

A grim relationship: regime instability, violence and refugees

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Abstract

The world is currently encountering one of the largest migrant crises ever. Especially Syria and Libya have been hard hit after the Arab Spring and have seen millions of their citizens flee from violence. These countries have entered civil wars after the Arab Spring, even though the Arab Spring started quite innocently with small protests. Yet, in most other countries small protests also arose but did not lead to civil wars. Thus, all countries were unstable as shown by the protests but this did not lead to violence and migration in most cases. The purpose of this study is to describe and explain these differences. The research question is therefore: What is the relationship between regime stability, violent conflict and forced migration? It will do so by means of System Dynamics, a simulation method. The study finds that this dynamic of the relationship between regime stability, violence and forced migration foremost depends on the decision of a regime whether to use their army to subdue the protests. Depending on the loyalty of the soldiers, the protests may be subdued or an armed rebellion may be started. In the last case, civil war is a given and mass migration will follow.

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Chapter 1: Introduction and Problem formulation

1.1 Introduction

The world is currently encountering one of the largest migration crises ever. Citizens from both Syria and Libya are moving in large amounts. Tunisia, with its 11 million citizens, has received 2 million Libyan refugees. Lebanon, with only 5 million citizens, has received 1.1 million Syrian refugees. Other Middle Eastern countries have also had their fair share of refugees. European countries, such as Germany, have received many refugees as well. The sheer number of refugees threatens to overwhelm these countries ("Syria's refugee crisis in numbers", 2016).

Moving from one country to another, refugees are a type of migrant, namely forced migrants. Forced migrants are migrants who move between countries, because they must flee from their home countries due to violence and or threats. They are essentially being pushed or forced out of their environment (Moore & Schellman, 2004). However, forced migration is only one type of migration. The other prominent type is voluntary migration. Where forced migrants are forced out, voluntary migrants are those who voluntarily move to another country for reasons such as income and jobs. They are not confronted with violence or threats but rather move due to financial or social reasons (Hansen, 2003) (Moore & Schellman, 2004).

The largest part of modern day migrants is a voluntary migrant. A study by Cassidy (2000) showed that, in 2000, 88.5 % of the foreigners in the US was a voluntary migrant and only 11.5 % was a forced migrant. There is no such study for Europe, but in 2015, of the total number of migrants arriving, 60% was a voluntary migrant (Worley, 2016). As a result, most scientific studies have focused on understanding voluntary migration. Therefore, many models have been developed to describe this type of migration, for example, the gravity model, the human capital model and the Borjas model (see Bodvarsson & van den Berg, 2013). In contrast, the number of models describing forced migration is considerably lower. Research on forced migration shows that its main driving factor is violence in a country, but the precise mechanisms are less well understood than those of voluntary migration. In this study, I will therefore focus on forced migration, as the mechanisms behind it are still to be elucidated and there is henceforth still a lot of knowledge to be gained (Moore & Schellman, 2004).

1.2 Forced migration & violence

Current research on forced migration has focused on violence within the countries where the migrants come from. This violence in countries may be due to an external conflict, for example, a conflict between two countries or an internal conflict, such as an insurgency (violent rebellion) or a civil war. The case of a war and forced migration is straightforward, as two countries fight one another, one might be invaded and the people of the invaded country might flee from the invading army because they expect violence. The other case, of a civil war, is less straightforward. It usually starts small, with minor conflicts between the regime and its opponents, called insurgents, who attempt to overthrow the regime by using hit and run tactics. Such an insurgency may, depending on the circumstances, escalate into a civil war. In that case, the violence in a country slowly increases and tends to be more intense and gruesome than the violence in a conventional war and therefore more likely to bring about migratory movements. Moreover, civilians are a primary target in civil wars and are therefore more likely to flee from their country. This makes the countries facing civil wars interesting cases to study the relationship between violence and the number of refugees (Kriger, 1992).

The level of violence within a country, involved in an insurgency or civil war, is determined by the capabilities or strength of the two fighting parties, namely, the regime and insurgents (Davenport et al., 2003). Choucri and colleagues (2007) developed a model to explain the strength of both regime and insurgents. They found that regime strength depends on its economic and political performance. The stronger a regime, the higher the willingness of its citizens to support it. A strong regime limits the appeal to citizens of joining the insurgency. The insurgents' strength, on the other hand, lies within their own numbers. Insurgents' commit violent acts to bring the government down, while the government commits violent acts to destroy the insurgents. Depending on regime strength, these violent acts increase the number of insurgents. For example, in a country with a strong regime, governmental violence will not lead many citizens to support the regime as they have too much to lose. The stronger the insurgents become, the more violent conflicts between insurgents and government forces occur, the more unstable a country is and the more people flee from the country.

Not mentioned by Choucri, but very relevant in stopping dissidents and defeating insurgents is the army. An army needs to be both loyal and of a certain size to defeat insurgents. A (partially) disloyal army will either not fight on behalf of the regime or (partially) join the insurgents. In the first case, the regime is lost and will lose power. In the second case, the insurgency will increase in size and may eventually

become a civil war (Brownlee et al., 2015) (Barany, 2011).

The conflict between insurgents and the regime becomes a civil war once the insurgents grow sufficiently strong to inflict serious casualties on the government and the total of deaths caused by violent incidents is larger than thousand. Whilst violent conflicts between insurgents and government forces lead to migration already, civil war leads to even more forced migration. However, the relationship between regime stability, insurgency / civil war and migration has not been validated by an empirically supported model. There is lack of knowledge regarding the precise relationship between regime stability and forced migration (Schmeidl, 1997) (Davenport et al., 2003).

1.3 Problem Formulation

To study the relationship between regime stability and forced migration, I will focus on the Arab Spring, the name for the mass protests in the Middle East in 2011 that left some governments toppled, others stuck in civil war and others only slightly changed with minor concessions to the protestors. At the start of the protests, not only the Syria and Libya were Arab Regimes did not seem very stable, as dissidents protested for their dismissal. However, only in a few countries regime change happened. Only in Tunisia and Egypt did the regime change. In four countries, namely Syria, Yemen, Libya and Bahrain the regime resisted demands for change violently and did not change. Bahrain succeeded in crushing its own protesting citizens and thereby restoring regime control. The three other countries were less successful in using violence to convince their citizens and thus entered civil wars, resulting in mass migratory movements. Most Arab countries simply reformed, to some extent, or used oil money to silence their citizens (Brownlee et al., 2015).

The choice for the Arab Spring is straightforward. It is a modern conflict, with a large amount of available data on it and clear examples of low regime stability leading to violence and eventually forced migration in the case of Libya, Syria and Yemen. Moreover, the forced migration caused by the violence in these three countries has caused the largest migratory movement since the second world war and hit Europe especially hard. In all three countries, the regime violently resisted the protesters, the conflict turned into an insurgency, with mass migration as consequence. In this way, both display the relationship between a seemingly instable regime, violence and migration. Thus, all three are good cases for understanding the relationship between regime stability and forced migration (Brownlee et al.,

2015). However, although the available data on the Arab Spring countries is better than that of earlier countries facing low regime stability, violence and mass migration the data is still not quite extensive. Especially, the fact that the three countries have all entered civil wars limits the availability of the data. Of the three countries, the most information is available on Syria, which will therefore be the centerpiece of this study.

The objective of this study is then to gain insight in the relationship between regime stability, violent conflict and forced migration, to understand how an instable government can lead to mass migratory movements of people. My research question therefore is: What is the relationship between regime stability, violent conflict and forced migration? We hypothesize that the lower regime stability, the more forced migration will occur. Theoretical research describes violent conflict as mediating factor between regime stability and forced migration and the main driver of forced migration. Sub questions will therefore address the relationship between regime stability and violent conflicts and between violent conflicts and forced migration.

1.4 Relevance

The relevance of the study lies in the importance of forced migration for current world affairs. The number of forced migrants is at its highest point since the second World War. Their numbers threaten to overwhelm the shelter capacities of many states. Handling the issue of forced migration is thus necessary. However, handling an issue requires understanding it first. This has already been done to a degree. Some studies have shown violence to be a prominent cause of forced migration. Others have studied some of the causes of the violence itself, but an overarching framework is missing. All studies have described some pieces of the puzzle, but not a complete picture. As such, the exact workings of the relationship between an instable regime and forced migration remain unclear. Moreover, almost all studies so far have been regression studies that have only studied one-way correlation, thereby omitting any feedback processes that are at work. Therefore, a more unifying framework is needed and feedback processes need to be considered as well. This study aims to do so.

1.5 SD Model

The relationship between regime stability, violent conflict and forced migration will be described and modelled by using System Dynamics (SD). SD is a modelling approach that allows for detailed

descriptions of complex systems, describing causal relationships between variables within the system and including feedback processes. Examples of such complex systems are the housing market or the earth's climate. Forced migration can also be considered as a complex system, where regime stability, the army and societal violence are the main variables. An SD model is a useful approach to understand and describe the causal effects between the three. Furthermore, SD is explicitly focused on policy discussions. On what to do, where to act in a system and change it, and therefore seems to be useful inroad in understanding and dealing with the migration crisis that seems to engulf Europe (Sterman, 2000).

Choucri and colleagues (2007) have built a SD model for describing regime stability and violence where the interaction between regime stability, the regime and its internal opponents and violence is considered in terms of causal relationships and feedback processes. As such SD has shown to be a fruitful method of describing the relationship between regime stability and violence. However, Choucri and colleagues have not described the relationship between regime stability, violence and forced migration. Nor have they modelled regime stability in a way easily applicable to the Arab Spring. This model will build on the work of Choucri and colleagues but add to that by describing the relationship between regime stability, violence and forced migration and apply it to the Arab Spring. The focus will be especially on Syria as it is, out of the Arab countries that have faced and are still facing mass migration due to the Arab Spring, the one with the most available data on it.

1.6 Set-up Thesis

This thesis will describe and model the relationship between regime stability, violence and forced migration. It will do so by providing both a theoretical framework and a model to test that same framework. The introduction has already shed some light on the overarching framework concerning the dynamic between regime stability, violence and forced migration. However, the framework still requires a more rigorous treatment. The second chapter will provide such a treatment as it will give an overview of the relevant concepts and theories. The third chapter will apply these concepts and theories to the Arab Spring, to both elucidate the concepts and theories and put the events of the Arab Spring in the theoretical framework. The fourth chapter will then discuss and elucidate the methodology chosen to model the dynamic between regime stability, violence and forced migration. The fifth chapter will concern the model itself. It will provide descriptions of the variables and their relationships with another. The sixth chapter will describe the tests performed to test the validity of the model. The thesis

will end with chapter 7, which provides the conclusion and discussion. It will discuss the findings of this study and place them in the theoretical framework.

Chapter 2: A Theoretical introduction

2.1 Regime stability

Thus, the model will be centered around the concepts of regime stability, violent conflicts and mass migration. The aim is to understand forced migration by linking it to violent conflict and regime stability. Some of these concepts have, however, been difficult to define. Defining regime stability has been especially difficult. It seems obvious that when a state, or rather its reigning regime which controls the army, is involved in a civil war, it is no longer stable. Yet, a strict, consensual definition of a stable state or regime has eluded political science so far. Five different definitions have been proposed over the years. They have ranged from the obvious: (1) a state in which there is no domestic violence and where political changes are the result of institutional processes such as elections rather than violence; (2) to a state is stable when its governments remain in power for a long time, thus when its institutions are stable; (3) the stability of a state is defined by the extent to which a government is considered to be legitimate by its citizens, that is whether people find themselves represented by the government and accept its policies and dealings as right; (4) a stable state is one where no structural changes, in its political/social system, take place; (5) a stable state is one where there is 'systemic stability', that is stability depends on several factors such as economic prosperity, economic equality and the presence of political parties (Hurwitz, 1973).

The first four definitions are very specific and quantifiable and not very meaningful. They do not explain the causes of regime stability, but rather a way to measure it. Moreover, the first four definitions are simple yes or no definitions. A regime is stable when it does not have any domestic violence, until it encounters domestic violence and then it is no longer stable. As such, these definitions are inadequate to define and understand both the notion of regime stability and its causes. The fifth definition captures the multi-attributes of a concept as stability better than the other definitions. It captures the underlying fundamentals of the concept better than the other four (Hurwitz, 1973). However, the fifth definition is not exact enough as to allow for precise measurements. It does not state how stability depends on several factors, only that it does depend on them. Nor does it mention factors that might decrease regime stability.

A definition that is both more exact and inclusive of negative factors has been offered by Choucri and colleagues (2007, 2): 'a state is stable to the extent that its resilience (capabilities) is greater than the

load (or pressures) exerted upon it'. The thesis will use this definition of regime stability, as it the most exact and inclusive of all definitions offered. Both the resilience and regime load will be discussed extensively in the coming chapters.

2.2 Regime resilience and state capacity

The resilience of a regime is based on its institutions or state capabilities. The institutions affect all the state's dealings in society and greatly affect the regime's standing in society. It should be noted that there is a difference between a state and regime. The state describes all bureaucracy and government institutions in a country. The regime describes those people, who give direction to the state and determine its rules and regulations. It also contains the rules and regulations themselves, essentially the environment in which the state functions. Consequently, regime and state are not alike. Yet, the regime depends on the qualities of the state for its survival, for people judge a regime on the accomplishments of the state (Geddes, 1999) (Derichs & Demmelhuber, 2014).

Thus, a regime depends on state capabilities, hereafter referred to as state capacity. State capacity is defined as a state's ability to: "penetrate society, regulate social relations, extract resources, and appropriate or use resources in determined ways" (Migdal 1988, 4). A state, no matter whether it is democratic or autocratic, with a high state capacity is less likely to break down under pressure than one with low state capacity. Thus, regime stability depends on state capacity. The higher state capacity is, the less chance a regime breaks down. State capacity can be divided in three different categories: coercive capacity, bureaucratic / administrative capacity and extractive capacity (Hendrix, 2010). However, not all studies do so. Choucri and colleagues (2007), for example, use state capacity as an overarching framework without subdivisions. They use five indicators for state capacity: Employment, GDP/capita, the polity index score, civil liberties score and literacy score of a country. Another study that does not subdivide state capacity is by Faeron and Laitan (2003), who only uses (log) GDP/capita as an indicator for state capacity.

2.2.1 Coercive capacity

Coercive capacity is the cornerstone of a state. For example, Weber (1919, 1) defines a state as: "the human community that (successfully) claims the monopoly of the legitimate use of force within a given territory". The size and extent of the force that a state can use in a territory is the coercive capacity of a state. Coercive capacity shows the ability of a state to maintain order, protect its citizens against threats

and control its borders. These are all required for a state to successfully enforce its policies. Thus, a successful state requires enough coercive capacity to limit these threats and resultantly being able to implement its policies. Coercive capacity can be measured by both (log) military expenditures per citizen of a state, and total of military personnel per 1000 citizens. However, the effect of military expenditures on coercive capacity is still under debate, because military expenditures are linked with corruption. This implies that military expenditures may be more linked with the buying of loyalty of army personnel than with increasing military effectivity. Consequently, higher military expenditures may not necessarily be associated with increased coercive or state capacity (Hendrix, 2010) (Andersen et al., 2014) (Henderson & Singer, 2000).

Moreover, the total of military personnel per 1000 citizens does not seem like an appropriate measurement because it does not give an indication of the strength of the military. For example, at the start of the Arab Spring, the Syrian military existed of 300,000 soldiers. However, many of these soldiers were conscripts and were not deployed out of fear they would defect (Kozak, 2015). Thus, the number of soldiers does not always give a representative view of the coercive capacity of an army and will therefore not be used as an indication of the Syrian coercive capacity strength.

2.2.2 Bureaucratic capacity

Bureaucratic capacity is the broadest capacity of all three. It involves “the ability of a state to design and implement policies throughout the territory, and regulate the economic and social spheres”. Effective policy implementation and regulation requires an state apparatus that is technically competent, has professional agents, proper coordination and monitoring mechanisms and influence with many different social groups across the country. Essentially, effective policy implementation requires an efficient state bureaucracy. Weber (1878) emphasizes the importance of an efficient bureaucracy for state capacity. An efficient bureaucracy, legitimizes a state, manages the complex affairs of a state and ensures the control of corruption and other inefficient state dealings. A high bureaucratic capacity both enables and is measured by a good economy. Indicators of bureaucratic capacity are therefore (log) GDP per capita, quality of the rule of law, regulatory quality and control of corruption of the government (Hendrix, 2010) (Savoia & Sen, 2015).

2.2.3 Extractive capacity

Extractive capacity, on the other hand, refers to the ability of a state to raise taxes. Raising taxes is one of the cornerstones of a state. Both coercive capacity and bureaucratic capacity require money, which a state can gain by means of taxes. Without taxes both soldiers and bureaucrats will refuse to work.

Moreover, being able to raise taxes is a good indicator of state power. States must be able to reach all of their citizens, find (financial) information on these citizens, have good civil servants to collect the taxes and make people pay their taxes. Thus, extractive capacity is both a necessary part of state capacity. It is measured by the amount of taxes/GDP (Hendrix, 2010) (Cheibub, 1998).

2.2.4 Interdependent capacities

All three categories are important, yet different, aspects of state capacity. Moreover, they are interdependent. They cannot exist without one another. Raising taxes is required for establishing both bureaucratic and coercive capacity, while those two are necessary for efficiently raising taxes.

Implementing the policies of bureaucratic capacity depends on coercive capacity and the amount of coercive capacity depends on the successful implementation of state policies. Thus, the capabilities of a state depend on all three of coercive capacity, administrative capacity and extractive capacity (Hendrix, 2010).

2.3 Regime load

However, just the presence of a low state capacity does not cause regime instability. It is low state capacity together with the size of the loads weighing on a regime that cause regime instability. There are two types of loads. There is a load provided by dissidents and a load provided by insurgents. Dissidents are people who protest for change, either a change in regime or a change in regime policies. These protests are non-violent, for example, the protests in the 1960s by Martin Luther King and others can be considered as dissident protests. Insurgents, on the other hand, fight for regime change. Insurgents are dissidents, who have given up belief in regime change by means of non-violent protests and have taken up arms to achieve that regime change. Both pose a threat to a regime, especially an autocratic regime. Protests form a challenge to the power of an autocratic regime in a public space and are therefore a

threat. Insurgents are a more obvious danger as they break the monopoly on violence of state and they use violence to overthrow the state (Choucri et al., 2007) (Sokolowski & Banks, 2007)

Both protests and violent actions motivate others to join respectively the group of dissidents and insurgents. Yet, in a state with a high state capacity, the effect of protests and violent actions on the recruitment of others is smaller than that in countries with a low state capacity. In a country with a high state capacity, fewer people tend to become either dissidents or insurgents as they prefer their government over the change demanded by dissidents and insurgents. Furthermore, more ordinary citizens will actively support the regime. Regime stability will therefore likely be higher (Choucri et al., 2007) (Braithwaite, 2010).

2.3.1 Dissidents and insurgents

Yet, dissidents and insurgents do not suddenly appear out of nowhere. They are a result of structural economic or political problems, such as high unemployment, low economic growth or a lack of political influence. Many of these problems not only bring forward dissidents and insurgents but also affect state capacity directly, for example, bureaucratic capacity is affected by GDP per capita and unemployment. Thus, these factors also affect the rising of dissidents and insurgents. For example, there was a high rate of youth unemployment in the Middle East before the Arab Spring, which caused significant dissatisfaction amongst the young population. This was a huge threat to regime stability, as youths are more likely than other groups to become dissidents or insurgents. The Middle East was especially threatened by this as most Middle Eastern countries underwent a 'youth bulge', before and during the Arab Spring, where a large part of the population is younger than thirty. Consequently, many Arabs were dissatisfied and anxious for change (Aarts et al., 2011) (Bricker & Foley, 2013) (Campante & Chor, 2012) (Malik & Awadallah, 2013) (Korotayev & Zinkina, 2011).

