A model-based study and policy analysis of Domestic Violence and Sexual Harassment against Women and Children

Abstract

This paper addresses the pervasive problem of sexual harassment and domestic violence against women and children. Following a brief introduction to the scope and consequences of sexual harassment in different regions, this article focuses on the current situation in Egypt. To gain insight on the effects of the different policies proposed in the Egyptian context, a System Dynamics model is used. First, a policy analysis is performed on the 'quick and dirty' simulation model and then the preliminary results are tested under uncertainty. The main conclusion is that reduction on the side of the offender is of significant importance, but comparatively time consuming and therefore not sufficient.

Keywords: Sexual Harassment, Offender, Uncertain parameters, Sensitivity, Health
Word count: 4899

1. Introduction

Sexual harassment has prevailed for centuries and in numerous countries around the world, the woman is usually the victim of violence resulting from the relationships between the different genders. Sexual harassment can be defined as the unwelcome sexual advances, requests for sexual favors, and other verbal or physical conduct of a sexual nature(Cutajar, 2010). A famous example of sexual harassment is the sexual coercion that was an entrenched feature of chattel slavery endured by African-American women without protection of law. Surviving accounts of women employed in manufacturing and clerical positions in the late nineteenth and early twentieth century's in England also point to a variety of contexts in which men imposed sexual relations ranging from assault to all manner of unwanted physical or verbal advances. Currently, at least one in three women is beaten, coerced into sex, or otherwise abused by an intimate partner in the course of her lifetime (Unifern-2003).

According to World Bank data (Heise, Lori L.; Pitanguy, Jacqueline; Germain, Adrienne. 1994), women aged 15-44 are more at risk from rape and domestic violence than from cancer, motor accidents, war and malaria. Sexual violence against women continues to be one of the most brutal forms of gender-based violence.

According to UNIFEM ("Press Release: UN Women calls on Governments to deliver a concrete roadmap on Ending Violence against Women," 2013) ,few countries have specific and 44 countries have no legislation at all. It is only in the United States in 1964 that sexual harassment law started having a history, and even then, the Civil Rights Act failed to consider the first sexual harassment cases until the 1970s. Except for the UK and Ireland (where the approach in legislation is quite similar to the US), sexual harassment policy adopted in European countries tended to avoid policy-

making via litigation. It also tended to emphasize union-management agreements on anti-mobbing[1] rules especially for the workplace. In general, sexual violence has been historically addressed as an issue of morality and honor, and was often viewed as a crime against the family or society.

The topic of this paper is related to health issues because of the physical and psychological effects of severe cases of sexual assaults (rape) and domestic violence. The paper aims to analyze the relations between sexual harassment victims and their offenders using a simulation model in order to provide a better understanding of growing number of offenses and it's relation to societies' characteristics (such as masculinity factor). Since one of the major drawbacks in studying this phenomenon is the lack of regular and comparable data, the system dynamics approach provides a tool with which all sort of uncertain assumptions and estimations can be explored for policy-making purposes.

The structure of this paper is as follows: First, the problem of sexual violence is further explored. Model boundaries, assumptions and intended interventions are introduced in section 2. In section 3, the base model and its behavior is presented. Proposed policies and their effects are then discussed in section 4. Concluding remarks, current and future propositions are then put forward in section 5. The Appendix includes the explanation of the used equations in the model.

2. The Problem

2.1 Why choose Sexual Harassment and Domestic Violence?

Despite the positive impact of all modern legal, educational, and economic reforms on the position of women in the society and the growing strength of feminist movements, the majority of women living in the Middle East region have not benefited from the opportunities created. In terms of the Gender Empowerment Measure (GEM)[2], the Arab region ranks lower than any other region except sub-Sahara Africa. The collective mechanisms aimed at controlling women's body and sexuality is a root cause of gender inequality in the region(Alabaster, 2013). The situation in Egypt seems to get out of hand quite uncontrollably, and this is irrespective of age, race, ethnicity and social class(Malik, 2009). Whether you are veiled wearing Hijab, Nikab or western, if you are a woman living in Cairo, chances are you have been sexually harassed(Martin, 2010). Tahrir Square, the center of 2011's Egyptian Revolution, has in itself been the scene of a number of assaults against women - both protesters and journalists - in the aftermath of the revolution("Egyptian women protesters sexually assaulted in Tahrir Square," June 2012). Sexual harassment became an organized crime. In February 2011, news broke about the mob sexual assault on CBS News correspondent Lara Logan in Tahrir square ("Stripped, punched and whipped with flag poles: Full horror of Lara Logan's attack emerges," 2011) . Protesters were no more the decent angels fighting for the truth, in the public eye, but it was true that thugs were also there among the protesters. The act of harassment not only happens on the streets but it extends to crowded buses, the workplace, schools, and even in doctors' offices(Rogers, 2010). Many Egyptian women are now scared to

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[1] European term for "systematic workplace hostility of long duration imposed on someone"
[2] Introduced by United Nations Development Program, Human Development Report

appear alone or even with female friends in public places. Campaigners in Egypt argue that the problem of sexual harassment is reaching epidemic proportions, with a steep rise in such incidents over the past couple of months and during the revolution. For many Egyptian women, sexual harassment - which sometimes turns into violent mob-style attacks, is a daily fact.

In 2008, a study by the Egyptian Centre for Women's Rights found that more than 80% of Egyptian women have experienced sexual harassment[1]("The status of Egyptian women in 2012," 2013), and that the majority of the victims were the ones who wore Islamic headscarves. It seems that the problem is deeply rooted in the society: a mixture of increasing Islamic conservatism, on the rise since the late 1960s, and old patriarchal attitudes. Nowadays, even the celebrations of religious holidays in crowded public squares – are considered a widespread opportunity for harassment of women by men(Hassan, 2009).

From what has been discussed in this section, it is clear that numerous actors shape the real-time performance of the system and its long-term progression. Additionally, the resulting interactions and interdependencies involve unknown consequences, which add an extra dimension to the complexity of the system. So rather than focusing on the specific system components or subsystems, our effort is aimed at understanding the structure and behavior of the system as a whole. Consequently, System Dynamics seems to be a better choice over other available methods.

