research question. In future research, multinomial regression using fewer categorical variables could improve the reliability of the results. A second methodological limitation is the use of the region to operationalize relative deprivation. As the region might not give the best reflection of the immediate environment of the respondent, other geo-spatial data can be used in further research. For example, Afrobarometer offers hyperlocal data that contains information at the village or town level and could represent the more direct surroundings of the individual. Future research is needed to establish whether using more detailed data would change the outcome.

A theoretical limitation might be that using relative deprivation is not the most suitable concept to explain the impact of water scarcity on individual behavior. Perhaps, because relative deprivation does not impact an individual when the individual has enough water. It would, therefore, not matter if a neighbor had more water as they would not necessarily feel deprived if the limit of absolute scarcity (1000m2 per person per year) is met, and everyone has sufficient access to water. Therefore, future research could address the impact of absolute water deprivation instead of relative deprivation.

A second theoretical implication is that because, in this thesis, a clear distinction was made between the different types of political participation, overlap in political participation is not accounted for. It is not ruled out that an individual participated in multiple types of political participation instead of just one, as participating in one type of political behavior does not rule out other participation. As Stockemer (2014) argues, political engagement is advanced in steps,

as often people start with conventional participation and continue to unconventional participation. Future research could address the interplay between different types of political participation and address how water scarcity impacts the change from one type of behavior to the other.

Conclusion

In this thesis, I had the aim to answer the research question: 'To what extent does a lack of access to clean drinking water impact different types of political behavior?'. By answering this question, I contribute to current debates on the relation between water scarcity and the possible impact on conflict in two ways. First, because I focused on various types of political behavior while existing literature primarily focuses on violent types of political behavior (e.g., Bell & Keys, 2018, Raleigh & Kniveton, 2012). Therefore, I also included non-violent types of political participation, namely, voting and protest behavior. Second, to study individual behavior, I focused on the disaggregated micro-level compared to existing literature that focuses primarily on country-level data.

Using the concept of relative deprivation, the impact of relative water scarcity on different types of political participation was investigated. The results from the quantitative analysis suggest that relative water scarcity does not have an impact on voting participation. Relative water deprivation does seem to impact both protest and violent behavior, namely, that individuals are less likely to resort to protest or violent behavior when they experience more water scarcity than others in their region. The logistic model does not show a significant result that relative water deprivation impacts the inclination of individuals to participate in voting. Contrary to the expectation that relative deprivation increases the likelihood of demonstration behavior, the impact of water scarcity and the propensity of demonstration decreases based on the ordinal regression results. Both the propensity of demonstration behavior and the propensity

of using violence are negatively impacted by relative water scarcity. Therefore, my conclusion is that water scarcity does not increase the propensity of individuals using violence instead of other means. Other determinants such as age, gender, and education explain the variance in the different types of behavior. A reason why voting behavior is not impacted by water scarcity might be that the individual will not think that voting will impact their scarce situation (Asingo, 2018). Regarding the negative impact of water scarcity on protest behavior, this might be due to the fact that individuals do not have sufficient resources to participate in protest (Dalton et al., 2010). This idea also applies to the negative impact of water scarcity on violent behavior, as people might be busy surviving, instead of fighting (Hendrix & Salehyan, 2012).

The results are important to consider because already, many people, especially in less developed states, suffer from water scarcity-related issues (Homer-Dixon, 1998). Because water scarcity issues are likely to become even more pressing in the future, the impact of water scarcity on people's behavior is important to understand. That is why water scarcity issues should be taken seriously, and future policymakers should consider the many risks that scarce situations are likely to bring about.

Considering the increasing water scarcity in the African region, problems caused by access to clean water might become more common. This thesis illustrates that water scarcity does impact protest, demonstration, and violent behavior. At the same time, the results raise new questions as to why water scarcity does not impact voting. As the impact of scarcity might not be uniform across the African continent, future studies could focus on more in-depth, context-specific instances where water scarcity might have influenced political behavior. Using qualitative research methods, the individual motivations for participating in different types of political behavior can be investigated.

Finally, I have no major theoretical reason to believe that the mechanisms between water scarcity and political behavior only apply to water scarcity in the African continent. As water

scarcity also affects other parts of the world, it can be fruitful to focus on political behavior in other countries outside of Africa in future research.

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