However, these troubles and their effect on people's dissatisfaction with the government often go unnoticed. Few people speak out against the government, because as Kuran (1989) argues the people are afraid of the government and its use of repression to silence those who speak out. Only some 'spark' such as an assassination or act of defiance puts people over the edge. It might be that such a spark shows people it possible to resist the government. Without the 'spark' things are seemingly fine. For example, the king of France, Louis XVI, on the eve of the French revolution, did not expect any violent protests whatsoever, nor did he expect to lose both his head and his throne in all the commotion (De

Tocqueville, 1955). Moreover, in 1977, the CIA declared Iran to be stable and the Shah's position to be very secure. The Shah shared this belief even in 1978. At the end of 1978, the Shah stepped down from his position. Iran became an Islamic Republic soon after (Kuran, 1989).

The same tranquility occurred in the Middle East, which seemed very stable in 2010. Only a few months later, Mohammed Bouazizi set himself in fire in protest against unemployment and corruption in Tunisia. This was the start of huge protests rocking the Middle East. All the simmering economic and political troubles caused disgruntled citizens to participate in protests demanding change (Aarts, 2010).

These demands for change usually take the form of nonviolent protests. By publicly demanding changes, these people become dissidents as they publicly disagree with the policy of the government. Dissidents may, for example, call for reforms in the political system such as implementation of elections, or women's suffrage, food subsidies or less corruption or they may call for regime change. Especially calls for regime change threaten a regime's power and are therefore likely to receive a violent response from the regime (Aarts, 2010).

In general, most non-democratic regimes are not eager to be confronted with dissent, of any form, as it threatens their power. The longer the dissent goes on and the more dissidents there are, the weaker the regime seems to be. Dissidents thus threaten the stability of a regime. However, no autocratic regime wants to seem weak out of fear of being displaced. Thus, they must deal with the dissent. The ways in which autocratic regimes deal with dissent differ. Some regimes listen to the dissidents and may consequently reform. Most, however, refuse to listen or reform. Financially well-off regimes, mostly rich due to oil or other primary resources, use their financial reserves for subsidies, investments and other monetary measures to appease the people. For example, at the start of the Arab Spring, Saudi Arabia announced a 120 billion subsidy program and increased the salaries of its civil servants considerably (Carey, 2009) (Bove, Platteau & Sekeris, 2016) (Yom & Gause, 2012).

Less financially well off regimes, also unwilling to reform, such as Syria, lack the finances to appease the people and consequently may only introduce minor reforms, such as allowing a formerly illegal website (facebook) back up again, and promises of more (minor) reforms. If these reforms do not appease the people, repression will be used. Not all regimes immediately use the army for repression, most only use the police to control the protests. However, if the police is not strong enough to contain the protests and the protests seem to move out of control, a regime may use its coercive capacity, by means of

deploying the army. Or if the regime wants to intimidate dissidents and prevent them from mobilizing at all, it may use the army immediately rather than later (Bove, Platteau & Sekeris, 2016) (Aarts, 2010).

However, repression does not always work. Its effectiveness shows an inverted u figure. Too little repression invites dissidents to mobilize, while too much repression affects both innocents and guilty people. In such an environment, it does not matter whether one is protesting or not, government violence will strike one anyhow. This will only lead to an increase in mobilization and cause people to turn to violence themselves as well. It is only a moderate level of repression that will lead to decreased level of mobilization (Bischof & Fink, 2014). There are five different levels of repression. These levels describe the intensity and scope of government repression in a country. A score of 1 indicates a country where political imprisonment, torture and beatings are very rare. At a score of 2, political imprisonment happens infrequently, torture and beatings are exceptional and political murder rare. A score of 3 indicates a country where political imprisonment and political murder is common. At level 4, political imprisonment and political murder are common and involve a large part of the population. At level 5, these practices involve the entire population (Poe et al., 1999). Bischof and Fink (2014) find that from a level of 4 onwards, repression becomes ineffective.

2.3.2 The Army

The army is of utmost importance in repressing dissidents. Nehru once said: “Always in a revolution the crisis comes when the army, which is the main prop of the government, refuses to fire on their brethren in the crowd” (1934). This remains true. An army can silence all internal challenges to the authority of a regime. For example, in Bahrain during the Arab spring, the army violently repressed the protests as dissidents were put in prison and protest spaces were cleared. However, not all armies are equally willing to silence these challenges. Some armies rather side with the protesters than silence them. Others decide to remain neutral. In these cases, the state lacks coercive capacity, as the army refuses to obey. Without the army, the regime cannot handle the load and challenge of the dissidents and consequently crumbles. The regime proves to be unstable and incapable of stabilizing itself by means of repressing dissidents (Nepstad, 2011).

In the case of a loyal army the consequences may differ. If the army remains loyal, the full coercive capacity of the state can be used to repress dissidents. Dissidents, confronted by the full coercive capacity of the state will not be enthusiastic in becoming insurgents as insurgents are resigned to a certain death when confronting the full wrath of a state’s army. In this way, the coercive capacity of the

state will repress and diminish the number of dissidents and prevent dissidents from becoming insurgents, thereby restoring regime stability (Nepstad, 2011) (Nepstad, 2013).

The loyalty of an army depends on three factors: (1) whether the army selects its own officers; (2) whether the country has a competing security force; (3) whether the army is a conscript army rather than a volunteer army. An army that selects its officers tends to be less loyal to a regime. Officers view themselves as state employees rather than regime employees, and will therefore be more likely to side with their dissident countrymen than the regime. This is unlike the case where the regime appoints the officers, for example, in Saudi Arabia many members of the royal family have positions in the army. They will always be loyal to their family and thus by extension the regime. The same applies to other regimes who appoint their officers. A competing security force, that receives money from the state, threatens the wellbeing of the army and thus its loyalty. Competing forces motivate the army to become disloyal and thereby get rid of both the regime and the competing security force. Soldiers in a volunteer army tend to be more loyal than soldiers in a conscript army, as they are more enthusiastic and motivated for their chosen profession. Moreover, they tend to be more loyal to the regime that has allowed them to join (Tofalvi, 2012).

If the army is not entirely loyal and is required, by the regime, to commit violence against dissidents and/or insurgents, or rather their fellow countrymen, soldiers may desert and leave both the army and country. They may also defect and become insurgents to fight against the government instead of supporting it, during the Arab Spring, defecting soldiers were the main sources of insurgents. Once some soldiers defect, others follow swiftly (Barnaby, 2011). In this way, the coercive capacity of the regime is weakened and the number of insurgents increases. As such, the regime becomes increasingly unstable and the threat of civil war looms.

2.4 Regime stability and violence

Thus, insurgents can be both dissidents who have turned to violence and ex-soldiers who refused to repress dissidents and insurgents. Insurgents are therefore those who use violence against a regime. Violence can be defined as: “behavior involving physical force intended to hurt, damage, or kill someone or something” (Retrieved from: <https://en.oxforddictionaries.com/definition/violence>). Insurgents seek to overthrow a regime by means of violence. These violent actions can have the form of assaults on soldiers or civilians, bomb attacks, suicide attacks, assassinations, or likewise. These violent actions have

two effects. First they show the strength of the insurgents. The stronger insurgents are, the more people are willing to join. Second, it shows the regime to be weak. The weaker a regime is vis-à-vis insurgents, the more people prefer to support the insurgents rather than the regime. Thus, insurgent violence diminishes the strength of a regime and motivates people to become insurgents. As mentioned before, it also negatively affects the economy and thereby state capacity. Thus, insurgents' violent actions decrease state capacity in two ways (Kilcullen, 2009) (Anderson, 2013) (Anderson & Black, 2007) (Metz & Millen, 2004).

The regime must respond to the insurgents' violence or risk being made look weak and eventually being overthrown. Thus, the regime increases its own level of violence against the insurgents. The insurgents then must respond with violence as well, or risk looking weak and thereby lose the struggle for popular support. The problem for the regime is that, depending on the size of the country and the terrain (mountainous or flat) insurgents are hard to find and defeat. Thus, regimes tend to participate in a lot of indiscriminate violence, such as arrests, torture and killings of anyone who is seemingly related to the insurgency (Kilcullen, 2009) (Metz & Millen, 2004) (Schutte, 2014).

This indiscriminate violence of the regime causes more people to abhor the regime, thereby decreasing regime legitimacy and state capacity, and join the insurgency. Whereas regime violence leads to more supporters for the insurgents, insurgent violence often does not lead to more government supporters. It often leads people to support the insurgents, who are perceived as being successful in their struggle against the government, while the government is perceived as lacking in not preventing the actions of the insurgents. Insurgent actions thus diminish the public's trust in the government and increase the public's support for the insurgents, as the successful side (Kilcullen, 2009) (Metz & Millen, 2004) (Anderson & Black, 2007) (Lyall, 2013). In this way, violence between a regime and insurgents once started tends to escalate. The number of violent actions committed by both parties rises and the conflict itself also intensifies, as measured by the number of deaths in the conflict.

Thus, the number of insurgents depends on the loyalty of the army, the state capacity and size of the population. The less loyal the army is, the more soldiers will desert or defect and join the insurgents. The greater the state capacity, the more people trust and like their regime and the less people are willing to join the insurgents. However, violent actions have a negative effect on state capacity as people see the regime as weak versus the insurgents or indiscriminate in its violence against civilians. The violent actions also lead to a poorer economy and thus a smaller state capacity. In these cases, people grow disillusioned with the government and may turn from dissidents into insurgents, the number of which

depends on the total number of dissidents and people in a country. The increase in insurgents drives the regime to be increasingly violent as well, in order to reduce the threat of the insurgents (Choucri et al., 2007) (Moore & Shellman, 2004) (Hegre et al., 2001).

2.5 Violence and migration

In this way, the violence between the two parties spirals out of control as both parties commit more and more violent actions. This leads to a decrease in state capacity and an increase in the load on the regime, as the number of insurgents increases, therefore regime stability decreases. The increasing violence also leads to an increase in the level of migration. The level of violence between the regime and opponents is a main factor influencing migration levels, as forced migration describes those people who migrate due to: “coercion including threats to life and livelihood, whether arising from natural or man-made causes (e.g. movements of refugees and internally displaced persons as well as people displaced by natural or environmental disasters, chemical or nuclear disasters, famine, or development projects)” (International organization of migration). Forced migration can thus be defined as the migration of people due (to fear of) violence (Moore & Shellman, 2004).

The working definition of forced migration is in line with theory, which states that violent conflict is the main cause of forced migration. Researchers find that people leave their houses and possibly country when they fear for their liberty, safety or life. People can handle a certain amount of danger, but when danger levels exceed this amount, people leave. In this way people are forced to leave because of danger. A forced migrant is therefore someone who, “due to a fear of persecution, has left his or her house to live in a different country or somewhere else in the same country” (Moore & Shellman, 2004), i.e. in this last case one is called an internally displaced person (Davenport et al., 2003) (Moore & Shellman, 2004).

Moore and Shellman (2004) find that it is violence of all different participants that drives people to migrate. People especially flee from human rights abuses and genocide. These are common features in a civil war as a civil war, unlike a war between states, is characterized by civilians being a primary and deliberate target of all parties involved. As such, civil wars are even more dangerous to people than normal wars and cause more forced migration (Kriger, 1992).

Regimes tend to use indiscriminate violence and terror to subdue the insurgents. However, this approach of repression based on indiscriminate violence and terror does not seem to be very effective,

rather than demotivating rebel supporters, it instead drives civilians and dissidents to support insurgents. Especially aerial bombardments are a proven way of increasing anger and frustration with the regime. Moreover, it creates civilian casualties and violent responses of the insurgents, who have to prove their effectiveness against the regime (Kocher et al., 2006) (Jenkins, 2013) (Lyll, 2009).

These violent tactics and responses of both parties create huge amounts of refugees (Jenkins, 2013) (Schmeidl, 1997). Yet, refugees do not all leave all at the same moment. Some people are more willing than others to leave. Melander & Oberg (2006) write that unlike in the model discussed by Moore & Shellman (2004) people have different notions of what is dangerous or when they should leave. Those most sensitive to danger leave first, whereas others find the benefits of leaving only high enough in the face of high amounts of danger. Some don't even leave at all. In this way, the amount of people migrating declines over time. As at a certain point in time only those unwilling to leave are left.

Thus, when the conditions in a country are so that people are dissatisfied, due to demographic and economic causes, they may become dissidents. The regimes may placate these dissidents by reforms, at the expense of their own political power, money or attempt to repress the dissidents. Most regimes are unwilling to lose their political power and therefore decide on the option of repression. Repression can be mild and done by the police or severe and done by the army. If the army is completely loyal, the dissidents will most likely be repressed successfully. If the army remains partially loyal, soldiers will defect and join the insurgents and eventually start a civil war leading to mass migration. If the army is completely disloyal, the regime will fall as it loses its coercive capacity and is shown to be powerless to stop the dissidents. Only the scenario of a partially disloyal army will lead to civil war and mass migration.

Chapter 3: Regime stability, violence and migration in the Arab Spring

3.1 Stable Arab regimes

When studying the Arab regimes, the influence of state capacity on the occurrence of political conflict seems to be limited. GDP per capita had been growing in all countries, while extractive capacity had grown smaller since the 1990s. Taxes/GDP was low, especially in the monarchies, due to the huge oil rents they received which caused the monarchies to not need to raise taxes for the budgets. The steady economic growth allowed Middle Eastern regimes to enter a bargain with their citizens. In this bargain, the citizens, in exchange for economic prosperity, accepted limited freedom of expression, limited freedom to associate and only some political influence, mainly in the form of limited or sham elections. Thus the people accepted wealth in exchange for respecting the regime's power. If citizens were not willing to respect the regime's power, swift repression followed. As a result, dissidents ended up in prison or worse. This system depended on the regimes delivering steady economic growth, which they did and the regimes' stability seemed high in 2010 (Aarts et al., 2011).

However, the regimes' stability proved to be not very stable. Although the Arab economies grew very well, not all people benefited. In Syria, for example, poverty also increased. Moreover, unemployment and especially youth unemployment did not decrease over time. The steady unemployment combined with the constant population growth meant that, in absolute numbers, more and more people and especially youths were unemployed. The youth unemployment led many youths to remain stuck in a pre-adulthood. Their lack of jobs, prevented them from gaining satisfaction in work, social prestige by having a job, declining chances of marriage (dowries are expensive in the Middle East) of renting or buying a house and thus of developing themselves. They were stuck, and as their society seemed deaf to their dissatisfaction, they protested late 2010 (Mulderig, 2013).

They had been protesting earlier as well. There had been minor protests in Egypt, Tunisia, Jordan and Algeria. However, none of the protests ever turned into mass movement. They were repressed quickly and thus never threatened their regimes (Oweidat, 2008). Thus, giving no reprieve to the dissatisfied youths. It was only in 2010 that protests not only threatened their respective regimes, but even managed to bring some of them down.

3.2 Instability & the start of the Arab Spring

Interestingly enough, state capacity, as measured by Choucri and colleagues, had only grown stronger since the 1990s (see chapter 5). The protests therefore seemed unlikely to become large and even overthrow their regimes. And yet, some did. The protests, later called the Arab Spring, started in December 2010. The 'spark' was lit when a Tunisian street vendor self-immolated because of his frustration with the corruption and poor economic prospects of the Tunisian regime. The self-immolation was filmed and quickly spread via social media causing many Tunisians to clamor for political change. Their clamors soon turned into non-violent protests demanding change. Youths were the main drivers of the protests, but elders joined in later as well (Ozegin & Husey, 2014) (Mulderig, 2013).

The Tunisian regime, at first, did not take the protests very seriously. They simply expected the protests to not go beyond the rural areas and be contained by the police. Minor reforms were announced to silence the dissidents. However, this did not help and the protests did spread to the cities. They grew larger and larger, until the police could no longer contain them, at which point the Tunisian regime grew afraid and sent the army to violently repress the protests. The army, however, sided with the protesters and refused to repress them. Rather than going on the streets, the soldiers remained in their barracks. Soon afterwards the Tunisian regime, threatened by the protests and the lack of support from the army, crumbled and its leader fled the country (Brooks, 2011).

3.3 The Regimes' responses and migration

The protests spread from Tunisia to Egypt, which like Tunisia used the police and minor reforms to contain the protests. In Egypt, this strategy did not work either. The Egyptian regime eventually, like the Tunisian regime, deployed the army to repress the protests and here too the army refused to repress the dissidents. Without army support the Egyptian regime crumbled (Barany, 2011).

After the successes of bringing down the regimes in both Egypt and Tunisia, protests occurred in many Middle Eastern countries. However, the severity of the protests was significantly less in most of the Arab monarchies, such as Saudi Arabia, Kuwait, Qatar, Jordan and Morocco than in the Arab Republics, such as Libya, Yemen, and Syria. There were some exceptions, for example, Bahrain which is a monarchy experienced severe protests, while Algeria, a republic, did not. Explanations for this discrepancy have been offered. These explanations do not include state capacity because state capacity had grown in all

countries, since the 1990s, and therefore did not seem a likely explanation for the difference in the severity of the protests between the countries (see chapter 5). The explanations that were offered for the resilience of the monarchies instead focused on the actions taken by the regimes. Most of the Arab monarchies and Algeria, had oil wealth which they used for subsidies, salary increases and other payments to buy off the people. For example, Qatar offered its citizens money thereby attempted to buy their silence. Saudi Arabia, on the other hand, announced a 120 billion subsidy program after the start of the Arab Spring. Jordan and Morocco meaningfully reformed in response to the demands for change and thereby prevented the protests from turning into something worse. The Arab republics, on the other hand, lacked the finances to buy their citizens' silence and the willingness to reform. They were therefore hit harder (Yom & Gause III, 2012) (Brownlee et al., 2015).

Moreover, the level of repression explains how conflict intensified in some countries. The level of repression, in the Arab republics, was higher than that in the monarchies. All except one of the Arab monarchies only used their police forces to contain the protests, while many of the Arab republics deployed their armies to subdue the protests, as they lacked both oil wealth and the willingness to significantly reform. Of the Arab republics only Lebanon, Algeria and Iraq did not. These three had experienced recent civil wars or were already mired in civil war and both their dissidents and governments were therefore not enthusiastic about the prospect of more violence, and consequently did not deploy their armies or protest violently and consequently survived the Arab Spring. Of the monarchies, only Bahrain deployed its army. The deployment of the army led in all cases to more mobilized dissidents and in some cases to the fall of the regime. If the army is not loyal to a regime, the regime loses its capability to threaten the dissidents and has no other options but to accede to their demands. This happened in Egypt and Tunisia (Bischof & Fink, 2014) (Aarts et al., 2011) (Brownlee et al., 2015) (Korotayev et al., 2015).

Where the regimes in Tunisia and Egypt fell because their armies refused to repress the protests, the armies in Libya, Syria, Yemen and Bahrain proved to be more loyal. The armies of Egypt and Tunisia had defected because in both cases, the officers, which were not appointed by the regime, decided they would not support the regime, nor were the conscripted soldiers eager to shoot their brothers. In Syria, where the regime appointed officers, almost all officers remained loyal. In Libya and Yemen some officers became disloyal and joined the insurgents. In Libya, the army was regarded as less important than security forces and consequently soldiers defected. Many conscripted soldiers also turned on their former paymasters, because they did not want to fire on their countrymen. However, volunteer soldiers

remained loyal to their regimes. This caused civil wars in both countries. In case of Syria, although the officers remained loyal, its army was also a conscription army. Consequently, many of the conscripted soldiers refused to shoot on the dissidents and instead defected from the army to become insurgents, to attack the army and defend the dissidents. Only the Bahraini army, which was a volunteer army, and whose officers were appointed by the regime, did not become disloyal or suffer defections (Barany, 2011) (Tofalvi, 2012).

Moreover, the Bahraini army was also limited in its use of repression, whereas, Syria and Libya used the full power of their armies. For example, Syria used snipers to fire on protesting dissidents, soldiers opened fire at random, soldiers performed house to house searches armed with guns and knives and tanks rolled in the city streets. As the protests continued and the insurgency grew stronger, the violence of the Syrian army intensified. Helicopters and jets were used, they performed intensive and indiscriminate aerial and artillery bombardments on both insurgents and dissidents. When striking dissidents, they indiscriminately hit civil buildings, such as commercial buildings, hospitals and food production buildings. These tactics have the purpose of putting fear in the hearts of both insurgents and dissidents as to make them stop their anti-regime behaviors. However, in this case the tactics did not work and many soldiers and dissidents became insurgents (Droz-Vincent, 2014) (Jenkins, 2013) (Bischof & Fink, 2014)

However, it was and is not only the regime which uses extensive violence. The rebels do too. In Syria both the government and the rebels kill civilians indiscriminately, although this is forbidden by the code of Geneva ("Syria: rebels' car bombs, rockets kill civilians", 2015). This type of violence, both by rebels and the government, is a threat to civilians and its intensity and amount have a large influence on the threat perception of civilians. Because of the escalating violence in both Syria and Libya, millions of Syrians and Libyans have fled their countries.