Growing up in Iran and Egypt, authors of this paper have personally experienced both the fear of being grouped or verbally harassed and the humiliation of one of the biggest impediments to addressing the issue: widespread mentality of "blaming the victim". Therefore, it is the authors' greatest hope that this work could help explore policies and provide a platform for discussion of more realistic and plausible interventions.

2.2 Overview and Boundaries

It is important to highlight that sexual harassment is an ongoing and, perhaps at some levels, a rewarded topic. Therefore, there is lots of disagreement on the legal, social, and other aspects of the problem. In addition, because of the sensitive sex related concept of the issue, especially in the more conservative regions (such as Egypt, our case study), finding accurate and reliable data is quite hard. The main reason for this, as estimated, is that only 46 percent of the physical sex abuses are reported. Aside from the low report rate, most cases are not even documented by the police with regards to verbal harassment ("Annual reports," 2012). The result of this is a number of uncertain parameters and relations in the model (See Appendix). The data has been extracted from several sources in order to form the best possible estimation.

In this paper, the long-term effects of severe forms of violation such as depression, PTSD[2] anxiety(Matthew Tull, 2008), drugs and substance misuse, have not been modeled in detail. In addition to the victim/survivor, the profound effects of sexual assault also extent to the victim/survivor's family members, friends, workers in the sexual assault field and the society as a

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[1] This statement refers to all kinds of sexual harassment including verbal
[2] Post-traumatic stress disorder

whole in detrimental and under-recognized ways. It can disrupt and alter a victim's work life, leisure activities and community life.

Furthermore, in masculine and traditional societies, victims can suffer "secondary victimization[1]"("What is secondary victimization?,") through their experience of the response of the criminal justice system, health service providers and degrading negative responses from friends, family, and the broader society. Sexual assault may have financial costs, including loss of earnings, loss of earnings capacity, medical and counseling expenses, and of course, a myriad of intangible costs not measurable in monetary terms (Mayhew & Adkins, 2003). In general, it is essential to highlight that this paper is adopts a 'quick and dirty' model that represents the basic system where estimations are rather simple.

Although there is no solid distinction presented between the different kinds of sexual harassment (verbal or physical), the data utilized is generally relevant to physical abuses. The time span of the model is 12 years, from 2000 to 2012, in order to account for cultural effects (such as the role of "Masculinity"). The Time Step in the model is in month. The data source used in the policy testing includes a significant fluctuating change in the number of offences in monthly period, so the time step chosen to adapt this situation.
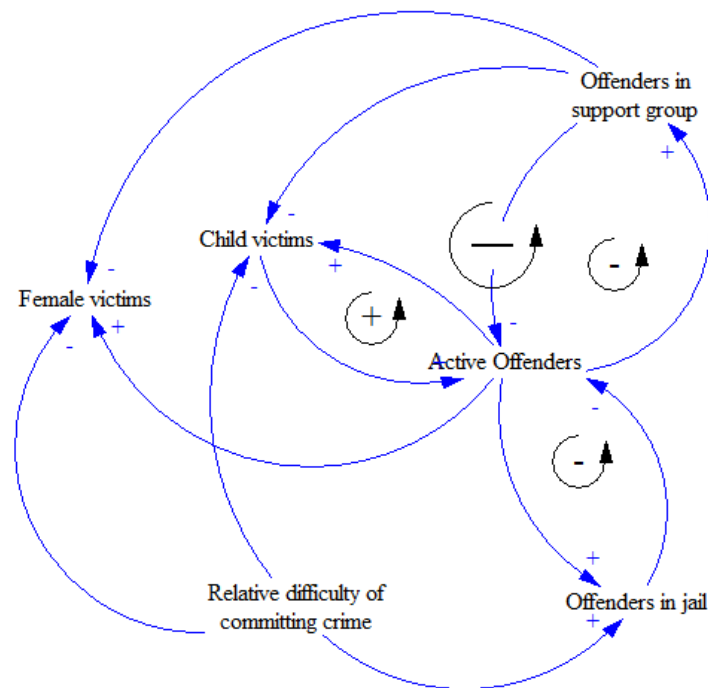

Figure 1: Aggregated Casual Loop Diagram of Violation and Sexual Harassment

3. The Simulation Model

In the previous section, the choice of employing the System Dynamics method for exploring the sexual harassment issue is discussed. In this section, the quantitative simulation model based on the aggregated causal loop diagram shown in Figure 1 is presented. The initial values and constants

for the base case scenario are listed in Table 1 (See Appendix). As was mentioned in the section 2, the data used in this scenario is from the year of 2000 to 2012. [1]

3.1 The Model Structure

The stock-flow diagram of the simulation model is presented in Figure 6. Although the model is adapted to the Egypt data set, it can be specified for every county by changing the parameters such as initials and constants. The main focus in building the model was that the behaviour stays dynamic and can be created by the structure rather than using highly uncertain constants and roughly estimated equations. This model presents a general structure for the cycle of sexual harassment and shows the impact of socio-psychological elements such as masculinity factor and the public reaction on the number of offenders and thus the number of victims. The base model consists of two main parts: Victims (Women and Children) and Offenders

- **Child victims:** Since Sexual harassment, defined as unwelcome sexual behavior, can occur as either a single isolated incident or repeated incidents over time, the children part is divided into three phases: *Number of child victims*, *Number of multi violated child victims* and *Number of traumatized adults who became offender* (Figure 2). The inflow of the *abused child* is determined by a proportion of *total number of assaults per month*. A constant fraction of child victims are assumed to be the target of multi-violation especially in the cases of domestic violence. Both child stocks are decreased through the *support* outflow and since the sources for the help provided to the victims is the same, a constant *Support rate* is divided into two non-equal fractions. The multi-violated stock is also decreased through suicide of the victims. The suicide rate for the single incidents of child abuse is negligible. There is a chance that a child would become an offender himself because of the childhood trauma and lack of proper support. The *Fraction of becoming offender* is higher for the multi-violated victims. The *transformation time* for this practice is considered to be on average, 10 years. This structure can also be modelled as an aging chain, but it has to be noticed that the victims who enter the stock at a same time are not of the same age; therefore, a simple N order delay cannot cover the fact.