3.4 Hypotheses and assumptions

A model does generally not answer hypotheses. Instead it makes or finds assumptions, in other studies, to build its structure on and then tests its assumptions by comparing the output of the model to real data. The purpose of a model is to capture a part of reality and see whether its way of capturing reality can be considered valid. The important question of a model is whether its description or understanding of reality can be considered as true. Based on the theory discussed so far, several assumptions have been made that the model must adhere to, in order to not violate reality.

We assume that the level of repression affects the total number of violent incidents as it will lead to an increase in the number of dissidents that become violent. If the army is a conscript army, or one which appoints its own officers or one which has another security force as rival then soldiers will refuse to commit violent incidents and instead defect. We also assume that the more soldiers defect, the stronger the insurgents become, the more violent the response of the regime will be and the more violent incidents will happen in total. Furthermore, we assume that the more violent incidents happen the more people will migrate.

Chapter 4: Methodology

4.1 Simulation and statistical modeling

The relationships between regime stability, violence and forced migration have been discussed extensively in the previous chapters. Yet, theoretical research so far is limited in explaining these relationships. Studies have described the relationship between regime stability and violence and between violence and forced migration. The relationship between regime stability and forced migration is not explicitly discussed and thus only known implicitly. Moreover, studies aimed at explaining the relationships between the factors have mostly done statistical modeling by means of regression studies. These regression studies are limited in their explanatory value because normal regression analyses, such as ANOVA or MANOVA, only describe the correlation between the dependent and independent variables, without regard for structure. A structure is necessary for understanding the behavior of a system, for example, the mortgage market or the climate. It describes all the actors, institutions and other forces involved in the mortgage market or climate. By describing the relationships between all these variables, one can attempt to understand the complete behavior of the system. An important role in a structure is played by feedback loops, where two variables (or more) affect each other. The dynamic between regime stability, violence and forced migration also forms a system, as will be discussed in chapter 5, where feedback loops play an important role. Normal regression analyses do not describe the structure nor do they describe the relationship between independent variables or any form of feedback between variables. Since understanding the structure, including feedback, is necessary for replicating the behavior of a system normal regression analyses will not be used in this study. This leaves two options, the use of simulation, on the one hand, or structure sensitive modeling procedures such as structural equation modeling (sem) and path analysis, on the other hand (Field, 2009) (Sterman, 2000) (Byrne, 2010)

Simulation models the structure of a real-life system, such as the climate or the mortgage market. It describes the interaction between the different parts of the system by means of equations to replicate the dynamic change, especially feedback, and behavior present in these real-life systems. Thus, modelling the structure of the real-life system gives rise to understanding the behavior of the real-life system. In simulation, the structure is key and a correct model of the structure allows for replicating the actual behavior of the systems. Structural equation modeling and path analysis also model the structure of a system, which includes feedback loops. They do, however, still differ from simulation methods in

their understanding of the relationships between the variables within the structure. Simulation uses causal relationships between variables rather than the regression coefficients used in structural equation modeling and path analysis. This difference in measurement of relationships between simulation and the two statistical methods poses a problem when describing the relationship between regime stability, violence and forced migration. Since simulation works with causal relationships, it only needs one case to found the structure on. If it works in one case, it can be generalized to other cases. This does, however, not apply to structural equation modeling and path analysis, which require a minimum of 30 case, to account for inter-country effects, as they work with statistical relationships. Unfortunately, there are not enough cases to build a reliable sem or path model (Stermann, 2000) (Byrne, 2010) (Wolf et al., 2015).

Since 1980, there have been 32 countries which have produced more than 25000 refugees. The majority of the total number of refugees has been produced by only 10 countries. These are Afghanistan, Iraq, Syria, Burundi, the Democratic Republic of Congo, Somalia, Sudan, Colombia, the Caucasus and the former Yugoslavia (Global Trends Forced Displacement in 2015, 2015). However, in many of these cases there is not sufficient data available for study. Nor have there been many studies on the causes of the violence in these countries. Moreover, not all of these cases show a clear relationship between lower regime stability, protests, insurgents and civil war. In Iraq, for example, the insurgency that caused mass migration was a response to the American invasion rather than a domestic situation. In Afghanistan, the forced migration first arose due to the Soviet invasion in 1979 (Fisk, 2005). This applies to some other cases as well. Thus, the lack of data poses a significant problem for modeling the relationship between regime stability, violence and forced migration by means of sem and path modeling as the number of applicable cases is too low for a proper model fit. Both the sem and the path model will not give a reliable model, meaning that the regression coefficients will most likely not give an accurate representation of reality.

Moreover, both sem and path modeling measure the model fit at certain points in time based on time points and data inserted by the user (Byrne, 2010). Simulation, on the other hand, only requires one to insert the data once and then let the structure determine the resulting outcome or behavior of the system. In this way, simulation puts the assumptions one has about the relationships between the variables to the test. If the output of the model, after a certain time period, does not fit the expected outcome the assumptions one has are wrong (Stermann, 2000). This makes simulation dynamic, as the system or structure itself changes the data which is not the case with sem or path modeling. They do

show the overall structure of the model, and regression coefficients between separate variables but not how a change in a variable, or assumption about relationships between variables, drives change in the total behavior of the system. As we would like to know the effect of every variable on the total behavior of the system, for example, whether or not an army is a conscript army or the effect of army size on the behavior of the system, both sem and path modeling do not seem applicable methods.

Thus, sem and path modeling are, with regard to this study's topic of regime stability, violence and forced migration limited in their usefulness due to the small number of cases and the importance of measuring total system behavior. Simulation proves to be the most applicable method. Thus, simulation will be used in this study. The goal of this study is to describe the relationships between these three factors and explain them by means of simulation. The research design of this study is therefore a combination of description and explanation by means of computer-assisted simulation.

4.2 Types of simulation

There are three major types of simulation, namely: Discrete-event Simulation (DES), System Dynamics (SD) and Agent Based Simulation (ABS) (Borschev & Filippov, 2014). SD will be used in this thesis, as SD is the most appropriate method for the subject at hand. ABS could have been a useful option, especially in analyzing the behavior of dissidents, insurgents and migrants on an individual level. However, modelling the individual behavior of these actors has only begun quite recently and is not yet well developed enough to describe the relationship between regime stability, violence and migration (Lemos et al., 2013). Especially because most of the studies cited in this study have assessed this relationship on the country level rather than the individual level and are therefore not very applicable to agent based models. The details of this relationship are not yet well described enough so far to model. Thus, ABS does not seem as an appropriate method for understanding the relationship between regime stability, violence and migration.

DES also uses individual actor behavior in modelling system behavior and because the information necessary for modelling this behavior is lacking, DES is not appropriate to use for this study. Moreover, DES only models feedback relationships implicitly and does not attribute much importance to feedback relationships to explain system behavior. The focus of DES in explaining system behavior lies in including stochastic or random behavior within a system. This is, however, at odds with the purpose of this study which explicitly requires feedback relationships between the different variables to be discussed. The purpose of this study is also to explore and study the causal relationships between regime stability,

violence and forced migration. Theory on these relationships implies deterministic rather than stochastic relationships, which makes DES a non-appropriate method. Furthermore, DES uses discontinuous time steps, dependent on the timing of pre-ordained events, which does not seem appropriate when modeling the relationships between dissidents and protests, violent incidents and insurgents and migrants because these relationships depend on continuous time steps. Violent incidents are continually caused by insurgents and protests by dissidents and not dependent on any event or discontinuous time-step. Thus, DES does not seem appropriate for this study and will therefore not be used (Borschev & Filippov, 2014) (Morecroft & Robinson, 2005).

SD, on the other hand, uses aggregates rather than individual behavior, which is better described with respect to migrants and dissidents as there is simply not known enough about the individual behavior of dissidents, insurgents, defecting soldiers and migrants. Moreover, a concept such as state capacity or regime stability is an aggregate per se and very difficult, close to impossible, to describe by means of simulating individual behavior. In addition, SD has explicit feedback processes in its models which seems appropriate when describing the relationship between regime stability and violence. Furthermore, SD uses continuous time steps that allow for continuous analysis of the dynamic relationships between the variables (Sterman, 2000).

Additionally, Choucri and colleagues (2007) have shown that regime stability and civil unrest together form a system that can be described by SD. SD allows for the modelling of the dynamics between different actors, actions and structures, such as the state and insurgents, in the environment of a nation-state. By modelling these dynamics, one can understand what policies to undertake to strengthen a regime and lessen the loads on it. As such, SD is a good method for understanding the dynamics between the state and dissidents or insurgents in the Middle East. This thesis will therefore use SD as simulation method.

4.3 System Dynamics

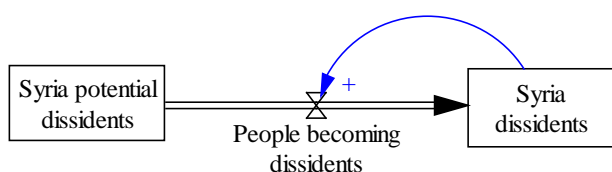
SD conceptualizes and models systems, tests its own models and assumptions with empirical data and then allows for the testing of different policies or decisions on the behavior of the system. In this way, there is both a scientific and a practical side to SD. SD is not just understanding systems but also about policy, or how to change or act within a system for a specific purpose. For example, the housing market could be modelled by SD, with empirical data from a country, that tests the effects on the housing market, of a possible policy such as the raising of taxes on the buying of a house. Or one could observe

the effects of repression, by authoritarian regimes, on civil unrest and migration within a country (Stermann, 2000) (Winz, 2008).

SD has been used to analyze many different systems. For example, the automobile market, the development of an insurgency in a country, the oil market and countless others. A benefit of SD is that it supersedes the artificial notion of linear causality, where there is a cause and an effect. By modelling feedback processes, there is a more realistic notion of non-linearity present, such as how violent actions lead to more violent actions. In this way, an effect can also be its own cause. This feedback dynamic of SD creates dynamics that are hidden or not captured at all in straightforward cause and effect models. Furthermore, the combination of empiricism and conceptualization allows for a better understanding than either an empirical or a conceptual approach (Stermann, 2000).

There are some concepts central to SD, especially the concepts of stocks, flows and feedback. Stocks are accumulations that have developed over time, for example, the amount of water in a bathtub or the number of people in a country. Stocks change over time because of in- and outflows. Inflows increase a stock and outflows decrease a stock (Stermann, 2000) For example, if the number of people in a country is taken as a stock, the number of births is an inflow and number of deaths is an outflow. Figure 1 is an illustration of a small SD model that shows two stocks, a feedback relationship and a flow that is both an inflow and an outflow.

Figure 1: Example of a small SD model



The two stocks in figure 1 are the number of dissidents, in Syria, and the number of people who are not yet dissidents but are potentially willing. There is an outflow from Syria potential dissidents to Syria dissidents. This describes the number of potentially willing dissidents who become actual dissidents. This flow decreases the number of potential dissidents and is therefore an outflow. At the same time, it is an inflow to the number of Dissidents in Syria, because that increases as people become dissidents.

These stocks and flow are influenced by feedback. Feedback describes how the output of a certain variable affects the input of another variable. Figure 1 shows a positive feedback loop from Syrian dissidents to people becoming dissidents. It is a feedback loop because the number of Syrian dissidents affects the amount of people going from potentially willing to being dissidents. The more dissidents there are, the stronger the movement seems and the more likely people are to join it. Thus, as the one stock increases so does the inflow. This is then a positive feedback loop (Sterman, 2000) (Meadows, 2008).

4.4 Drawbacks of System Dynamics

There are also some drawbacks to using SD. Foremost, modelling a system requires extensive knowledge about such a system. Often not all knowledge is available and one must work with estimates and educated guesses. These can affect the extent to which the model captures the real-life system. Moreover, there is the risk of 'overfitting' the available data. That is, one can tweak the model so long, and develop all kinds of extra variables, for the model to fit the real-life system data extremely well despite it being a poor model (Sterman, 2000).

4.5 Validity testing

As mentioned before, the model will focus on Syria. Just modeling Syria may pose a validity issue as a single case study poses questions about generalizability. However, the structure of the model is based on general theories, not specific to Syria. Thus, conclusions drawn from the model are still based on the generally applicable structure of the model and may therefore be generalized. Furthermore, the current civil war in Syria makes it difficult to gain precise data, and estimates are therefore used. This should not negatively impact the validity of the general behavior of the model but the exact system behavior in Syria cannot not be replicated perfectly.

Another important drawback of system dynamics is the difficulty of determining whether or not a model is a good model. there is the question of verification of a model. When is a model a good model? There is no easy answer to this question, as opinions differ on what is important in a model. Moreover, it is impossible to find whether it really captures the objective truth of the system it attempts to portray. The impossibility arises from the simplified nature of the model. A model is always a simplified version of a real life system and is therefore limited in its ability to capture reality. What matters then is whether a

model can be considered useful. Does it capture what it intends to capture? As such validation is necessary to estimate the usefulness of the model and thereby build trust in it (Sterman, 2000).

All these issues should be kept in mind when modelling. Fortunately, Sterman (2000) has developed several tests to account for these issues. These validity tests determine whether a model adheres to the quality standards and does not fall to the aforementioned issues. Moreover, the validity tests also offer some idea of how good a model is. These tests will be performed to observe the quality of the model and account for the drawbacks of SD.

4.6 Data

The data used for the model is based on estimates. The Syrian regime has forbidden journalists from entering the country, henceforth verification of data is impossible and estimates are used. The estimates come from several sources. Data on the number of dissidents comes from several newspapers, such as the New York Times. These articles report around, at least 100,000 dissidents in March and hundreds of thousands of dissidents in April, May and June ("Dozens of Syrians reported killed in Daraa", 2011) (Stack & Zoeff, 2011) (Daragahi, 2011) (Daragahi & Sandels, 2011). One newspaper article mentioned at least 300-400 thousand dissidents in July in one city, the city of Hama. The same article quoted a government official who said there were only 30,000 dissidents in Hama in July (Harkin, 2016). Another article quoted a Syrian man who concluded there were 650 thousand dissidents, in Hama in July and another 500,000 dissidents in another city ("Protestors killed amid huge Syria protests", 2011). These different estimates make it difficult to ascertain the truth. The government official wants to downplay the size of the protests, while others want to impress the West by mentioning large numbers of protests. The very high estimates and low estimates seem to be guilty of downplaying and exaggerating, consequently this study will stick to the estimate of hundreds of thousands, which can range from 300,000-800,000. It is most likely closer to 800,000 than 300,000, if we find any truth in the statement of 300,000 dissidents in one city in July. In this study, we have based the number of dissidents on the number of unemployed youths between 17-26. This age group is the one group most easily activated to protest. Unemployed to them means significant social and economic disadvantages and therefore a significant reason to protest (Mulderig, 2013). The number of unemployed youths between 17-26 is 670,000 and fits the number between 300,000-800,000.

The data on army size is clear. All sources agree on pre-war army size of 300,000 soldiers (Black, 2015) (“With Syria army in tatters, pro-Assad militias fill the gap.”, 2015) (“Syria launches new commando force as war heats up.”, 2016). The number of army defections is, however, less certain, especially the number of army defections per month. Nevertheless, the consensus seems to be that by May 2012, tens of thousands of soldiers had defected, estimated by Lister to be at least 60,000 in total, of which at least half joined the insurgents, while the rest simply moved away (Pfeffer, 2012) (Lister, 2016).

Data on the number of insurgents is difficult to come by, because the insurgents themselves report their numbers. The lack of journalists in Syria makes it difficult to verify their claims. Nevertheless, the insurgents have grown in size enormously from a reported 10,000 in October 2011 and around 40,000 in May 2012 of which 30,000 were rumored to be ex-soldiers and 10,000 civilians (Pfeffer, 2012) (Abouzeid, 2012) (Stack, 2011).

Data on the number of protests and violent incidents comes from GDELT. GDELT monitors a countless number of newspapers in 100 countries and puts events, such as protests and strikes, as mentioned by the newspapers in a database. The data on state capacity variables has been retrieved from different sources. Employment numbers, regulatory quality and rule of law numbers have been retrieved from the World bank. GDP/capita and taxes/GDP have been retrieved from the IMF. The numbers on civil liberties have been retrieved from Freedom House and the polity index has been retrieved from the Polity project. The number of Syrian migrants has been retrieved from the UNHCR database (from: <http://data.unhcr.org/syrianrefugees/regional.php>).

Chapter 5: Analysis and model

To understand the dynamics of regime stability, violence and forced migration an SD model has been developed. The model describes the protests and their consequences in Syria. The case of Syria clearly displays the dynamics at work. In response to the protests, the Syrian regime used its army to subdue the protests. Not all soldiers, however, remained loyal to the regime. Many abhorred the violence they had to use against the protests and therefore decided to become insurgents, rather than soldiers. The violence by both insurgents and soldiers led many people to flee Syria. Syria therefore is a good country to show the relationship between regime stability, violence and forced migration. The model works over a period of 17 months. It is limited to 17 months, as Syria officially entered a civil war in June 2012 (Ghattas, 2012). The dynamics of a civil war are quite different from those of an insurgency and therefore require a different model. However, the dynamics between regime stability, violence and migration can be understood by modelling the pre-civil war phase.

5.1 Analysis of state capacity

Theory attributes an important role to state capacity in affecting the relationship between regime stability, violence and migration but measuring state capacity is not altogether easy. An SPSS study was performed to test the effect of the state capacity variable on regime stability in the Middle East. This was done because data inspection showed a non-causal relationship between state capacity, as measured by Choucri and regime stability, measured by the severity of the protests. For example, Syria which experienced severe protests had a higher state capacity (=4.54) than Saudi Arabia (=2.34), UAE (=1.91), Oman (=4.11) which experienced only minor protests. Moreover, Tunisia which also experienced severe protests, had a higher state capacity (=2.05) than the UAE and quite close to Saudi Arabia. This showed that state capacity does not have a causal relationship with regime stability, consequently statistical research was done to understand the relationship. This SPSS study uses a study by Byun and Hollander (2015) as template for testing. Byun and Hollander (2015) ranked all countries in the Middle East and North Africa on the severity of protests during the Arab Spring, as shown in the figure 2.

Figure 2: Severity of protests during the Arab Spring

Country	Outcome	
Egypt	Regime overthrown.	“Regime threatened or removed”
Libya	Regime overthrown.	
Tunisia	Regime overthrown.	
Yemen	Regime overthrown.	
Bahrain	Militarized, civil insurrection.	
Syria	Militarized, civil insurrection.	
Algeria	Major demonstrations.	
Iraq	Major demonstrations.	
Jordan	Major demonstrations.	
Kuwait	Major demonstrations.	
Lebanon	Major demonstrations.	
Morocco	Major demonstrations.	
Mauritania	Minor, isolated protests, if any.	
Oman	Minor, isolated protests, if any.	
Qatar	Minor, isolated protests, if any.	
Saudi Arabia	Minor, isolated protests, if any.	
UAE	Minor, isolated protests, if any.	

They grouped the outcomes in three different groups. Minor protests, major demonstrations, and regime threatened or removed. Thus, the severity of these protests can be scored from 1-3, with 3 being the worst, as an ordinal variable. The severity of the protests is an indication of regime stability in the different countries. It can therefore be used as a dependent variable when testing the effect of state capacity. Admittedly the statistical importance and confidence in the findings is limited as the sample size N=17 is not enough for a definite conclusion. However, despite the limited sample size the findings of this study offer some perspective on the effect of state capacity indicators on regime (in)stability.

With regard to state capacity, Hendrix (2010) offered several variables that can be used as indicators. For example, he used GDP/capita, taxes/GDP and military expenditures. Another study, one by Choucri and colleagues used other indicators to measure state capacity. They measured state capacity or regime resilience as an overarching variable, consisting of an interaction between five variables: polity index, civil liberties index, GDP index, employment index and the literacy index. The formulas necessary for computing state capacity can be seen in figure 3.