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[1] Secondary victimization occurs when the societal response to a victimizing stigma is more disabling than the primary stigmatic condition itself.
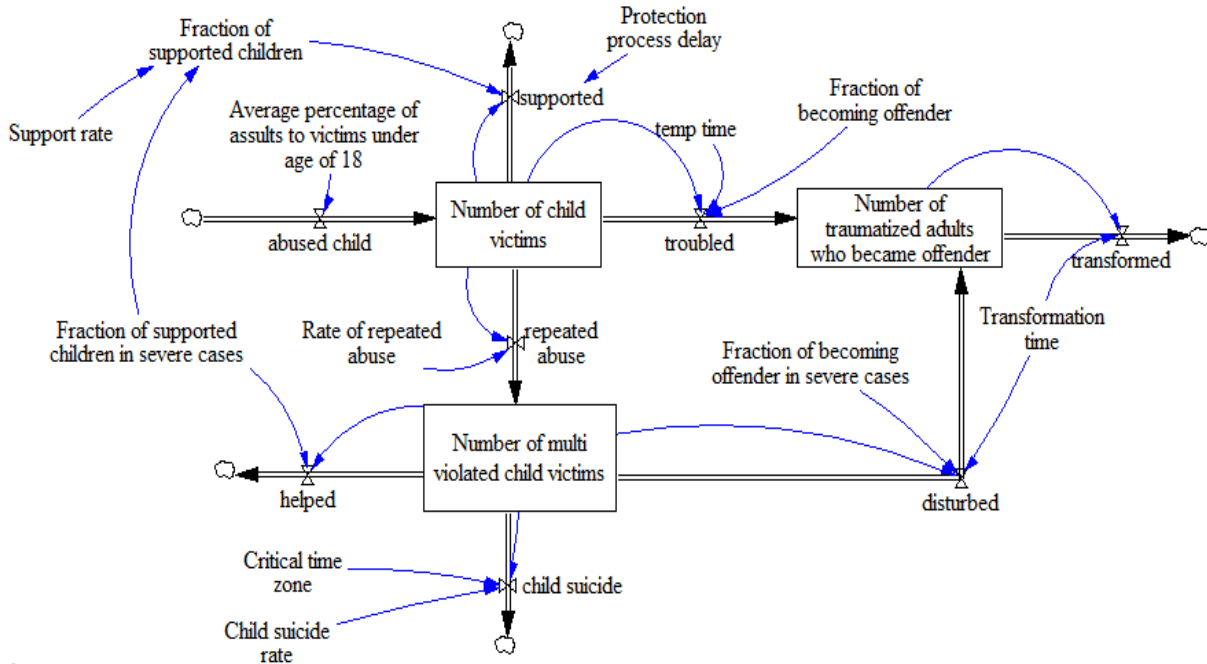
Figure 2: Children Violation Stock Flow

- **Female victims:** According to the data sources, female victims, on average, are most likely to report their harassment during the year following the incident. Therefore, this period is a critical time in terms of providing support to the victims, since they do not tend to participate in the support groups or report the incidents after this time. Therefore, in the following structure of Figure 3, the accumulated stock of *Number of female victims* is decreasing by two outflows: one representing the victims who leave the critical time zone and the other indicating the attempt of suicide, which is one of the most investigated results of assaults among victims.
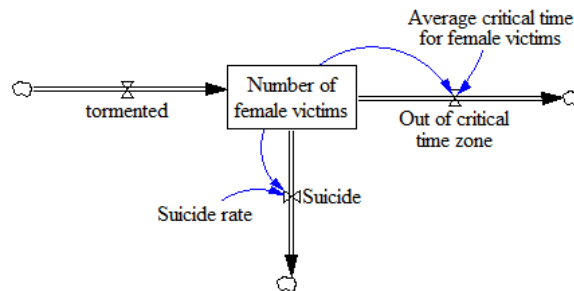

Figure 3: Women Violation Stock Flow

- **Offenders**: Total number of offenders (unknown and known) determine the *total number of assaults per month.* The *Unknown offenders* refer to those offenders who are still not caught and therefore, no record of them is available. As a result, these offenders feel safer to commit assault again and their *Average number of offences* is higher. The number of

Unknown offenders is increased by an inflow of *new offenders* that is affected by a net increase. An unknown offender can turn into a known offender by means of being prosecuted and sentenced to jail. It could be argued that some of the offenders will not commit assault after they get out of jail, but this fraction was too low compared to the remaining known offenders, and therefore this statistic has been neglected. An important assumption in this structure is that *the total number of arrests* is divided between known and unknown offenders and has a direct relation with the proportion of known offenders to the sum of known and unknown offenders. (For detailed explanation of the equations, see Appendix).
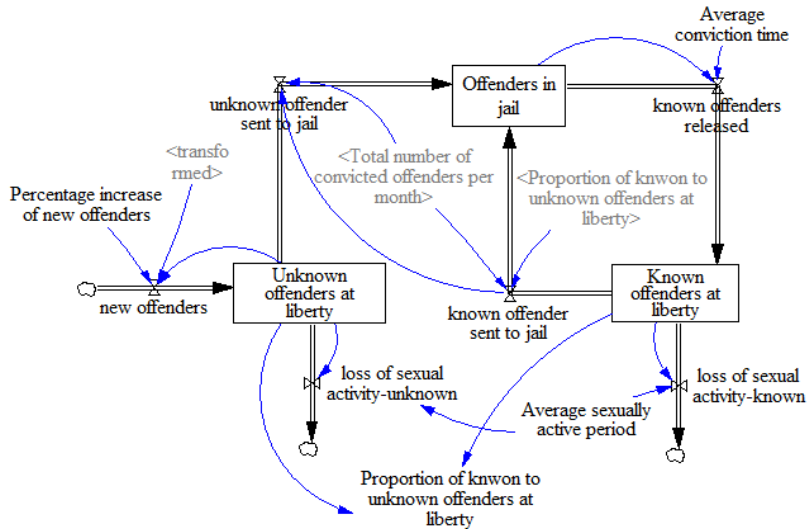
Figure 4: Offenders Stock Flow

The **population** is presented by a simple ageing chain structure with children and adults. This structure is used to calculate the proportion of number of victims to the population. The data on the *birth*, *death* and *age of consent* match the Egypt population growth from near 2000 to 2012.
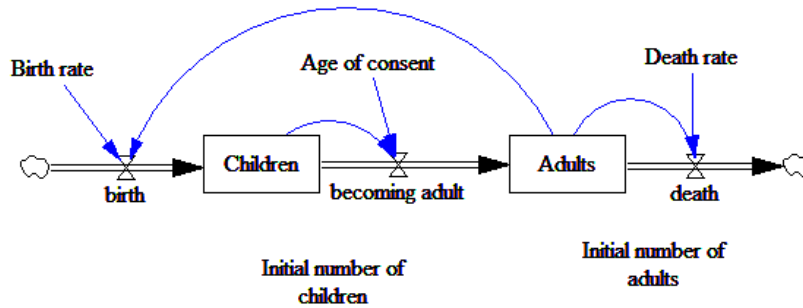
Figure 5: population structure

Figure 6: Stock-flow diagram of the base model

3.2 Model Behavior: Base case and simple basic policies

Simulation of the base case model in Figure 7, shows the results if nothing changes in terms of policy implementations: growth in the number of offenders and increasing number of victims. The extra increase in the number of victims that occurs every six months is due to the *seasonality* factor. According to the data set there is always more violation happening after Ramadan which is the sixth month of the year and continuous for one month(Hassan, 2009). The number of unknown offenders shows a higher growth rate which is caused by the higher inflow (sum of *transformed abused adults* and the multiplication of *Percentage increase of new offenders* to *Unknown offenders at liberty*).
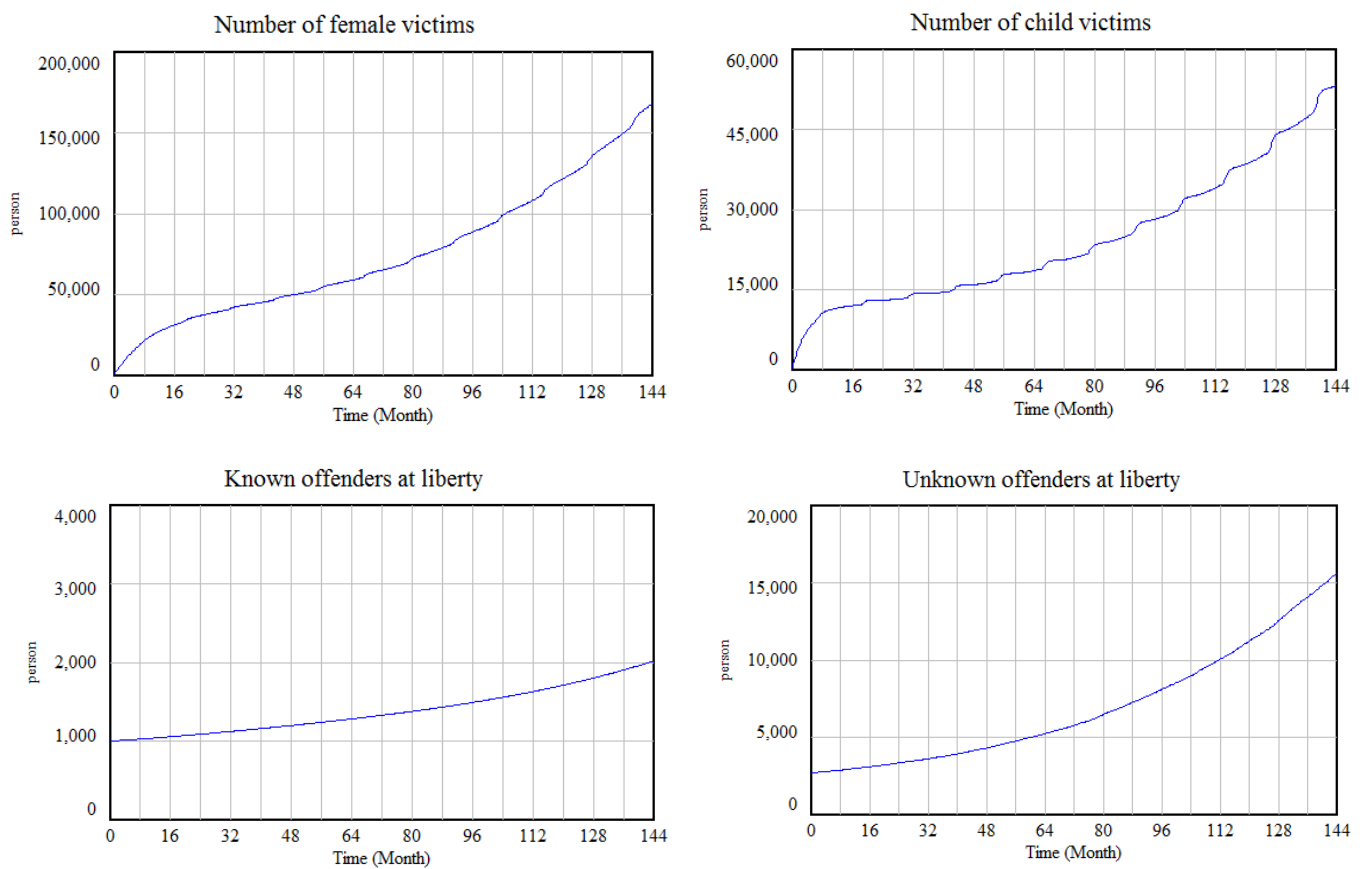
Figure 7: Base case behavior

3.3 Validation

For the validation test of the model, two of the most important factors that are influencing the *Unknown offenders* are chosen for the extreme value test:

Lines	Fraction of becoming offender in severe cases	Chance of getting caught
Grey	100 (all of them will become offenders)	0
Green	0	100 (all the offenders will be arrested)
Red	100	100
Blue	0	0