Figure 3: Formulas regime resilience Choucri et al.

$$\text{Regime_Resilience}_t = \alpha_t * \beta_t * \gamma_t * \delta_t * \varepsilon_t$$

$$\text{Polity Index: } \alpha_t = |\text{Polity}_t / \text{Polity}_{1980}|$$

$$\text{Civil Liberties Index: } \beta_t = \text{Civil_Liberties}_t / \text{Civil_Liberties}_{1980}$$

$$\text{GDP Index: } \gamma_t = (\text{GDP}_t / \text{Population}_t) / (\text{GDP}_{1980} / \text{Population}_{1980})$$

$$\text{Employment Index: } \delta_t = \text{Emp_per_Capita}_t / \text{Emp_per_Capita}_{1980}$$

$$\text{Literacy Index: } \varepsilon_t = \text{Literacy}_t / \text{Literacy}_{1980}$$

Choucri and colleagues compare the values of five different variables in a certain year to those in the base year of 1980. The five variables used are the polity score index, which scores countries on a scale of -10 (full autocracy) to 10 (full democracy). The polity index's relationship to regime stability can be seen as a U curve, hence the absolute value signs in the formula. People have shown to be more likely to protest in moderate autocracies or democracies than in full autocracies or democracies. Then there is the civil liberties index, which scores countries on how free their citizens are. The freer citizens are, the less likely they are to protest. The GDP index shows change of the GDP per capita. GDP per capita is an indicator of state capacity and welfare of a country, the higher these are the less likely people are to protest. The same applies to employment, the more employed people, the fewer people will go and demonstrate. Literacy has been excluded from this SPSS study as the effect of literacy on state capacity is not clear. Choucri and colleagues seem to imply that an increase in literacy, increases regime resilience. However, the increase of the literacy rate in the Middle Eastern countries is correlated with the protests, as especially educated, but unemployed youths participated in the protests (Mulderig, 2013) ("A Look at the Root Causes of the Arab Revolution", 2011). Moreover, the literacy rate of many countries is not available for all years. The literacy index can therefore not be measured and has been excluded from this SPSS study.

Furthermore, the Middle Eastern countries lacked data from 1980. The first year in which all the necessary data was available is 1991. 1991 has therefore been picked as base year. The change in state capacity from 1991 to 2010 has been computed and used as the independent variable state capacity.

Ordinal logistic regression was used to test the effect of state capacity on the severity of the protests. Ordinal logistic regression was chosen, as ranking of the protests on severity is an ordinal variable. The

effect of not only state capacity, but also the effect of the separate variables that constitute state capacity was measured. The other variables measures are thus: GDP/Capita, employment, polity index and civil liberties. Moreover, the taxes/GDP as proposed by Hendrix has been tested as well. The military expenditures variable has not been included as data on both Syria and Libya is missing, regarding military spending. Since both were in the group with the severest protests, there would only be 4 countries left in that group which is rather small to draw any meaningful conclusions from.

All other variables, state capacity, GDP/Capita, employment, taxes/GDP, polity index, civil liberties, rule of law, regulatory quality and control of corruption have been tested separately to test for their effect on protest intensity. All these independent variables are scale variables and have been used as such in the ordinal logistic regression.

Results show that only one of the state capacity indicators has a significant effect on regime stability. State capacity as measured in accordance with the method proposed by Choucri and colleagues (2007) is insignificant: ($\beta=0.275$, $p=0.333$). So are all the separate determinants of state capacity as measured by Choucri: GDP per capita ($\beta=-7.104E-5$, $p=0.164$), Employment ($\beta=0.039$, $p=0.535$), Polity index ($\beta=-369$, $p=0.064$) and Civil liberties ($\beta=-0.342$, $p=0.534$). Moreover, the Taxes/GDP variable, proposed by Hendrix is also insignificant ($\beta=0.008$, $p=0.869$). Furthermore, the two of the three indicators of bureaucratic capacity proposed by Savoia et al (2015) were also insignificant: rule of law ($\beta=-0.26$, $p=0.219$) and regulatory quality ($\beta=-0.29$, $p=0.207$). The third variable proposed by Savoia et al (2015) namely control of corruption is the only variable that has a significant effect on regime stability ($\beta=-0.43$, $p<0.05$).

The significance of the control of corruption variable is in line with research done by Byun and Hollander (2015) who also found corruption to be a significant variable in explaining the severity of the protests. Nevertheless, control of corruption and corruption only show that there is a relationship, of some sort, between bureaucratic capacity and regime stability. This study shows that the relationship is unclear as the other variables measuring bureaucratic capacity and state capacity do not have a significant effect on regime stability. Moreover, administrative capacity has altogether not shown to be significant in explaining regime stability and coercive capacity could not be tested.

Thus, there is an effect of bureaucratic capacity on regime stability in this limited sample. Yet, the exact relationship between state capacity and regime stability remains unclear and cannot be easily modelled. This is problematic for the model because in Choucri's model, state capacity affected the variable

‘propensity to be recruited’ for non-dissidents. The higher state capacity was, the smaller the chance non-dissidents would become dissidents. She thereby used state capacity as an infection rate. This seems logical because people are not eager to join protests when they do not have much to complain about. When the economy is robust, the government is strong and legitimate and when governments offer financial incentives or reforms to prevent people from becoming dissidents, not many people will become dissidents. In such a case, people will likely support the government rather than protest against it. In case of a low capacity, with a weak economy, a weak government, no reforms and no financial incentives people will be more likely to join protests against it.

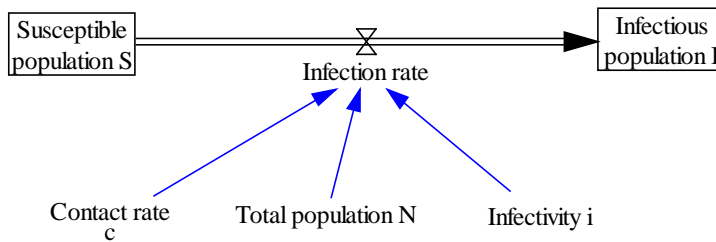
Although the relationship between state capacity and regime instability is unclear, this study shows there is a significant effect of state capacity on regime stability. This means that there is an effect of state capacity on the likeliness of people to join protests and thus the severity of the protests. Yet, this relationship cannot be modelled accurately due to the contradictory and unclear findings described above. Nevertheless, the likeliness of people to join protests or the infection rate of the protests can be based on historical data because we can observe the speed with which the number of dissidents grew. The infection rate can therefore be included as a separate variable, while future research may study the effect of state capacity on this infection rate.

5.2 Model Structure

The model’s structure is mostly original, for example, the role of defecting soldiers in an insurgency and the relationship between violence and migration have not been modelled before. Some other concepts have been used in earlier SD models. Those earlier SD models were created by Choucri and colleagues (2007), Anderson (2006) and Abdel-Hamid (2010). Choucri is important for describing how citizens turn into dissidents, and how dissidents turn into insurgents. One main cause for these flows is the number of dissidents and insurgents. The higher these numbers; the more inclined others are to join. The other main cause is violence, committed by insurgents. The more violence insurgents commit, the more dissidents become insurgents. However, Choucri does not consider the army’s role in the creation of insurgencies, even though, for example, the main rebel force in Syria, the Free Syrian Army, existed mostly of defected soldiers. Anderson is important for noting governmental violence drives people to become insurgents.

Abdel-Hamid (2010) then is especially relevant for his way of modelling an insurgency. He developed a model that described the development of citizens into insurgents, based on the common SI model, where the development of a disease is modelled based on the contact between people with the disease and people without the disease. That spreads slowly in the beginning, but fast at the end. Figure 4 shows the SI model.

Figure 4: SI model



The SI model depends on the different variables shown. The exact formula for describing the development of the disease is: $Sc \cdot (I/N) \cdot i$. In this formula, S is the susceptible population. These are the people that do not have the disease, but may contract it. The susceptible population is part of a larger population, namely the total population N. All people of the population interact with one another. They meet, talk, visit or otherwise encounter each other. They do so at a certain contact rate (c), which describes the number of contacts per time period. Thus, in a specific time period the total number of encounters of susceptible people is Sc. They encounter both healthy and infected people. The chance that they will meet an infected person is (I/N). The chance that a susceptible person will encounter an infected person during at least one of his encounters is therefore $(Sc \cdot (I/N))$. This multiplied with i, the chance that when encountering an infected person one will get infected himself as well, means that the chance that susceptible people will get infected is it $Sc \cdot (I/N) \cdot I$ (Sterman, 2000).

5.3 The protest disease model

This study applies the principles of the SI model, as proposed by Abdel-Hamid, to the growth of both dissidents and insurgents. Abdel-Hamid did not include dissidents as separate group in his model, although they are as essential part of the development of an insurgency as Choucri has shown. This model is thus the first to use the SI model to model the protest dynamics of dissidents. To use a disease dynamic to describe the growth seems logical because in the case of protests, there is also a susceptible

population, an infected population, a contact rate, an infection rate and a total population. The susceptible population exists of those possibly willing or able to join the protests. The infected people are those who already protest, dissidents. The contact rate is obviously different from that of a disease, as meeting a dissident does not necessarily mean that he will share his ideas of protest or demanding change. Especially in repressive countries it can be dangerous to share your anti-regime opinions.

Thus, simply meeting dissidents is not a good indicator of contact rate. A more suitable option seems to be the number of protests in a country. A protest immediately and explicitly brings a person in contact with the idea of demanding change. Moreover, one does not simply need to encounter a protest on the street. Knowledge of them spreads due to (social media), such as facebook and whatsapp. Thus, as more protests occur, the more the susceptible population encounters the idea of demanding change from their government, by means of protesting. Whether or not they decide to join these protests depends on two other factors, namely the infection rate and the number of dissidents/total population. The infection rate, as mentioned before, is a value, in this case based on historical behavior but in principle based on socio-economic, political indicators and government measures. The number of dissidents/total population, on the other hand, displays the strength of the opposition movement and the attractiveness of joining them. The more dissidents there are, the more likely they are in achieving change and the more attractive it is for others to join their winning team. Furthermore, participating in a protest of only 100 people is riskier than participating in a protest of 100.000 people as there is safety in numbers. In this way, the development of protests can be described by the formula: $Sc \cdot (I/N) \cdot i$. The same dynamic applies to dissidents who become insurgents. This will be discussed in more detail in chapter 5.8.

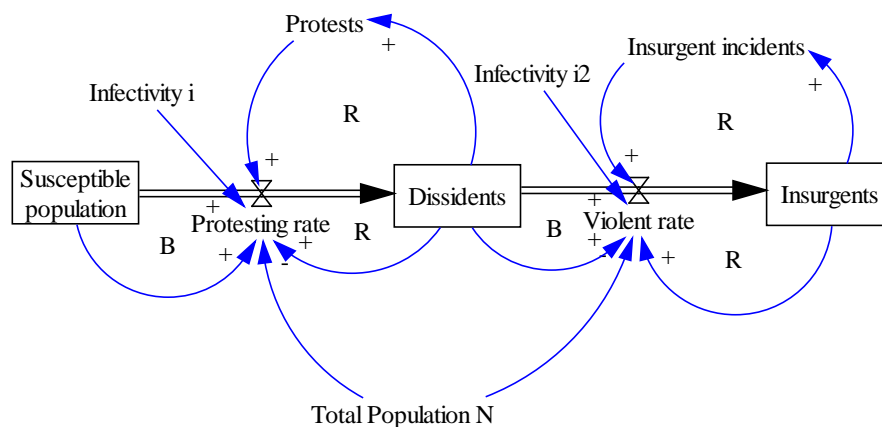
5.4 Causal Loop Diagram

The dynamic of the disease model can be captured with a causal loop diagram (CLD), as shown in figure 5. In the CLD a + sign refers to a positive relationship between variables (when the one rises, the other does too). Whereas a – sign means a negative relationship (when the one rises, the other goes down).

The R and B letters reflect reinforcing and balancing feedback loops. There are two balancing loops and four reinforcing loops in the CLD. Two of the reinforcing loops describe the relationships between protests and dissidents and between insurgents and insurgent incidents. The more dissidents there are, the more protests occur. The more protests occur, the more susceptible people are convinced to join the dissidents. The same applies to insurgents and insurgent incidents. The other two reinforcing loops describe the relationship between the number of dissidents and the protesting rate and the number of

insurgents and the violent rate. The more dissidents and insurgents there are, the stronger they seem and the more inclined people are to join them. The balancing loops, on the other hand, describe how the number of susceptible people declines as the protesting rate increases and how the number of dissidents decreases as the violent rate increases.

Figure 5: CLD SI model

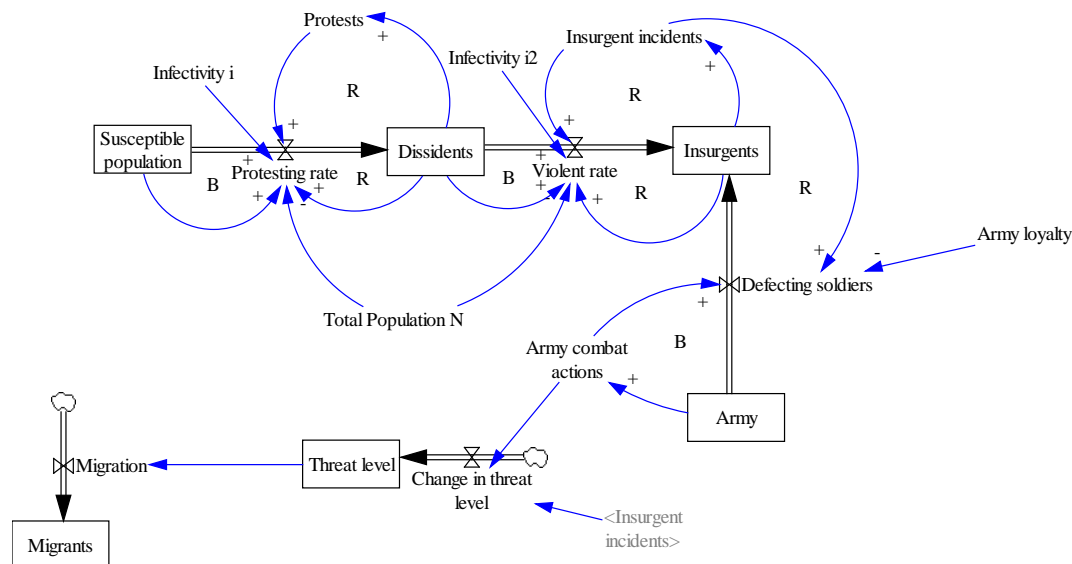


This causal loop diagram does not, however, show the complete model. It misses the role of the army and the effect of violence on migration. Figure 6 shows a complete CLD of the model. The army is an essential part of the model, because in Syria many of its members defected and became insurgents. Moreover, government violence is one of the main drivers of migration and consequently important to model. The next CLD shows how an army performs combat actions. Both these combat actions and insurgent incidents affect the level of defecting soldiers. The more violence soldiers use the more likely they are to defect, if they are not loyal. Moreover, the more violence insurgents use the weaker the army seems and the stronger the insurgents and the more attractive it is for soldiers to join the insurgents.

The CLD includes a new balancing loop that describes how an army performs combat actions, the more combat actions the more soldiers defect and the fewer combat actions can be performed. The reinforcing loop shows how an increase in defecting soldiers leads to an increase in insurgents, which leads to an increase in insurgent incidents, which leads to an increase in the number of defecting

soldiers. The total number of violent incidents, those committed by both the army and the insurgents, increases the danger of staying in a country. Thus, the threat level rises, which affects the number of people willing to migrate.

Figure 6: Extended CLD



5.5 Model Boundaries

The CLD already shows boundaries with respect to the variables used. For example, the model assumes that all soldiers are equally like to defect. This is in reality not the case, as members of the Syrian's regime sect are less likely to defect. However, including this would unnecessarily complicate the model. Modelling the system of regime stability, protests, insurgency and migration, as it is, is already quite difficult. To describe all the variables present in the real world system would be impossible. Time, resource and knowledge constraints do not allow it. Consequently, choices have been made as to include what variables. The purpose of this thesis was to understand the relationship between regime stability and forced migration.

As such, the focus of this model is on how people may become dissidents and how a violent response of the government may lead dissidents and defecting soldiers to become insurgents. As a result, some variables have been left out. Other variables have been included in the model, but only exogenously. Most importantly, state capacity, which was supposed to be an endogenous variable could due to

measurement difficulties not be included as an endogenous or exogenous variable. Two other variables, infection and quitting rate, have taken its place as exogenous variables. Exogenous variables are not affected by feedback from the system. Endogenous variables, on the other hand, are affected by the system dynamics. Table 1 gives an overview of the exogenous, endogenous, and excluded variables relevant to the system and shown in the SD model below.

5.6 Variable selection

Endogenous variables	Exogenous variables	Excluded variables
Susceptible population	Initial protests	Population aging
People turning into dissidents	Initial dissidents	Intelligence actions army
Dissidents	Protests per dissident	Migration within Syria
Protests	Infection	State capacity
Population	Repression	
Dissidents quitting	Quitting rate	
Potentially violent dissidents	Insurgent incidents per insurgent	
Potentially violent dissidents quitting	Conscript army	
Effect of repression on dissidents	Presence of rival security force	
Dissidents turning violent	Non-selective officer selection	
Insurgents	Soldiers defecting per incident	
Insurgent incidents	Effect of protests and insurgents on combat	
Army disloyalty	Migration delay	
Defecting soldiers	Effect of threat on migration	
Army		
Combat actions per soldier		
Combat actions		

Total violent incidents		
Threat level		
Total population		
People migrating		
Migrants		

5.7 Model assumptions

During the Arab Spring, not all countries used their armies to repress the protests. Many only used their police force and survived the Arab Spring intact. Five countries did use or attempted to use their armies to crush the protests and except for one, Bahrain, all ended up either with the fall of the regime or civil war. Thus, when understanding the relationship between regime stability, violence and forced migration the army should be included. Consequently, this model simulates the presence of an active army that commits violence. Without such an army, the violence will not escalate and therefore not lead to a civil war and forced migration and not be suitable in answering the research question. This means that the model only reflects those countries who used their armies to subdue the protests rather than their police. Moreover, as state capacity is not included in the model, the model uses a specific infectivity and quitting rate to account for the presumed effect of state capacity on dissident growth and thereby copy the historical behavior of the dissidents' growth in Syria.

Furthermore, the rate with which soldiers and insurgents killed one another is not known and difficult to estimate. What can be estimated is the impact of this rate on the size of the army and the insurgents. In both cases, the effect was not very large. The army was harder hit by the amount of desertions and defections and the insurgents were well set-up in the mountainous terrain of Syria, from which they did not suffer much. It was mostly the civilian population that suffered. Hence, the death rate of insurgents and soldiers will not be included in the model.

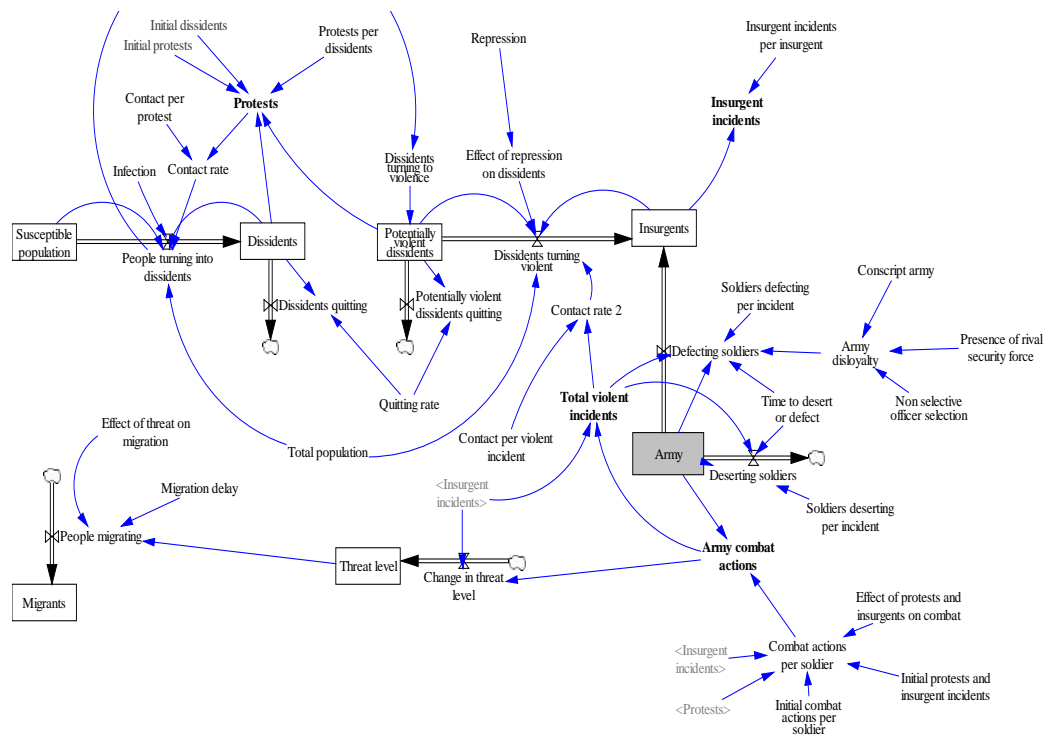
The last assumption of the model is that the notion of threat, the level of danger that causes people to migrate, is based on the accumulation of violent incidents that have happened in the country since the start of the protests and unrest. People do not judge the violence of every month separately. Instead, as violence continues in a country, it becomes more and more dangerous and unsafe: First there was violence in this part of the country, now it moves elsewhere, but it might still crop up here.

Furthermore, people have been hurt by the violence, stories spread of the violence committed. In this way, a threatening atmosphere develops within a country. The country is enveloped by a feeling of unsafety. This feeling accumulates as the violence continues and causes people to flee.

5.8 The Model

This brings us to the complete model, which can be seen in figure 7. Descriptions of the separate variables in the model will follow after figure 7.

Figure 7: The Model



Level variable - Susceptible Population

The susceptible population is that part of the population potentially willing to join the protests. These are, at the start, mostly young people. The young people most likely to demand change are those between 17-26 (Bricker & Foley, 2013). Young people are most likely to demand change from a regime as argued by Goldstone (2010) are therefore at the forefront protests and insurgencies. Of course, not all youths are willing to join demands for change. It is especially unemployed youths, who are dissatisfied with the status quo, willing to join protests. Consequently, the susceptible population exists of the amount of unemployed youths between 17-26 in Syria.

Admittedly, this approach to the susceptible population is incomplete as older generations have also participated in the protests, especially later on as the protests went on. However, the extent to which the older generations participated is unknown. Some did participate, but their participation rate was smaller than that of the youths. It is known that hundreds of thousands of Syrians participated in the protests, of which many were youths. As a result, this model focuses explicitly on the number of unemployed youths between 17-26 as being the susceptible population.

Flow variable - People turning into dissidents

This flow describes the number of people from the susceptible population that join the protests and thus become dissidents. Their becoming dissidents, depends on the factors discussed during the overview of the disease dynamic of the protests. As the number of protests increases, so does the number of susceptible people becoming dissidents. As there are more dissidents, there are more protests and the opposition movement seems more attractive as its size is larger. In this way, the number of people becoming dissidents depends on both the amount and size of the protests. These are, besides the infection rate, the determining factors underlying the dynamic between susceptible people and number of dissidents.

Auxiliary variable - Protests

Dissidents come together to protest. The more dissidents there are, the more protests occur. However, the number of protests does not increase linearly with the number of dissidents. As the number of dissidents increases, protests increase in size rather than quantity. For example, during the Arab Spring, in Egypt, the Tahrir square in Cairo was a focal point for dissidents to demand change. At the beginning of the Arab Spring, several thousand-people demonstrated together against the Egyptian regime. After

two weeks, a million-people protested on the Tahrir Square. Thus, while the amount of protests on the Tahrir square did not increase, the size of the protest did increase significantly (“Timeline: Egypt's revolution, 2011”).

The same happened in Syria, where the protests grew increasingly large. However, in Syria, after some time the number of protests increased, even though the number of dissidents did not. This happened as a response to the violent government response. The government responded violently to large protests. As a result, people started to participate more and more in small protests that only lasted for a small time, so the government could not respond in time. This behavior has not been included in the model, as the data is limited on the number of dissidents in these later months and we therefore do not know how many dissidents participated in these smaller protests (Ajnabi, 2011).

Look-up variable - dissidents and protests

This lookup describes the relationship between the number of dissidents and the number of protests. As discussed under the protests header, there is a non-linear relationship between the number of protests and the number of dissidents. Consequently, a look-up has been used to capture this non-linear relationship. The look-up is based on data, retrieved from GDELT, that shows the number of protests in Syria per month and data from newspapers. The newspaper data gives rough estimates of the number of dissidents per month.

Auxiliary variable – Contact rate

The contact rate determines how many protests people encounter. It is assumed that every person only encounters every protest once. Thus, he or she hears or sees a (about a) protest and at that moment decides whether or not to join. The decision moment only arrives again when encountering a new protest. This is assumed as repeated encounters of the same protest would probably have a diminishing effect on the decision process of the person, because repeated viewing may attenuate the impact of the protest. Moreover, it is impossible to account for the times one may encounter the same protest. Someone may hear about it on whatsapp and afterwards see the protest on tv or read about it on the internet.

Constant variable - Infection

As discussed before, the infection rate is determined by both socio-economic indicators and government measures. It describes the speed with which people join protests once they encounter them. The case of Egypt, where the number of dissidents on the Tahrir square increased tenfold in mere days showed that the infection rate was high. The pattern repeated itself in Syria, where the number of dissidents and protests was limited in January and February but exploded in March and April as hundreds of thousands went to protest. This implies a high infection rate, as a low infection rate and *ceteris paribus*, the protests would not spread so fast.

Level variable - Dissidents

Dissidents are people who demand political change, by means of protests. If the number of dissidents increases, so does the number of protests, which again increases the number of dissidents. In this way, feedback causes the number of dissidents to increase. Moreover, as the number of dissidents grows the movements seems stronger, more likely to be heard and less dangerous to join. Consequently, more people want to join. Over time, some dissidents may quit because of the danger, boredom or imprisonment. Thus, the number of dissidents decreases over time.

Flow variable - Potentially violent dissidents

Dissidents are by nature those who protest peacefully. However, a small part of them might be convinced to use violence rather than protests to see the change they want. They become a new type of susceptible population, the one susceptible to violence. Whether or not they become insurgents depends on the total number of violent incidents in a country and the level of repression. Based on historical data, around 10,000 dissidents joined the insurgents at the end of May 2012.

Flow variable - Dissidents and Potentially violent dissidents quitting

Both dissidents and potentially violent dissidents may stop protesting because of a variety of reasons. They may be imprisoned, killed or simply give up on achieving change. They may also be convinced to quit by government measures, such as financial incentives or reforms. Just like the socio-economic conditions and government measures discussed at the infection variable, the exact impact of these measures on the quitting rate of dissidents is unknown. There is not enough data available to

adequately model this. Consequently, the model uses a quitting rate that is based on newspaper descriptions, which related how tens of thousands of dissidents were imprisoned or otherwise convinced to stop protesting.

Flow variable - Dissidents turning violent

The dissidents turning violent is also based on the SI disease model as people turning into dissidents is. In this case, a small fraction of the total number of dissidents, those potentially willing to use violence to achieve change, form the susceptible population. Depending on the amount of violence, which is the contact rate, and the level of repression. The amount of violence defines the intensity of the violence, while the level of repression defines the scope of the violence. The higher the level of repression, the more people will be hurt by the violence, including innocent people, this will cause dissidents to turn to violence as well. In this way, the level of repression functions as an infection rate.

In this case, the contact rate is affected by violent incidents rather than protests as dissidents take up violence as a response towards governmental violence. Insurgent violence also affects this contact rate, as the more insurgent incidents happen, the more people encounter the idea of fighting the government than just protesting. The amount of insurgents/total population is an indication of the strength of the insurgents. The more insurgents there are, the more potentially violent dissidents are willing to join their numbers as they seem more and more likely to win.

Auxiliary variable – Contact rate 2

The contact rate determines how many violent incidents people encounter. It is assumed that every person only encounters every violent incident once. Thus, he or she hears or sees a (about a) violent incident and at that moment decides whether or not to join. The decision moment only arrives again when encountering a new violent incident. This is assumed as repeated encounters of the same violent incident would probably have a diminishing effect on the decision process of the person, because repeated viewing may attenuate the impact of the same violent incident. Moreover, it is impossible to account for the times one may encounter the same violent incident. Someone may hear about it on whatsapp and afterwards see the violent incident on tv or not.

Constant variable - Repression

The level of repression describes the intensity and scope of government repression in a country. As the size of government repression, in the form of combat actions, is already described elsewhere this variable is used to indicate the scope of the combat actions. From level 4 onwards, many innocent people are affected by the government violence as well. Bischof and Fink (2014) report how, from level 4 onwards, the attacks on innocents cause people to become violent against the regime. Below level 4 dissidents do not tend to use violence against the regime. The level of repression therefore affects the rate with which potentially violent dissidents become insurgents. However, this rate remains rather low as most dissidents are not very willing to use violence themselves.

Level variable - Insurgents

Insurgents are those who use violence to fight the regime. They arrive from two different sources. There are the potentially violent dissidents who decide to fight rather than protest, because the government uses violence and they find that protests are an ineffective answer to governmental violence. This is, however, only a small amount. The largest number of insurgents is produced by defecting soldiers. Soldiers defect because they do not want to use violence against their fellow citizens and insurgent incidents show that the idea of an insurgency against the government is possible. Violent incidents thus drive soldiers to become insurgents instead.

Auxiliary variable - Insurgent Incidents

As the number of insurgents increases, there are more insurgents available to commit violent actions. Thus, the total number of insurgent incidents or attacks increases as well. The rate at which it increases is an educated guess based on the available data. That is, GDELT only has the data on the total of violent incidents in Syria. Thus, violent actions committed by both insurgents and the army. Based on earlier data, and the growth of the insurgents, the Syrian army seemed as if it performed the most violence of both groups. The insurgent rate is based on this understanding.

Level variable - Army

The army is the key to a revolution. Regimes depend on the army to perform combat actions to subdue both dissidents and insurgents. However, if the army is not completely loyal soldiers may refuse to

participate in the violence and instead choose to defect or desert. The size of the army depends on historical data.

Auxiliary variable - Army disloyalty

Army disloyalty is the factor that determines whether soldiers will perform combat actions without problem or if they will be affected by performing the combat actions and thus defect. The loyalty of an army depends on three factors: (1) whether the army selects its own officers; (2) whether the army has a competing security force; (3) whether the army is a volunteer rather than a conscript army. The lower the loyalty of an army and the higher the disloyalty, the more soldiers will defect when they are deployed. In case of Syria, the presence of a conscript army caused that many soldiers, who had not volunteered to be in the army, were unwilling to shoot their fellow citizens and consequently defected. In Egypt and Tunisia, on the other hand, the officers were not selected by the regime but by the army itself, and the armies were conscript armies. In those cases, both officers and soldiers refused to support their regimes, thereby causing their regimes to crumble.

Flow variable - Soldiers defecting

The number of soldiers defecting depends on the size of army loyalty, the size of the army and the total amount of violence in the country. The size of the army defines how many soldiers can flee. The total amount of violence is the primary cause of soldiers defecting. Conscripted soldiers do not like to fight against their fellow citizens, thus the more they have to fight against their fellow citizens, the more soldiers flee. On the other hand, insurgent incidents are both a threat to soldiers and an indication of insurgent strength. The more insurgent incidents happen, the more threatening it is to remain a soldier and the more inviting it is to join the insurgents. The rate with which the soldiers defect is based on historical data.

Flow variable - Soldiers deserting

While defecting soldiers join the insurgents, deserting soldiers simply leave the army or country and do not fight again. Like the number of soldiers defecting, the number of soldiers deserting depends on the size of army loyalty, the size of the army and the total amount of violence in the country. It is especially the presence of a conscript army that affects army loyalty. The size of the army defines how many soldiers can flee. The total amount of violence is the primary cause of soldiers deserting. Conscripted soldiers do not like to fight against their fellow citizens, thus the more they have to fight against their

fellow citizens, the more soldiers flee. The more insurgent incidents happen, the threatening their situation as soldier is and the more inviting it is to desert. The rate with which the soldiers desert is based on historical data.

Look up variable - Combat actions per soldier

The number of combat actions per soldier depends on the number of protests and insurgent incidents. In case of Syria, the ongoing protests and insurgent incidents caused the Syrian regime to intensify their combat actions against dissidents and insurgents to subdue them. For example, the army started to use more artillery, rockets, jets, helicopters and tanks in response to an increase in protests and insurgent incidents. Thus, the number of combat actions per soldier increased in response to the increase in protests and insurgent incidents. The look-up describing the effect of protests and insurgent incidents on the combat actions per soldier is based on an estimate based on historical data. It is a relatively low number because many soldiers were used to defend cities, perform support acts, or were not used at all out of fear they would defect.

Auxiliary variable - Combat actions

The army commits violence to repress both insurgents and dissidents. The combat actions per soldier depends on the intensity of the protests and insurgent incidents. The total number of combat actions depends on the number of soldiers performing combat actions and the combat actions per soldiers.

Auxiliary variable – Violent incidents

The number of violent incidents per month is the aggregation of the total number of army combat actions and insurgent incidents per month. It adds these two together because it is the total number of violent acts committed by all parties in a country that drives migration. Moreover, violent incidents also drive the contact rate of dissidents turning to violence. Dissidents become insurgents as an answer to government violence and the non-effectivity of protests against this violence. They also become insurgents due to insurgent violence, which, shows people that violence is an answer to the government. The more insurgent incidents happen, the more often they encounter the idea of using violence against the government. Insurgent incidents also show the weakness of the government in preventing the insurgent incidents from happening.

Level variable - Threat level

As discussed at the model assumptions header, the model assumes that the threat level is the accumulation of the violent incidents that have happened in the country since the start of the protests and unrest. Because every single violent incident and the effects it causes linger in a country. By doing so they create an atmosphere of fear. Thus, the threat level changes with the number of violent incidents per month. Normally, it would decrease as well if there would be a time without violent incidents, but since this does not apply to Syria it has not been included.

Level variable - Migrants

People flee out of fear for violence or more violence. Thus, as the threat level increases, more and more people, in a country, flee. There is a delay to the migrants. People do not flee immediately. Moreover, the journey to migrate takes time and the process of registering migrants takes time as well (Alsalem & Riller, 2013).

Constant variable - Migration Delay

The best fit, in this model, for the delay in migration caused by the time it takes to migrate and the time it takes to register oneself at the UNHCR is 8 months. Hence the migration delay in this model is 8 months.

5.9 Base Run

The base run of the model shows how well the model data fits the real data. It has been compared for the four most important variables, namely, protests, violent incidents, number of migrants and the number of insurgents. Figure 8 show that the protests do not fit completely, especially after the 8 month the discrepancy becomes obvious. This discrepancy is most likely caused by the response of dissidents to governmental violence. As mentioned before, as the violence increased, the protests became smaller because smaller protests were less likely to suffer violence due to the ease with which people could get away. The violence data, shown in figure 9, does not completely overlap, this is especially hindered by the downturn in the real violence in month 16 and 17. In month 18 it rises again, but as month 18 is not

part of this model, the data fit is less than great. However, the discrepancy in violence does not affect the migration due to the migration delay.

Figure 10 and 11 show that migration and insurgent data overlap very well. Admittedly the number of data points for both insurgents and migrants is limited, but the data overlaps with that of the real world in so far as there is data for these two variables.

Figure 8: Protests in Syria

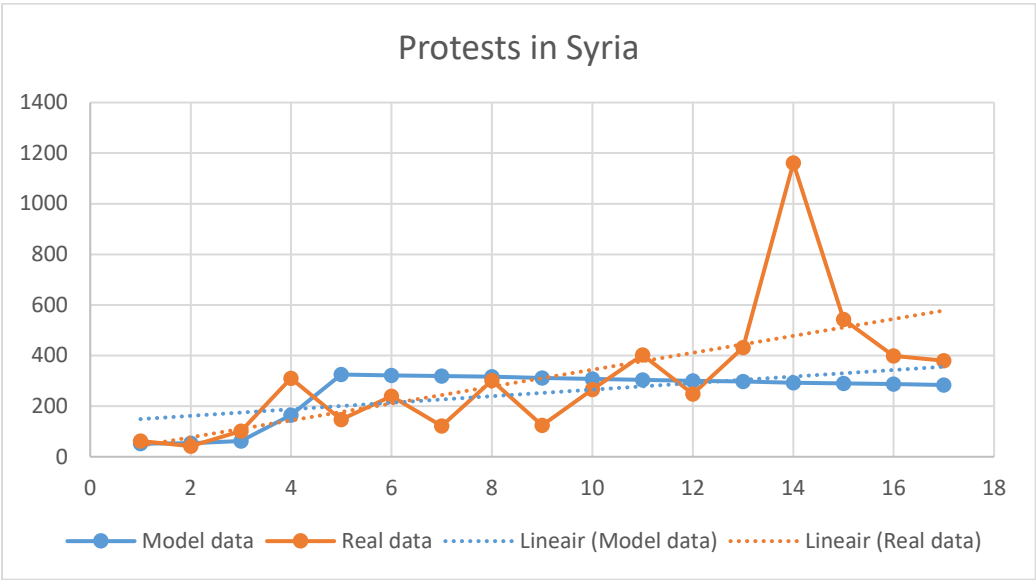


Figure 9: Violent incidents in Syria

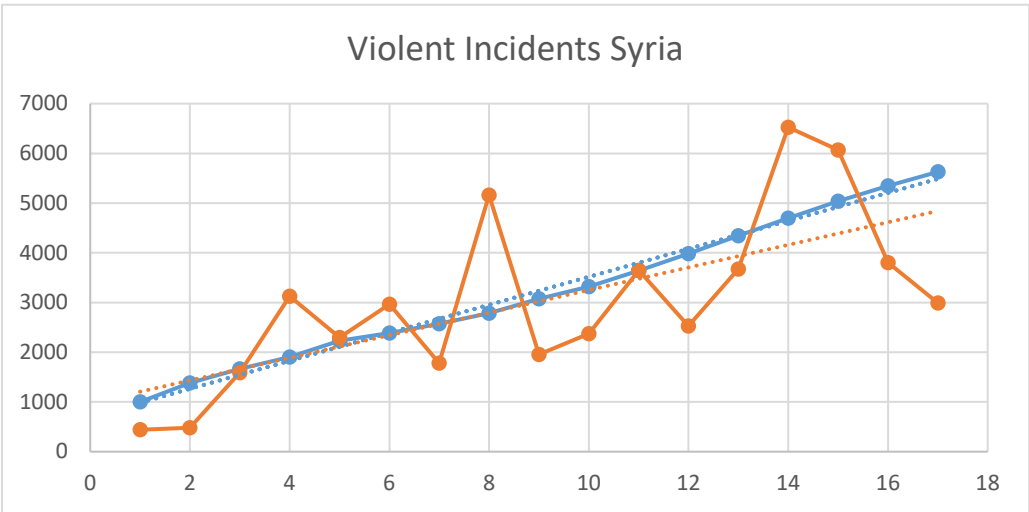


Figure 10: Number of insurgents in Syria

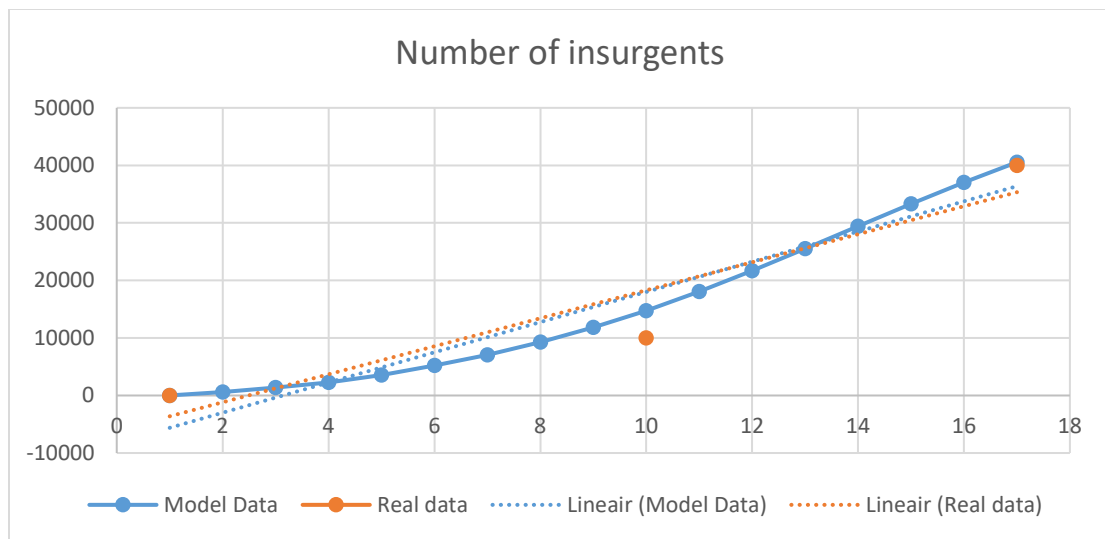
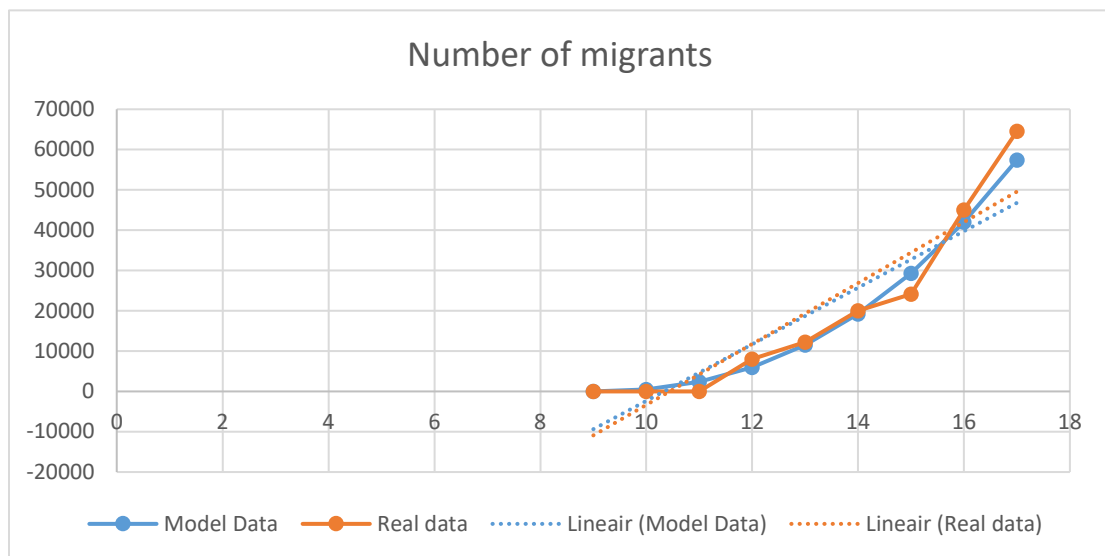