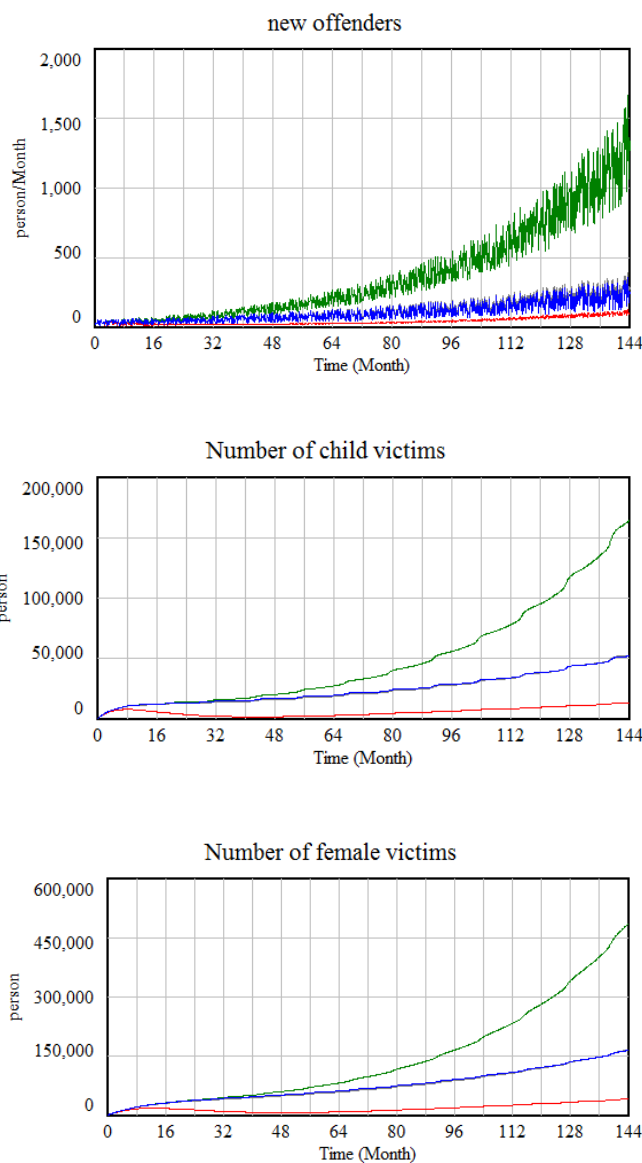**Table 1 Extreme test values**

The results of this extreme test can be seen in figure 8 (The black line shows the original graph). This test shows an interesting dynamic behavior indicating that a change in the *Fraction of becoming offender in severe cases* has more effect on the growth of offenders and victims than the *Chance of getting caught.* Unfortunately, a change in the *Fraction of becoming offender in severe cases* needs significant social and financial support for the child victims of violence. As was mentioned before, there is also another hidden aspect of the domestic violence in the model, which is the effect of witnessing violence and sexual harassment by children on the *Percentage increase of new offenders.* The adults who witnessed violence and sexual assaults seem to be more likely to become offenders themselves, which will change the number of potential offenders in the society and relatively the number of active offenders.

However, since the changes in this fraction will happen much more slowly than the *Percentage increase of new offenders*, it is not considered in the upcoming policy interventions.

Figure 8: Children Violation Stock Flow

4. Policy Analysis

Although the base case might not show an interesting dynamic behavior, exploration of different interventions does lead to interesting conclusions. Analyzing effects of policy interventions individually, would clarify the system's influences and behavior. There are three main policy interventions, which are marked with the orange color in the completed model, Figure 9.

– **Policy 1: Effect of capable police force**

The high number of victims does not necessarily result in the high number of reports and therefore, high number of arrests. Especially in the more masculine societies the victims of sexual harassment and domestic violence are usually blamed for the incident too. Another important factor in the number of reports is the definition of sexual harassment from the perspective of the law. In some cases, the victim may report to the police but the case would be dismissed due to the lack of evidence or the fact that the case would not be recognized as sexual harassment. The *Masculinity factor effect* and *Corruption of the police* would change *the chance of getting caught* which in return would decrease the *number of arrests.*

– **Policy 2: Relative media attention**

It was assumed that there are an *acceptable number of victims* in the society which would directly affect the *relative media attention* as soon as the proportion of victims to the population reaches a certain level. The more the media focuses on this matter, the higher the number of people paying attention to it and therefore, would request for solutions such as more restrict regulations or more severe punishment for the convicted offenders. So the *relative media attention* which is a look up function of the *acceptable number of victims* would result into a social nuisance with a delay time of one year. The social nuisance then affects the offender fraction, either by affecting the potential victims so that they would not actually commit violence (this could even affect the *Percentage increase of new offenders* in the society by educating the children but this policy may take decades before showing any visible results) or by forcing more restrict laws against violation that makes the crime more costly and therefore less likely to happen.

– **Policy 3: Providing help to offenders**

There are so many factors that would affect whether or not a potential offender commits sexual harassment or if he would repeat it again. Further, re-offense rates vary among different types of sex offenders and are related to specific characteristics of the offender and the offense. However, it seems that putting even a small number of offenders in the reform program would create a great opportunity to take them out of the threat zone and to decrease the number of assaults by monitoring high-risk offenders. It is assumed that offenders who enter the program, would either be monitored and controlled in the system or leave it as someone who does not oblige danger anymore.
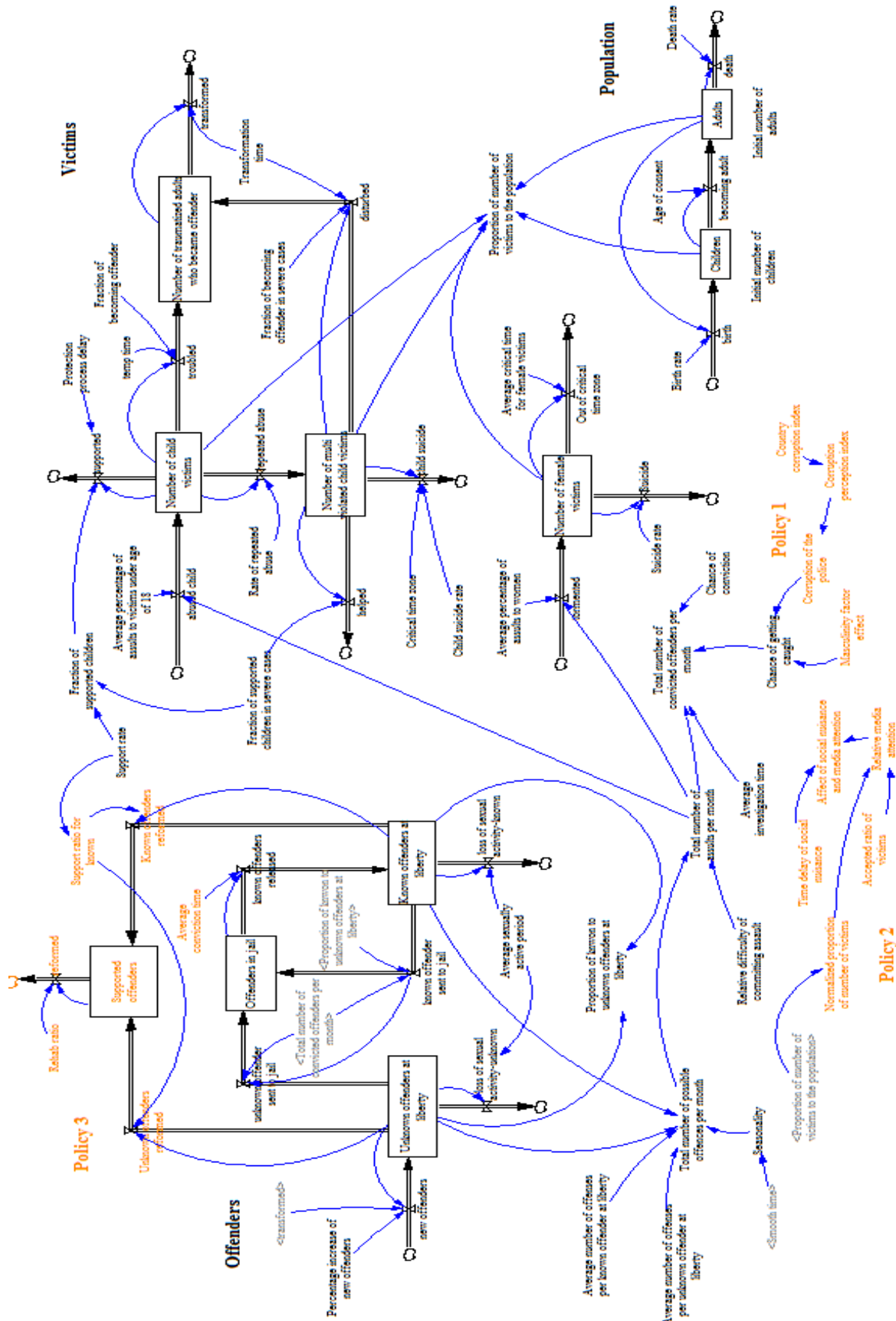
Figure 9 Stock-flow diagram of the base model

The sensitivity graph in Figure 10 shows the change in the number of unknown offenders after implementation of the three policies individually. With the increase of *the masculinity factor,* the number of offenders increases resulting in higher growth in the number of victims. As mentioned in the policy description, *the easiness of committing violence* has an inverse relation with the *offender fraction.* The easier it is to commit sexual harassment/violence; the lower is *the chance of being caught* will be, resulting in a higher fraction of offenders. In Figure 10, policies number 2 and 3 are combined.
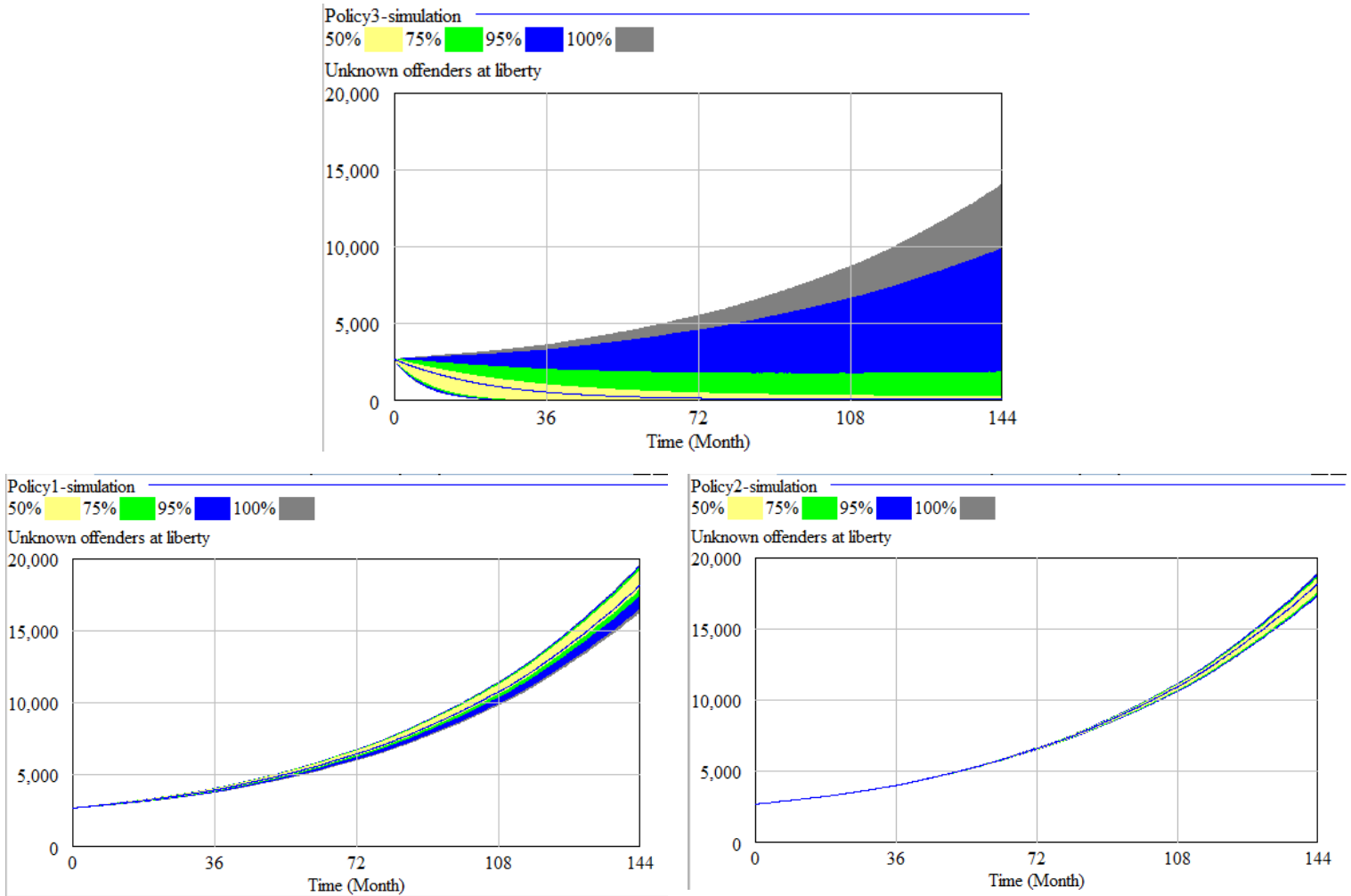