Figure 11: Number of migrants leaving Syria



Chapter 6: Testing the Model

6.1 Validity Tests

The model thus captures the dynamic between regime stability, violence and migration. It shows how the SI model can be applied to both protest and insurgent dynamics. Moreover, it also shows the importance of the army in this dynamic. Last, the model shows how both insurgent and army violence leads to migration. The assumptions and dynamics, of the model, are based on theoretical insights. Although the assumptions and dynamics of the model are based on theory does not necessarily mean that the model is a good one. The problem of judging a model is a hard one. Due to the simplified nature inherent to a model, it can never capture all of reality. Yet, it does not need to do so. A model needs only to capture that part of reality, it intends to capture. If it succeeds in this mission, it can be considered a useful or good model.

Sterman (2000) has proposed several tests to determine the whether a model can be considered useful or valid. These range from the behavior reproduction test, to the boundary adequacy, structure and parameter assessment, direct extreme conditions test and sensitivity analysis. He also describes tests such as the family member test, surprise behavior, behavior anomaly and the system improvement test. Due to time and resource constraints not all of these can be performed on the model. Therefore, some tests have been performed. The tests that have been performed are the boundary adequacy, dimensional consistency test, integration error, structure and parameter assessment, the direct extreme conditions test and sensitivity analysis. The results of these tests will now be reported.

6.1.1 Boundary Adequacy

This test assesses the appropriateness of the boundaries used in the model. This should be tested by looking at a boundary chart, causal loop diagram, the stock and flow diagram and the equations used in the model. Literature should also be reviewed in assessing the boundaries of the model. The limitations of the model, regarding boundaries, show themselves when assessing the role of state capacity in the model. Theory describes an important role for state capacity in affecting the size of protests. However, the model does not include state capacity as a separate variable in the model, because its relationship with regime stability could not be discerned clearly enough, as discussed in chapter 5. The model uses the infection rate and quitting rate as exogenous replacements for the state capacity variable. The inclusion of these variables causes the proposed effect of state capacity on the growth of dissidents by Choucri and colleagues (2007) to still be emulated. However, it also causes the feedback relationship

between violence and state capacity or regime stability to disappear. The infection rate and quitting rate are based on historical data, and show that used in the model imply a low state capacity, but as it is exogenous the effect of violence on it cannot be ascertained. Theory proposed that violence negatively affects state capacity as it affects the economic reality underlying state capacity and the legitimacy of the state. This is unfortunately not in the model due the non-inclusion of state capacity.

Despite the limitation of not-including state capacity, other boundaries within the structure are appropriate. The relevant actors that cause violence are in the model, the role of violence in creating insurgents is included as is the role of army loyalty. Moreover, the effect of violence on migration is also included. Thus, all relevant theoretical concept, except for state capacity, are included in the model.

6.1.2 Dimensional consistency test

The dimensional consistency test tests whether the units of the variables used in the model are consistent within the equations of the structure. Vensim offers the possibility of testing whether the units are consistent over the entire structure and it shows that they are consistent.

6.1.3 Integration Error

The integration error test describes the sensitivity of the model to changes in the time step used. A model should not report significant behavioral changes when the time step changes. This would mean that the model includes unreported and unexpected dynamics that depend on non-modelled factors such as the type of integration and time-step. Fortunately, the model behavior does not show itself to be sensitive to different time-steps. The model uses a time-step of 0.03125. Model behavior does not change when a time-step of 0.0625 or 0.015625 is used.

6.1.4 Structure and parameter assessment

The structure of the model is based on the theoretical insights presented in the theory. Inspection of the stock and flow structure and the equations used in the model shows that these adhere to the theoretical insights of the model.

The parameter assessments are more difficult, especially as several of the parameters have not been measured in the outside world, for example, the infection rate, insurgent incidents per insurgent, soldiers defecting per incident, soldiers deserting per incident, and the combat actions per soldier. These variables have been based on historical data, for example, the soldiers deserting per incident may not be so high that it goes beyond the total number of defected soldiers as discussed in the theory. This may differ per country, but the effect of the parameters is relevant for the general model.

6.1.5 Extreme conditions test

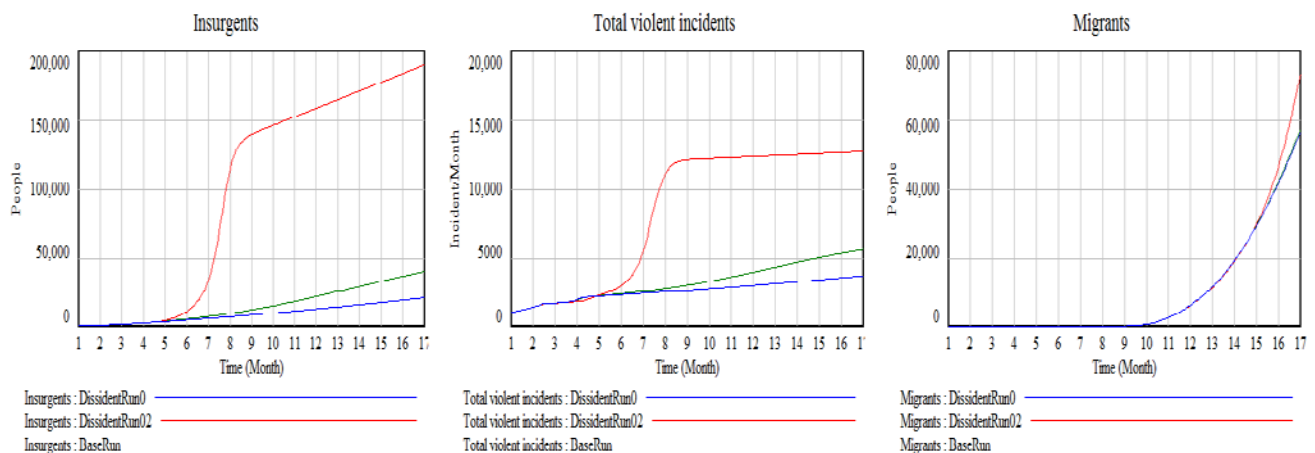
The purpose of this test is to observe the behavior of the system when put under extreme stress.

Extreme conditions may show fallacies in assumptions and the overall structure by producing impossible behavior when put under significant stress. The variables that will be tested in this case are dissidents turning to violence, quitting rate, the insurgent incidents per insurgent, soldiers defecting per incident and the migration delay. These are four of the most important variables. The quitting rate has a large effect on the number of dissidents, the dissidents turning to violence variable has a large effect on the number of insurgents and hence the number of violent incidents. Insurgent incidents per insurgent has a large effect on the total number of violent incidents and migration delay has a large effect on the total number of migrants.

Dissidents turning to violence

In these extreme conditions, the number of potentially violent as fraction of the total number of dissidents is changed. It changes the amount of potentially violent dissidents from the base run of 0.03 to 0.2 and 0. The figure shows how the number of insurgents explodes as the potential insurgent population increases. The number of migrants does, however, not increase significantly due to the delay in between violent incidents and migrants.

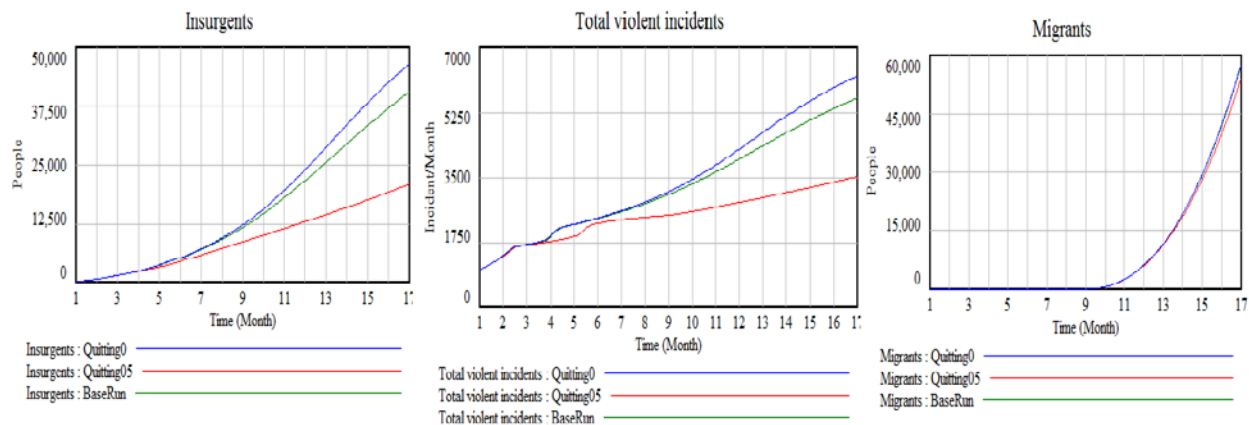
Figure 12: Effect of extreme changes in the number of dissidents turning to violence



Quitting rate

The quitting rate determines the number fraction of dissidents and potentially violent dissidents that quit due to imprisonment, being killed and losing motivation. The quitting rate is 0.5 in Quitting05, 0 in Quitting025 and 0.03 in the Base Run. The number of dissidents rapidly declines as the quitting rate increases. This affects the number of potentially violent dissidents as well, hence the smaller number of insurgents. It also affects the total number of violent incidents, because there are fewer insurgents to commit violence and because there are fewer protests and insurgents incidents, which increase the combat actions per soldier and thus the total number of violent incidents. protests decrease and protests affect the combat actions per soldier. Migration, however, only differs to a small extent due to its delay.

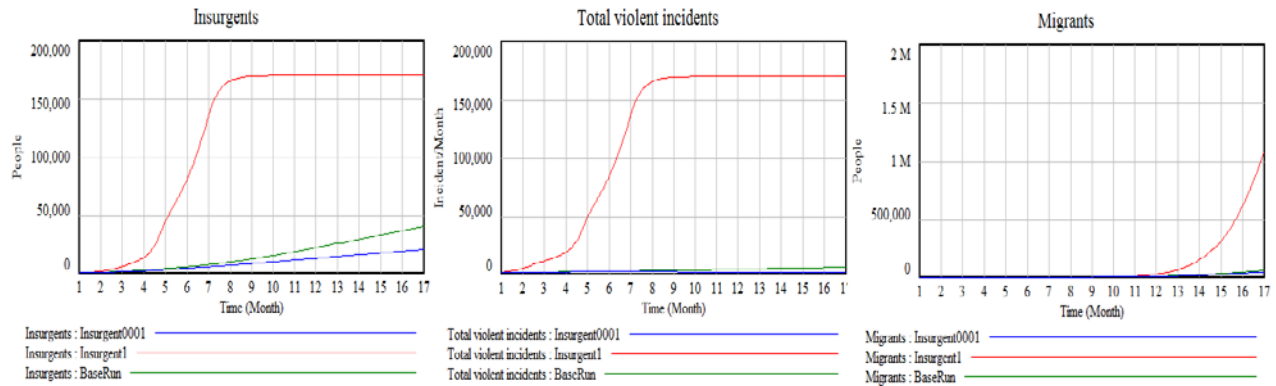
Figure 13: Effect of extreme changes in the quitting rate



Insurgent incidents per insurgent

Insurgent incidents per insurgent determines the amount of insurgent committed per insurgent. It will range from 1 to 0.0001 and the base run of 0.05. The figure shows how the number of insurgents and violent incidents and migrants explodes at the value of 1. In case of 0.0001, the number of insurgents, violent incidents and migrants is much lower than during the base run but not yet zero. It is not yet zero due to the defecting soldiers and the violence committed by the army.

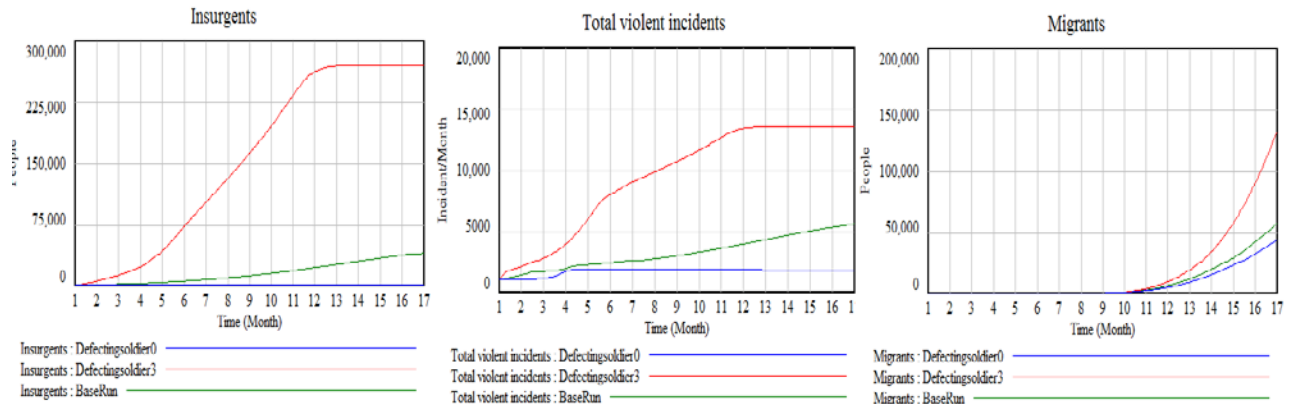
Figure 14: Effect of extreme changes in the number of insurgent incidents per insurgent



Soldiers defecting per incident

The soldiers defecting per incident variable describes how many soldiers flee per total committed violent incident each month. This is an important variable, because defecting soldiers form the core of the insurgents. It will range from 3 to 0 to the base run value of 0.5. The figure shows how the number of insurgent increases enormously, as do the total number of violent incidents and migrants in the scenario of 3 defecting soldiers per incidents. In the scenario of 0 defecting soldiers, the total number of insurgents is significant as it goes from 10 in month 1 to 25 in month 17. However, the number of violent incidents and migrants do not go to 0 due to the army which commits violence.

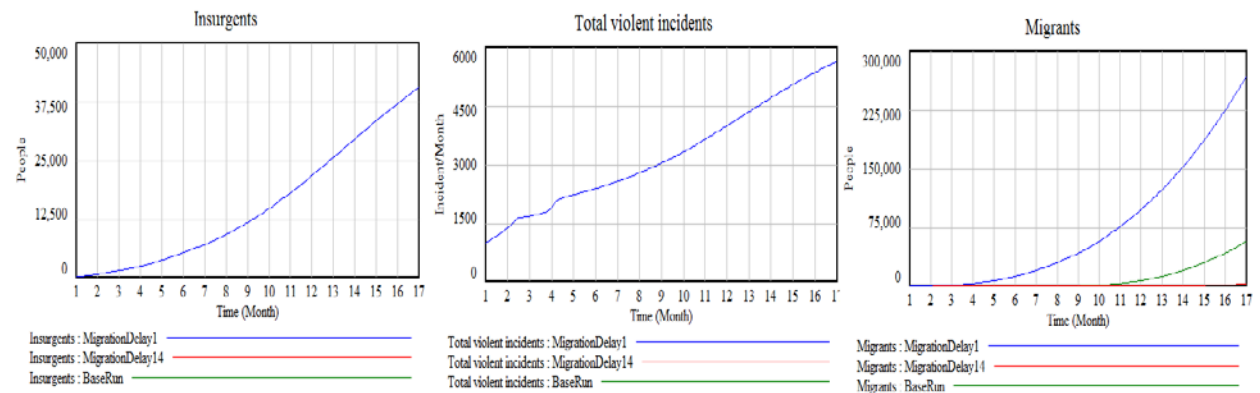
Figure 15: Effect of extreme changes in the number of soldiers defecting per incident



Migration Delay

This is one of the most important variables, because it directly influences the effect of threat and violence on the number of migrants. The range will differ from only 1 month delay to 14 months' delay to the base run delay of 8 months. The figure shows the same value for insurgents and violent incidents in all cases. The number of migrants, however, differs quite a bit. The behavior remains the same, but the numbers differ enormously due to the increase in accumulated threat in the later months. Especially later on the number of violent incidents increases enormously and this clearly affects the number of migrants.

Figure 16: Effect of extreme changes in the migration delay



6.1.6 Sensitivity analysis

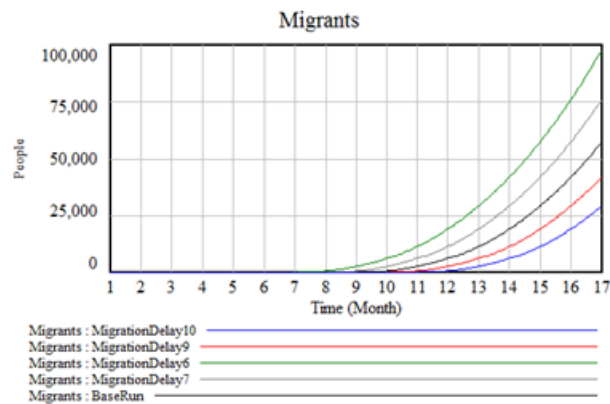
The purpose of this test is to observe how sensitive the model is to changes in parameters. Not large changes, like in the extreme conditions test, but small changes. In this way, the robustness of the model can be observed. The model is supposed to show the same behavior as the parameters change.