Figure 10 Sensitivity graphs for number of offenders by changes through policies 1, 2, and 3

As shown in Figure 10, the portion of the changes due to policies 1 and 2 is quite low in comparison to policy 3. This is quite logical, considering that all the relations are implemented linearly in policies 1 and 2, when policy 3 implements a change in the structure of the model and creates feedback loops. The effect of the *relative media attention* is an information delay with the delay time of one year but the number of offenders is growing each month with the much higher pace than these changes by the *relative media attention*. Another factor that can help explain the small changes; is that one of the important parameters adding to the number of offenders is the adults with childhood trauma, who will become offenders. These two policies are not affecting this

stock-flow system. In addition, the media attention is not that strong to change the whole system by itself. The third policy however shows promising change in some of the scenarios and leads to the declining of the offences.

While sketching the behavior of the system under different interventions, the effectiveness of each policy could be analyzed. However, before favoring one policy over the other, their combined effects should be examined. In addition, their effect in different scenarios could be explored, since there are many uncertain parameters in the base model. The sensitivity diagram for the combination of all policies is shown in figure 11. These effects are explored in different scenarios generated by the uncertain factors mentioned in Table 2.

Parameter	Uncertainty interval	
Rehab ratio	0.05	0.4
Support ratio for known offenders	0	0.15
Chance of conviction	0	1

Table 2 Uncertain parameters and their ranges used in scenario creation
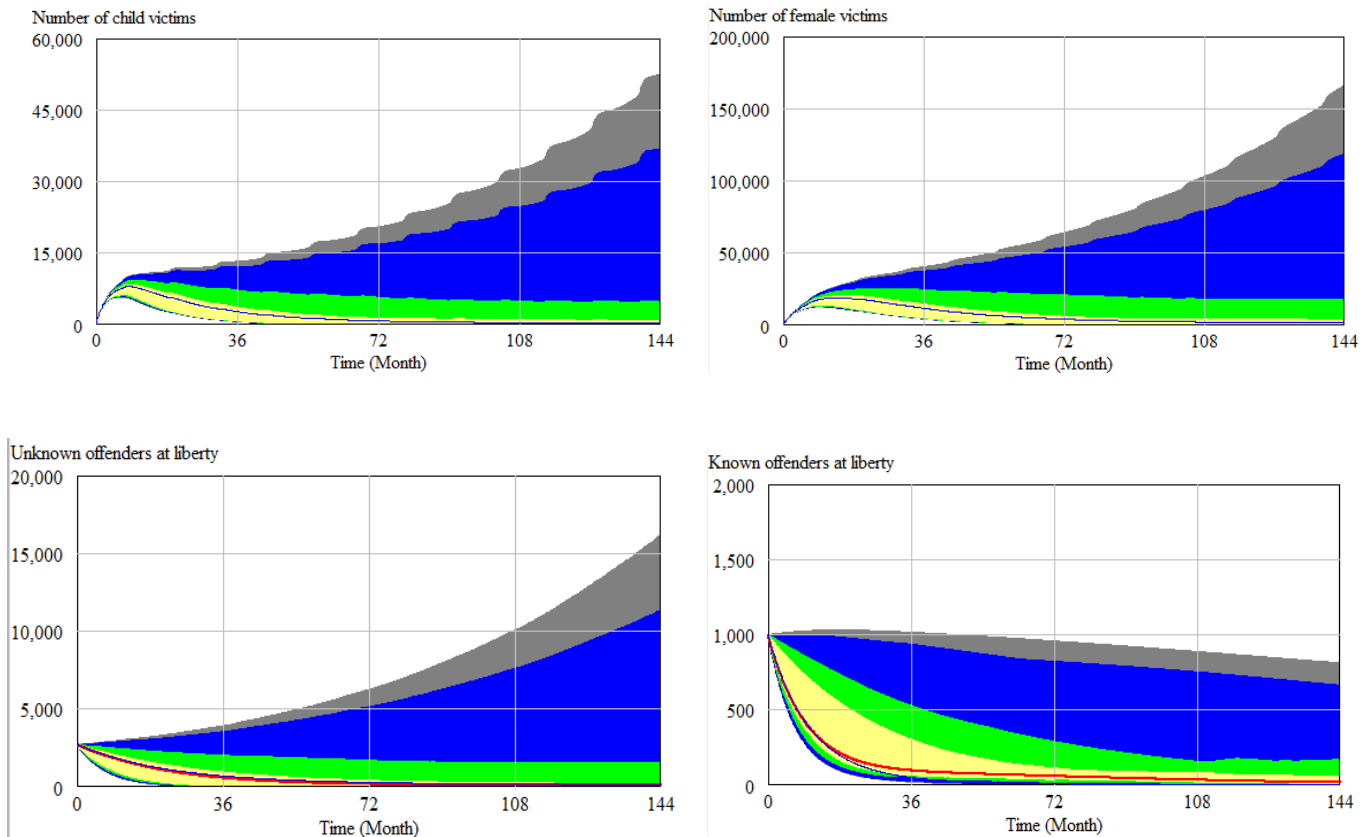

Figure 11 Sensitivity graphs for combination of policies

From these graphs, it could be concluded that although there is significant numeric difference, the third intervention still ranks higher in terms of influence in the system. Therefore, it seems that implementing the stock-flow diagram for reforming offenders is promising approach. By protecting the public and reducing the risk of reoffending by appropriate rehabilitative interventions combined with a more active supervision and monitoring of higher risk sex offenders after their release from prison, there can be a decrease in the number of sexual assaults.