For the sensitivity test, the values of the parameters are changed from the base value by 50 and 100 percent. Sensitivity will be tested for several variables. It will be tested for migration delay, because it is so important for the total number of migrants. It will also be tested for insurgent incidents per insurgent, combat actions per soldier and the look-up that affects the combat actions per soldier. In this way, the sensitivity of the variables affecting the number of violent incidents and the total number of migrants can be assessed. The tests show that the sensitivity of these parameters is only numerical rather than behavioral. The model is therefore relatively robust.

Migration Delay

The base value of migration delay is 8, this has been changed to 6, 7, 9, 10. These different values have been tested for their effect on the total number of migrants. The figure shows that the behavior remains the same between the different values. It is only the numbers that change.

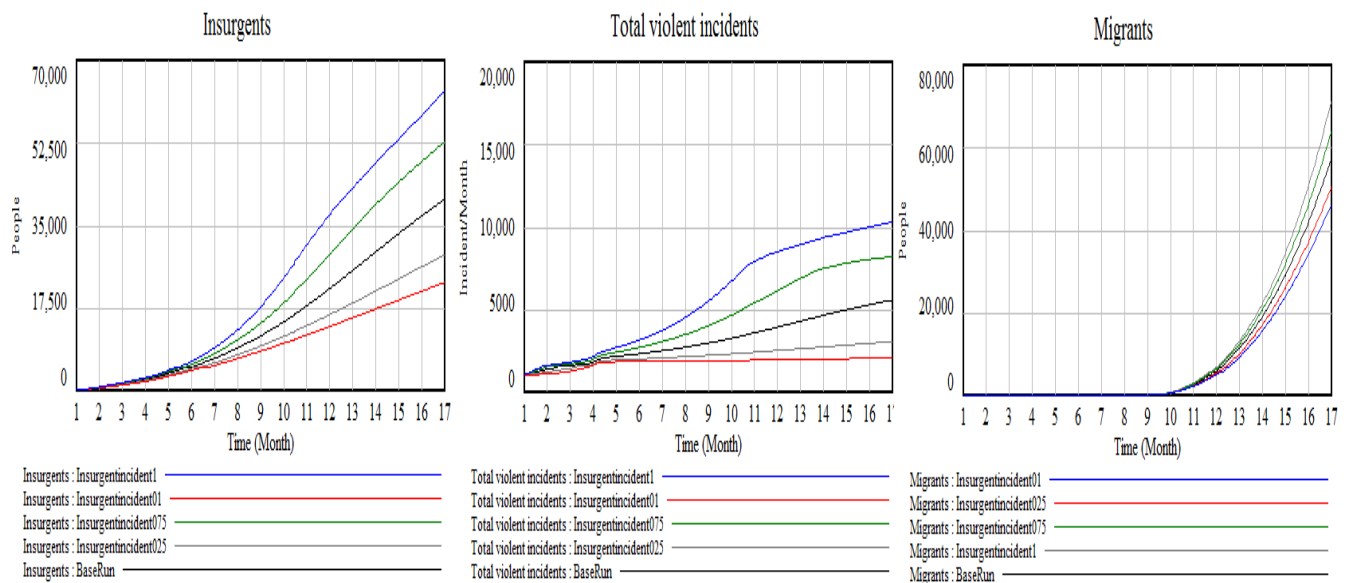
Figure 17: Sensitivity of migration delay



Insurgent incidents per insurgent

For the insurgent incidents per insurgent the parameter value has changed from 0.05 as base value to 0.025, 0.01, 0.075 and 0.1. The behavior of the model does not change unexpectedly as the parameters change.

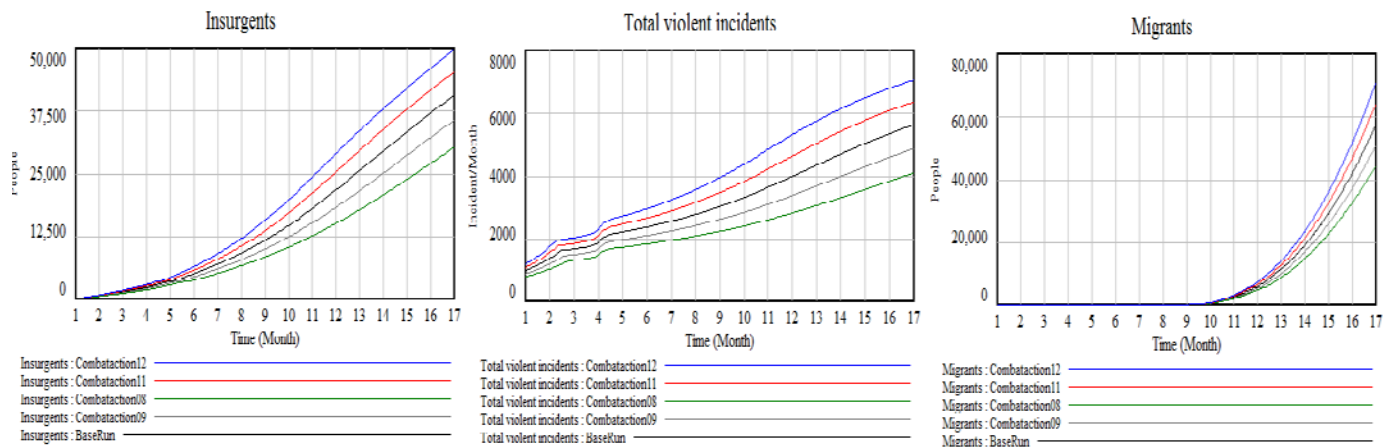
Figure 18: Sensitivity of insurgent incidents per insurgent



Combat actions per soldier

This variable determines the effect of the number of protests and insurgents on the number of combat actions per soldier by means of a look-up function. The effect of this variable has been tested by manually increasing its value by 10 and 20 percent and by also decreasing the value of this variable by 10 and 20 percent. The behavior of the system does not significantly change as the value of the parameters changes.

Figure 19: Sensitivity of combat actions per soldier



Look-up change

The look-up itself is also an important variable in affecting the total number of violent incidents and thereby the total number of migrants. The figure on the left-hand side shows the base-run look-up. If we change its value to make it completely linear, it looks like the right-side figure. The effect of this change is only numerical rather than behavioral as can be seen in the other figure.

Figure 20: Changes in the look-up

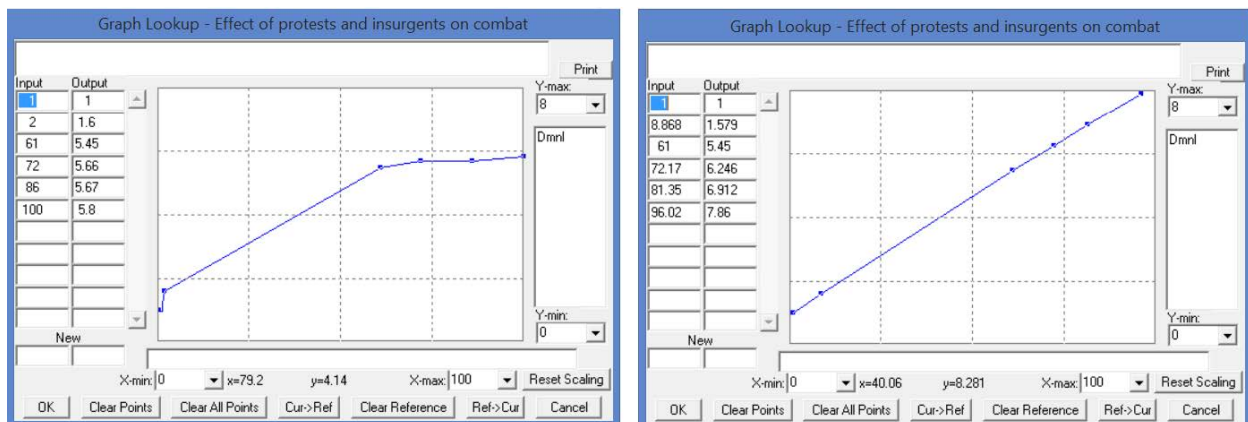
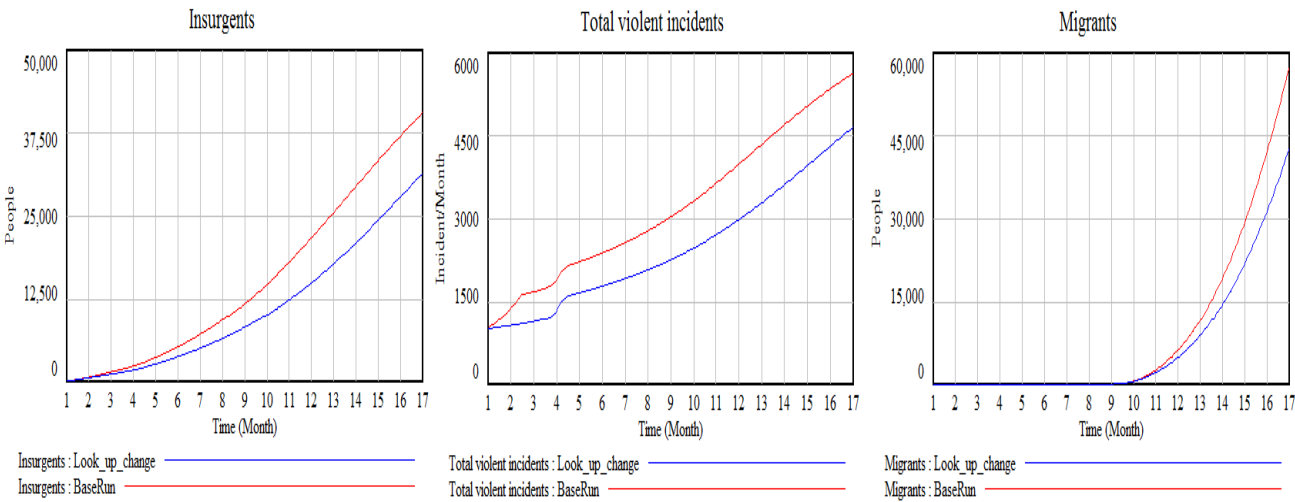


Figure 21: Sensitivity of the changed look-up



Chapter 7: Conclusion and Discussion

7.1 Conclusion

The civil war in Syria is still raging. It has become a dark hole filled with violence and blood that has produced millions of forced migrants. Understanding, explaining and preventing forced migration thus remains ever necessary. The goal of this study was to gain insight into the relationship between regime stability, violence and forced migration. The research question was accordingly: What is the relationship between regime stability, violent conflict and forced migration? This study attempted to answer this question by means of applying a disease model to model how the idea of protesting and insurgency develop in a population.

In order to model this dynamic several assumptions have been made and included in the model. Aside from assuming that the disease model is applicable to the issue at hand there were some important others. For instance, we assumed that the level of repression affects the total number of violent incidents as it will lead to an increase in the number of dissidents that become violent. Moreover, we also assumed that more violent incidents happen in country where the army is deployed. If the army is a conscript army, or one which appoints its own officers or one which has another security force as rival then soldiers will refuse to commit violent incidents and instead defect. We also assumed that the more soldiers defect, the stronger the insurgents become, the more violent the response of the regime will be and the more violent incidents will happen. Furthermore, we assumed that the more violent incidents happen the more people will migrate.

By including these assumptions in the model, we can show how regimes with low regime stability, who deploy their armies, go from encountering small protests to civil war and a mass migratory movement. The model shows that lower regime stability does not necessarily lead to violence. Lower regime stability can be caused by both dissidents and insurgents. Both put pressure on a regime and by demanding social and political change lower regime stability. However, dissidents and their protests do not necessarily lead to violence, while the arrival of insurgents does necessarily lead to violence. The development of dissidents into insurgents depends on the response of regimes to the protests. Many regimes use the police, who use minimal violence, to control the protests. These same regimes may then reform or use financial incentives or other incentives to placate the dissidents and restore order. In

this way, the lower regime stability does not lead to much violence. Thus, the hypothesis posed in the introduction that ‘the lower regime stability, the more forced migration will occur’ is not true.

However, not all governments are not willing to do reform or otherwise placate the dissidents. Instead, they use severe violence and repression to control the protests and subdue the dissidents. This severe violence is performed by the army. Army violence tends to be large in scope and hits both dissidents and innocents in large crackdowns. In this case, the government becomes a threat to everyone and some people will take up weapons to defend themselves from the regime. In this way, the government response to the protests leads to the growth of an insurgency and violence. However, the number of dissidents that become insurgents is small in comparison to another group of people. The number of defecting soldiers. Not all soldiers are equally motivated to violently repress their fellow citizens. Some soldiers will always defect. However, the occurrence of large groups of defecting soldiers depends on three factors. These three factors are: (1) whether or not an army is a conscript army, with unwilling soldiers or a volunteer army; (2) if officers are appointed by the regime or by the army itself; (3) if the army has to compete with other security forces in a country. Defecting soldiers are the largest group of insurgents. A disloyal army that is employed to crush protests will therefore lead to a sharp increase in the number of insurgents and may possibly lead to a civil war and migration.

Thus, this model has shown how, if no government measures placating dissidents are taken, protests spread like an infective disease and lead to increased amounts of dissidents. It also shows how violence may lead to more and more insurgents, depending on the scope of repression in the country and army loyalty. It then shows how the growth of insurgents leads to an increase in violence and in the number of forced migrations. Herein also lies the originality of this simulation model. The only other simulation model on regime stability and violence, by Choucri and colleagues omits the role of the army in the dynamic and is therefore limited in its explanatory value. Moreover, no other simulation study has connected violence to migration.

Of course, none of this matters if the model is a poor one. However, sensitivity analysis of the model shows how the model is relatively robust, as it not behaviorally sensitive to individual variables.

Numerical sensitivity is, however, present and especially affected by variables that affect the level of violence, such as combat actions per soldier and insurgent incidents per insurgent. The model is also sensitive to migration delay. Nevertheless, the general behavior of the model remains in place, the assumptions have shown to be valid and the model consequently offers a new perspective on the dynamic between regime stability, violence and forced migration.

7.2 Limitations

However, there are some limitations to this study. Future studies would do well to account for these limitations. The first limitation concerns the use of SD to study the relationship between regime stability, violence and forced migration is the use of aggregation in the model. The model now assumes that every soldier and every migrant is equally likely to either defect, desert or migrate. Yet, theory finds that migrants have different levels of danger they can handle before they move. The same principle will probably apply to defecting and deserting soldiers. Dissidents too will most likely be able to handle different levels of danger before they quit protesting. This is difficult to capture by means of SD. Second, the decisions of regime actors are difficult to implement in SD models. For example, most regimes did not use their army to repress the protests. The ones that did were the ones most in trouble, but Syria, for example, was in trouble because it used its army which used excessive violence. What would have been the impact if the regime did not decide to use the army? Other government measures such as the subsidy program of the Saudis, that motivated people to not go out and protest, are also difficult to simulate by means of SD. A simulation form that models decisions, such as agent based modeling may be appropriate to answer some of these problems and questions that remain unanswered for now. However, given the lack of available information on the individual behavior of the susceptible population, dissidents, insurgents, migrants and defecting soldiers agent based modeling would still be limited. SD therefore remains the most applicable method.

Third, another caveat of this study is the omission of state capacity, government reforms or other socio-economic indicators that affect regime stability. Choucri and colleagues found that regime stability was affected by a load (state capacity) and pressures (dissidents and insurgents). This study did not include state capacity, but used infection and quitting rate as replacement variables for the assumed effect of state capacity, government reforms and other socio-economic indicators, which were very limited in the case of Syria. The reason for this omission is the lack of scientific consensus on how state capacity should be measured and what relevant indicators are. A causal model of regime stability and violence is necessarily limited when the exact nature of some of the causes is unknown. However, this study has elucidated some other causes that are important in affecting this relationship. Moreover, this study has also shown that the measurement of state capacity offered by the only other simulation study of regime stability and violence is insufficient to explain their dynamics.

The fourth limitation of this study is the presence of the army in the model. The army is necessary to explain the role of regime instability and violence in countries that became mired in violence or whose regimes fell because the army altogether refused to support them. However, the army is not necessary in explaining those countries where regime stability did not lead to violence, where the regime reformed or took measures to solve the protest issue. In those cases, the police force was present and used minor violence to subdue the protests. Yet, the police force is not modelled or present in the model nor is the effect of police violence on regime stability shown in the model. Unfortunately, the police could not be included because there are no studies on the effect of police violence, or the role of the police in the Arab Spring. Nor is there data on the size of the different police forces in the Middle East.

7.3 Recommendations

This study offers but few practical recommendations due to its theoretical nature. However, the main practical insight that stands out from this study is how migration practitioners must look out for the role of the army in countries with protests. If the regime employs its army and the army is not entirely loyal there is a high risk for the development of civil war which will lead to a mass migratory movement.

Future research should foremost focus on the role of socio-economic indicators and state capacity in affecting the infection rate of the protest model. This would make generalization of the model much easier, as the infection rate is now based on historical behavior rather than predicted behavior. Future research should also test what measures influence the infection rate. What are effective measures to take and limit it? Research should also focus on why some countries make do with police officers to control the protests and others, such as Egypt and Tunisia, did not benefit from employing their police because, despite not employing their armies, the protests kept on growing. Moreover, research needs to be done to understand army loyalty. A conscript army leads to defecting soldiers, but what soldiers do defect? Is there a limit to the number of soldiers that defect?

Furthermore, research should focus on the role of (social) media in affecting the contact rate of protests and violent incidents. Media exposure, most likely has an important role in determining how and how many people encounter protests and violent incidents by reading or hearing about them. Elucidating this effect could show the role of government censure in limiting the growth of protests or the role of whatsapp or other social media in growing the protests.

References

- Aarts, P., van Dijke, P., Kolman, I., Statema, J., Dahhan, G. 2012. *From Resilience to Revolt*. Amsterdam: University of Amsterdam.
- Abdel-Hamid, Tarek K. 2011. "A System Dynamics Modeling Perspective of Iraq's Conflicts." (Gregg, Heather ed.). *Three Circles of War* (117-136). Lincoln, NE: University of Nebraska Press.
- Abouzeid, Rania. 2012, June 27. "Dozens Defect From Syrian Army, But Impact Is Limited." *Al-Monitor*. Retrieved from: <http://www.al-monitor.com/pulse/originals/2012/al-monitor/two-hundred-defect-from-syrian-a.html>
- Ajnabi, The. 2011, August 30. "Flash Mobs: The Changing Tactics of Syria's Protesters." *Mideast Posts*. Retrieved from: <http://mideastposts.com/middle-east-politics-analysis/flash-mobs-the-changing-tactics-of-syrias-protesters/>
- "A Look at the Root Causes of the Arab Revolution." 2011, May 20. *Der Spiegel*. Retrieved from: <http://www.spiegel.de/international/world/rising-literacy-and-a-shrinking-birth-rate-a-look-at-the-root-causes-of-the-arab-revolution-a-763537.html>
- Alsalem, Reem. & Riller, Frauke. "UNHCR slashes waiting time, clears backlog of Syrian registrations in Jordan." 2013, October 3. *UNHCR*. Retrieved from: <http://www.unhcr.org/news/makingdifference/2013/10/524d5e4b6/unhcr-slashes-waiting-time-clears-backlog-syrian-registrations-jordan.html>
- Andersen, David., Møller, Jørgen., Rørbæk, Lasse Lykke & Skaaning, Svend-Erik. 2014. "State capacity and political regime stability." *Democratization*, 21 (7): 1305-1325.
- Anderson, Edward G. Jr. 2006. "A Preliminary System Dynamics Model of Insurgency Management: The Anglo-Irish War of 1916-21 as a Case Study." Paper presented at the 2006 System Dynamics conference.
- Anderson, Edward G. Jr. & Black, Laura J. 2007. "Accumulations of Legitimacy: Exploring Insurgency and Counter-Insurgency Dynamics." Paper presented at the 2007 System Dynamics conference.

- Barany, Zoltan. 2011. "The role of the military." *Journal of Democracy*, 22 (4): 27-39.
- Bischof, Daniel. & Fink, Simon. 2015. "Repression as a Double-edged Sword: Resilient Monarchs, Repression and Revolution in the Middle East." *Swiss Political Science Review*, 21 (3): 377-395.
- Black, Ian. 2015, October 1. "Wake-up call on Syrian army weakness prompted Russian intervention." *The Guardian*. Retrieved from: <https://www.theguardian.com/world/2015/oct/01/syrian-military-weakness-russian-intervention>
- Bodvarsson, Orn. B., van den Berg, Hendrik. 2010. *The Economics of Migration*. New York, NY: Springer
- Borschev, Andrei. & Fillipov, Alexei. 2004. "From System Dynamics and Discrete Event to Practical Agent Based Modeling: Reasons, Techniques, Tools." Paper presented at the 22nd International Conference of the System Dynamics Society.
- Bove, Vincenzo., Platteau, Jean-Philippe. & Sekeris, Petros G. 2016. "Political Repression in Autocratic Regimes." *Journal of Comparative Economics*.
- Braithwaite, Alex. 2010. "Resisting infection: How state capacity conditions conflict contagion." *Journal of Peace Research*, 47 (3): 311-319.
- Bricker, Noah Q. & Foley, Mark C. 2013. "The Effect of Youth Demographics on Violence: The Importance of the Labor Market." *International Journal of Conflict and Violence*, 7 (1): 179-194.
- Brooks, Risa. 2011. "Abandoned at the Palace: Why the Tunisian Military Defected from the Ben Ali Regime in January 2011". *Journal of Strategic Studies*, 36 (2), 205-220.
- Brownlee, Jason., Masoud, Tarek., & Reynolds, Andrew. 2015. *The Arab Spring: Pathways of Repression and Reform*. Oxford: Oxford University Press.
- Byun, Chonghyun Christie. & Hollander, Ethan J. 2015. "Explaining the Intensity of the Arab Spring." *Digest of Middle East Studies*, 24 (1): 26-46.
- Byrne, Barbara M. 2010. *Structural Equation Modeling with Amos* (2nd ed.). New York, NY: Routledge.
- Campante, Filipe R. & Chor, Davin. 2012. "Why was the Arab World poised for Revolution? Schooling, Economic Opportunities and the Arab Spring." *The Journal of Economic Perspectives*, 26 (2): 167-187.

Carey, Sabine. 2009. *Protest, Repression and Political Regimes: An Empirical Analysis of Latin America and sub-Saharan Africa*. Albingdon: Routledge.

Cheibub, Jose Antonio. 1998. "Political regimes and the extractive capacity of governments: Taxation in democracies and dictator ships." *World Politics* 50 (3): 349-376.

Choucrist, Nazli, Daniel Goldsmith, Stuart E. Madnick, Dinsha Mistree, J. Bradley Morrison & Michael D. Siegel. 2007. "Using system dynamics to model and better understand state stability". *Working Paper*.

Daragahi, Borzou. 2011, May 13. "Syrian protests, expected to wane, grow stronger." *The Los Angeles Times*. Retrieved from: <http://articles.latimes.com/2011/may/13/world/la-fg-syria-protests-20110514/2>

Daragahi, Borzou. & Sandels, Alexandra. 2011, July 30. "9 reported slain in Syrian protests." *The Los Angeles Times*. Retrieved from: <http://articles.latimes.com/2011/jul/30/world/la-fg-syria-protests-20110730>

Davenport, Christian A., Will H. Moore, and Steven C. Poe (2003). "Sometimes You Just Have to Leave: Domestic Threats and Forced Migration, 1964–1989." *International Interactions*, 29 (1), 27–55.

De Tocqueville, Alexis. 1955. *The old regime and the French Revolution* (Stuart Gilbert, transl). New York: Doubleday.

Derichs, Claudia. & Demmelhuber, Thomas. 2014. "Monarchies and Republics, State and Regime, Durability and Fragility in View of the Arab Spring." *Journal of Arabian studies*, 4 (2): 180-194.

"Dozens of Syrians reported killed in Daraa." 2011, April 26. CNN. Retrieved from: <http://edition.cnn.com/2011/WORLD/meast/03/25/syria.unrest/>

Droz-Vincent, Philippe. 2014. "'State of Barbary' (Take Two): From the Arab Spring to the Return of Violence in Syria." *Middle East Journal*, 68 (1): 33-58.

Fearon, James D. & Laitin, David D. 2003. "Ethnicity, insurgency, and civil war." *American Political Science Review*, 97 (1): 75-90.

Field, Andy. 2009. *Discovering Statistics Using SPSS* (3rd ed.). London: SAGE Publications

Geddens, Barbara. 1999. "Authoritarian Breakdown: Empirical Test of a Game Theoretic Argument." Paper prepared for the annual meeting of the American Political Science Association.

Ghattas, Kim. 2012, June 12. "Syria in civil war, says UN official Herve Ladsous." *BBC*. Retrieved from: <http://www.bbc.com/news/world-middle-east-18417952>

"Global Trends Forced Displacement in 2015." 2015. *UNHCR*. Retrieved from: <http://www.unhcr.org/576408cd7.pdf>

Harkin, James. 2016, December 7. "The incredible story behind the Syrian protest singer everyone thought was dead." *GQ*. Retrieved from: <http://www.gq-magazine.co.uk/article/syria-civil-war>

Henderson, Errol A. & Singer, David J. 2000. "Civil war in the post-colonial world, 1946-1992." *Journal of Peace Research*, 37(3): 275-299.

Hendrix, Cullen S. 2010. "Measuring state capacity: Theoretical and empirical implications for the study of civil conflict." *Journal of Peace Research*, 47 (3): 273-285.

Hegre, H., T. Ellingsen, S. Gates, N. Gleditsch. 2001. "Toward a Democratic Civil Peace? Democracy, Political Change, and Civil War, 1816-1992," *American Political Science Review*, 95 (1), 33-48.

Hurwitz, Leon. 1973. "Contemporary approaches to political stability." *Comparative politics*, 5 (3), 449-463.

International Crisis Group. 2011. "Popular Protest In North Africa And The Middle East (VI): The Syrian People's Slow Motion Revolution." Middle East/North Africa Report # 108 – 6 July 2011.

Jenkins, Brian Michael. 2013. "The role of terrorism and terror in Syria's civil war". *Rand Corporation*.

Kocher, Matthew Adam, Thomas Pepinsky, & Stathis N.Kalyvas. 2011. "Aerial Bombing and Counterinsurgency in the Vietnam War." *American Journal of Political Science* 55(2), 1-18.

Korotayev, Andrey V., & Zinkina, Julia V. 2011. "Egyptian Revolution: A Demographic Structural Analysis." *Revista Interdisciplinar*, 13: 139-169.

Korotayev, Andrey V., Issaev, Leonid M., Malkov, Sergey Yu. & Shiskina, Alisa R. 2015. "The Arab Spring: A Quantitative Analysis." *Arab Studies Quarterly*, 36 (2): 149-169.

Kozak, Christopher. 2015. "An Army in All Corners": Assad's Campaign Strategy in Syria." *Institute for the Study of War*. Retrieved from:
<http://understandingwar.org/sites/default/files/An%20Army%20in%20All%20Corners%20by%20Chris%20Kozak%201.pdf>

Kriger, Norma J. 1992. *Zimbabwe's Guerrilla War*. New York: Cambridge University Press.

Kuran, Timothy. 1989. "Sparks and prairie fires." *Public Choice*, 61: 41-74.

Lemos, Carlos., Coelho, Helder. & Lopez, Rui J. 2013. "Agent-based modeling of social conflict, civil violence and revolution: state-of-the-art review and further prospects." Paper presented at the 11th European conference on Multi-Agent systems.

Lister, Charles. 2012. "The Free Syrian Army: A decentralized insurgent brand." *Brookings Institute*.

Lyall, Jason. 2009. "Does Indiscriminate Violence Incite Insurgent Attacks? Evidence from Chechnya." *Journal of Conflict Resolution*, 53(3), 331-362.

Lyall, Jason, Graeme Blaur, Kosuke Imai. 2013. "Explaining support for combatants during wartime: A survey experiment in Afghanistan." *American Political Science Review*, 107 (4).

Malik, Adeel. & Awadallah, Bassem. 2013. "The economics of the Arab Spring." *World Development*, 45: 296-313.

Meadows, Donella H. 2008. *Thinking in Systems – A Primer*. White River Junction, VT: Chelsea Green Publishing.

Melander, Erik & Öberg, Magnus. 2006. "Time to Go? Duration Dependence in Forced Migration." *International Interactions*, 32 (2), 129-152.

Metz, Steven. & Millen, Raymond. 2004. "INSURGENCY AND COUNTERINSURGENCY
IN THE 21st CENTURY: RECONCEPTUALIZING THREAT AND RESPONSE." *Strategic Studies Institute*.

Migdal, Joel S. 1988. *Strong Societies and Weak States: State-Society Relations and State Capabilities in the Third World*. Princeton. NJ: Princeton University Press.

Moore, Will H. & Stephen M. Shellman (2004). "Fear of Persecution: A Global Study of Forced Migration, 1952–1995." *Journal of Conflict Resolution*, 40 (5), 723–745.

Morecroft, J. D. W. & Robinson, S. 2005. "Explaining Puzzling Dynamics: Comparing the Use of System Dynamics and Discrete-Event Simulation." *Proceedings of the 23rd International Conference of the System Dynamics Society*.

Mulderig, Chloe M. 2013. "An Uncertain future: Youth frustration and the Arab Spring". *The Pardee Papers*.

Nehru, Jawaharlal. 1934. *Glimpses of World History*. London: Penguin Books.

Nepstad, Sharon E. 2011. "Nonviolent Resistance in the Arab Spring: The Critical Role of Military-Opposition Alliances." *Swiss Political Science Review*, 17 (4): 485-491.

Nepstad, Sharon E. 2013. "Mutiny and Nonviolence in the Arab Spring: Exploring military defections and loyalty in Egypt, Bahrain and Syria." *Journal of Peace Research*, 50 (3): 337-349.

Oweidat, Nadia., Benard, Cheryl., Stahl, Dale., Kildani, Walid., O'Connell, Edward., & Grant, Audra K. (2012). "The Kefaya Movement." *Rand Corporation*.

Özekin, Muhammed Kürsad & Akkas, Hasan Hüseyin. 2014. "An empirical look to the Arab Spring: causes and consequences." *Turkish journal of International Relations*, 13 (1/2), 75-87.

Pfeffer, Anshel. 2012, May 28. "Syrian rebel leader to Haaretz: Assad's opposition will secure chemical weapons." *Haaretz*. Retrieved from: <http://www.haaretz.com/blogs/the-axis/syrian-rebel-leader-to-haaretz-assad-s-opposition-will-secure-chemical-weapons-1.433021>

Poe, S.C., Tate, C.N. & Keith, L.C. 1999. "Repression of the Human Right to Personal Integrity Revisited: A Global Cross-National Study Covering the Years 1976–1993." *International Studies Quarterly* 43(2): 291–313.

“Protesters killed amid huge Syria protests.” 2011, July 22. *Al Jazeera*. Retrieved from:
<http://www.aljazeera.com/news/middleeast/2011/07/2011722171756722811.html>

“Syria: Rebels’ Car Bombs, Rockets Kill Civilians.” 2015, March 22. *Human Rights Watch*. Retrieved from:
<https://www.hrw.org/news/2015/03/22/syria-rebels-car-bombs-rockets-kill-civilians>

Sambanis, Nicholas. 2004. “What is a Civil War? Conceptual and Empirical Complexities of an Operational Definition.” *Journal of Conflict Resolution* 48 (6): 814-858.

Savoia, Antonio. & Sen, Kunal. 2015. “Measurement, Evolution, Determinants, and Consequences of State Capacity: A Review of Recent Research.” *Journal of Economic Surveys*, 29 (3): 441-458.

Schmeidl, Susanne (1997). “Exploring the Causes of Forced Migration: A Pooled Timeseries Analysis, 1971–1990.” *Social Science Quarterly*, 78 (2), 284–308.

Schutte, Sebastian. 2014. “Geography, Outcome and Casualties: A unified model of insurgency.” *Journal of Conflict Resolution*, 59 (6): 1101-1128.

Sokolowski, John A. & Banks, Catherine M. 2007. “From Empirical Data to Mathematical Model: Using Population Dynamics to Characterize Insurgencies.” *SCSC '07 Proceedings of the 2007 Summer Computer Simulation Conference*, 1120-1127.

Stack, Liam. 2011, October 27. “In Slap at Syria, Turkey Shelters Anti-Assad Fighters.” *The New York Times*. Retrieved from: <http://www.nytimes.com/2011/10/28/world/europe/turkey-is-sheltering-antigovernment-syrian-militia.html>

Stack, Liam. & Zoeff, Katherine. 2011, April 8. “Syrian Protests Are Said to Be Largest and Bloodiest to Date.” *New York Times*. Retrieved from:
<http://www.nytimes.com/2011/04/09/world/middleeast/09syria.html>

Sterman, John D. 2000. *Business Dynamics: Systems thinking and modeling for a complex world*. New York: McGraw Hill.

“Syria launches new commando force as war heats up.” 2016, November 22. *Al Jazeera*. Retrieved from:
<http://www.aljazeera.com/news/2016/11/syria-seeks-volunteers-support-army-successes-161122160216259.html>

"Syria's refugee crisis in numbers." 2016, December 20. *Amnesty International*. Retrieved from:
<https://www.amnesty.org/en/latest/news/2016/02/syrias-refugee-crisis-in-numbers/>

"Timeline: Egypt's revolution." 2011, February 14. *Al Jazeera*. Retrieved from:
<http://www.aljazeera.com/news/middleeast/2011/01/201112515334871490.html>

Tofalvi, Fruzsina. 2012. *Military Disloyalty and Regime Change: A Comparative Examination of Loyalty shifts in the Armed Forces* (Master's thesis). Retrieved from: www.etd.ceu.hu/2012/tofalvi_fruzsina.pdf

Ulrich, Marybeth, P. & Atkinson, Carol. 2012. "The Arab Spring and Arab Militaries: The Role of the Military in the Transitioning Middle East." *Working Paper*.

Weber, Max. 1919. "Politics as a vocation." Retrieved from: <http://anthropos-lab.net/wp/wp-content/uploads/2011/12/Weber-Politics-as-a-Vocation.pdf>

Winz, Ines., Bierley, Gary. & Trowsdale, Sam. 2009. "The use of system dynamics simulation in water resources management." *Water Resources Management*, 23 (7): 1301-1323.

"With Syria army in tatters, pro-Assad militias fill the gap." 2015, September 25. *Middle East Eye*. Retrieved from: <http://www.middleeasteye.net/news/syria-army-tatters-pro-assad-militias-fill-gap-1516906335>

Wolf, Erika J., Harrington, Kelly M., Clark, Shaunna L. & Miller, Mark W. 2015. "Sample Size Requirements for Structural Equation Models: An Evaluation of Power, Bias, and Solution Propriety." *Education and Psychological Measurement*, 76 (6): 913-934.

Worley, Will. 2016, January 27. "Six out of 10 migrants to Europe come for 'economic reasons' and are not refugees, EU Vice President Frans Timmermans says." Retrieved from:
<http://www.independent.co.uk/news/world/europe/six-out-of-10-migrants-to-europe-come-for-economic-reasons-and-are-not-refugees-eu-vice-president-a6836306.html>

Yom, Sean L., & Gause III, Gregory C., 2012. "Resilient Royals: How Arab Monarchies hang on." *Journal of Democracy*, 23 (4): 74-88.

Appendix (A) Formulas

Protests

Susceptible population (Stock-initial value:670000): -People turning into dissidents - (Unit: people)

Infection (constant): 0.9 - Unit: Dmnl

People turning into dissidents (flow): $\text{Contact rate} * \text{Susceptible population} * \text{Infection} * (\text{Dissidents} / \text{Total population})$

Dissidents (stock – initial value 1000): $(0.97 * \text{People turning into dissidents}) - \text{Dissidents quitting}$ - Unit: People

Dissidents turning to violence (auxiliary): $0.03 * \text{People turning into dissidents}$ –Unit: People/Month

Potentially violent dissidents (stock- initial value 0): $\text{Dissidents turning to violence} - (\text{Dissidents turning violent} + \text{Violent dissidents quitting rate})$ – Unit: People

Initial dissidents (constant): 1000 – Unit: People

Protests (auxiliary): $(\text{Protests per dissidents} ((\text{Dissidents} + \text{Potentially violent dissidents}) / \text{Initial dissidents})) * \text{Initial protests}$

Initial protests: (constant): 52 – Unit: Incident/Month

Protests per dissident (Look-up): [(0,0)-(650,8)],(1,1),(100,2),(150,3),(200,3.7),(250,4.3),(300,4.8),(400,5.3),(500,5.7),(600,6.1), (700, 6.4), (800, 6.6), (900, 6.8)

Contact per protest (constant): 1 – Unit: 1/Incident

Contact rate (auxiliary): $\text{Protests} * \text{Contact per protest}$ – Unit: 1/Month

Dissidents quitting (flow): $\text{Quitting rate} * \text{Dissidents}$ - (Unit: People/Month)

Potentially violent dissidents quitting rate (flow): $\text{Quitting rate} * \text{Potentially violent dissidents}$ – Unit: People/Month

Quitting rate (constant): 0.03 - Unit: 1/Month

Total population (constant): 21,000,000 – Unit: People

Insurgency

Dissidents turning violent (flow): $\text{Contact rate 2} * \text{Effect of repression on dissidents} * \text{Potentially violent dissidents} * (\text{Insurgents} / \text{Total population})$

Contact rate 2 (auxiliary): $\text{Total violent incidents} * \text{Contact per violent incident}$ – Unit: 1/Month

Contact per violent incident (constant): 1 – Unit: 1/Incident

Repression (constant): 4 – Unit: Dmnl

Effect of repression on dissidents (auxiliary): IF THEN ELSE (Repression=4, 0.05, IF THEN ELSE (Repression=5, 0.1, 0)) – Unit: Dmnl

Total violent incidents (auxiliary): $\text{Army combat actions} + \text{Insurgent incidents}$ – Unit: Incident/Month

Insurgents (stock – initial value 10): $\text{Defecting soldiers} + \text{Dissidents turning violent}$ – Unit: People

Insurgent incidents per insurgent (constant): 0.03 – Unit: Incident/Month/People

Insurgent Incidents (auxiliary): $\text{Insurgents} * \text{Insurgent incidents per insurgent}$ – Unit: Incident/Month

Army

Army (stock – initial value 300000): $-(\text{Defecting soldiers} + \text{Deserting soldiers})$ – Unit: People

Defecting soldiers (flow): $\text{MIN} (\text{Army} / \text{Time to desert or defect}, \text{Total violent incidents} * \text{Soldiers defecting per incident} * \text{Army disloyalty})$ – Unit: People/Month

Deserting soldiers (flow): $\text{MIN} (\text{Army} / \text{Time to desert or defect}, \text{Soldiers deserting per incident} * \text{Total violent incidents})$ – People/Month

Soldiers defecting per incident (constant): 0.5 – Unit: People/Incident

Soldiers deserting per incident (constant): 0.5 – Unit: People/Incident

Time to desert or defect (constant): 1 – Unit: Month

Army disloyalty (auxiliary): Conscript army+Presence of rival security force+Non selective officer selection – Unit: Dmnl

Conscript army (constant): 1 – Unit: Dmnl

Presence of rival security force (constant): 0 – Unit: Dmnl

Non selective officer selection (constant): 0 – Unit: Dmnl

Army combat actions (auxiliary): Army*Combat actions per soldier – Unit: Incident/Month

Combat actions per soldier (auxiliary): Effect of protests and insurgents on combat (Insurgent incidents+Protests) – Unit: Incident/Month/People

Effect of protests and insurgents on combat (lookup): [(0,0)-(100,8)],(1,1),(2,1.6),(61,5.45),(72,5.66),(86,5.67), (100, 5.8)

Initial combat actions per soldier (constant): 0.00333 – Unit: Incident/Month/People

Initial protests and insurgent incidents per soldier: 52.3 – Unit: Incident/Month

Migration

Threat level (level-initial value 0): Change in threat level – Unit: Incident

Change in threat level (flow): Army combat actions+Insurgent incidents – Unit: Incident/Month

People migrating(flow): DELAY FIXED (Effect of monthly threat on migration*Threat level,Migration delay,0) – Unit: People/Month

Migration delay (constant): 8 – Unit: Month

Effect of threat on migration (constant) : 1 – Unit: People/Month/Incident

Migrants (stock – initial value 0): People migrating – Unit: People