5. Conclusions

5.1 Remarks

The purpose of this paper was to determine the relation between the offenders and victims involved in the domestic violation and sexual harassment system, and a rough estimation of the policy effects on the number of victims. The results provided by this paper were based on the case of Egypt but since the model has a general structure, it can be adjusted to other countries by changing initial values, external factors and by adding other relevant variables or changing equations in case there was a huge difference between the base model and destined country.

In the policy sector, it seems that any effective policy should aim to reduce the number of active offenders. However, the management of convicted sex offenders, whether they did not receive a custodial sentence or are released back into the community following completion of their sentence poses numerous challenges for the criminal justice agencies involved. Key challenges include protection and reassurance of the public, identification of offenders at higher risk of re-offending, provision of successful mechanisms for monitoring and controlling such offenders, integration of criminal justice responses, balancing the rights of offenders to privacy with the need for public protection, and reintegration of offenders through continuity of interventions and provision of adequate supports. Since the youth population of the country plays an important role in this issue, the population growth rate needs to be considered when modeling different systems. Egypt is a country that is growing rapidly, with an average of 3 births per household. The population is extremely young, as more than a half (57.2 percent) of the nationals are under 25 years old and 37.3 percent are under 15("World Bank Search," 2013). That is to say, that 33.5 percent of the whole population is between 10 and 25 and if we compare this proportional to less populated countries with similar issues, it would be realized easily how crucial the situation is.

The issue of sexual harassment and domestic violence is indeed complicated and this complexity goes beyond the power of a 'quick and dirty' policy analysis. There are several uncertain fundamental assumptions that should be further developed in order to be used for a more accurate policy testing.

5.2   Current and Future work

This paper presented a first `quick and dirty' assessment of the important phenomenon of domestic violence and sexual harassment against women and children using an SD simulation model. Many assumptions and variables used in the model are highly uncertain. Some uncertainties may be reduced through further research although many of them will remain uncertain. This model is therefore plausible at best and other plausible models regarding this phenomenon may have to be developed and included to deal with uneducable uncertainties. Multi-model simulation over a large uncertainty space is expected to lead to a deeper understanding of the joint causes of undesirable futures and important policy levers for curbing the phenomenon.

Hence, we will soon extend the quick and dirty research approach as reported in this paper with an explorative multi-model SD research approach as in (Pruyt and Kwakkel 2011). The anticipated insights will then be used to design more realistic and effective policies across all plausible futures as in (Hamarat et al. 2013). Finally, the effectiveness of these policies will be tested and compared across the full uncertainty space spanned by the models and remaining uncertainties as in (Lempert et al. 2003).

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Appendix

Table 1: Constants and initial values:

Initial number of Unknown offenders	2700	person
Initial number of known offenders	1000	Person
Initial number of female victims	1000	Person
Initial number child victims	280	Person
Initial number of multi-violated child victims	70	Person
Initial number of traumatized adults who became offenders	10	Person
Initial number of offenders in jail	180	Person
Initial number of children	17,000,000	Person
Initial number of adults	53,000,000	Person
Birth rate	0.02	1/year
Death rate	4.8	1/1000*year
Age of consent	18	1/year
Average number of offences per known offender	1	1/year
Average number of offences per unknown offender	2.5	1/year
Average conviction time	2	years
Average sexually active period	40	years
Average investigation time	4	months
Average percentage of assaults to women	0.56	
Average percentage of assaults to children	0.44	
Support rate	0.15	1/month
Fraction of supported women	0.1	1/month

Table 2: Stock equations

Number of child victims	abused child-repeated abuse-supported-troubled	Person/month
Number of multi violated child victims	repeated abuse-child suicide-disturbed-helped	Person/month
Number of traumatized adults who became offender	disturbed + troubled-transformed	Person/month
Number of female victims	tormented-Out of critical time zone-Suicide	Person/month
Unknown offenders at liberty	new offenders-"loss of sexual activity-unknown"-unknown offender sent to jail-unknown reformed	Person/month
Known offenders at liberty	known offenders released-known offender sent to jail-known Reformed-"loss of sexual activity-known"	Person/month
Offenders in jail	known offender sent to jail+ unknown offender sent to jail-known offenders released	Person/month
Supported offenders	known Reformed + unknown reformed-reformed	Person/month
Children	birth-becoming adult	Person/month
Adults	becoming adult-death	Person/month

Table 3: Highly uncertain constants

Rehab ratio	0.05	
Percentage increase of new offenders	RANDOM NORMAL(1/200, 1/50 , 1/100 , 1/100 , 1234)	1/month
Relative difficulty of committing assault	0.1	
Masculinity factor	0.45	
Suicide rate	0.25	1/year
Child suicide rate	0.43	
Average critical time for female victims	1	year
Critical time zone	1	year
Fraction of becoming offender	0.0025	
Fraction of becoming offender in severe cases	0.14	
Transformation time	10	years
Protection process delay	6	years
Average rehab time	5	years
Rate of repeated abuse	0.25	1/month

Equations

Inflows and Outflows:

Reformed (person/Month):

The number of *Supported offenders* multiplied to the *Rehab Ratio* and divided to the *Average rehab time*

Unknown reformed (person/month):

The number of *Unknown offenders at liberty* multiplied by the total *Support rate* (percentage of those who are supported by the responsible authorities) minus *Support ratio for known offenders*

Known Reformed (person/Month):

The number of *Known offenders at liberty* multiplied by the *Support ratio for known offenders*

Abused child (person/month):

Total number of assaults per month multiply by the *Average percentage of assaults to victims under age of 18*

New offenders (person/month):

Sum of *Unknown offenders at liberty*Percentage increase of new offenders* and the additional number of adults who were violated as a child and will become offenders.

Repeated abuse (person/month):

Number of child victims multiply by the *Rate of repeated abuse*

Helped (person/month):

Number of multi violated child victims multiply by the *Fraction of supported children in severe cases*, represents the number of multi violated victims who are supported. |

Transformed (person/month):

Number of traumatized adults who became offender will transform to offenders after some time that's represented by the division to *Transformation time.*

Troubled (person/month):

 Total *Number of child victims* divided to the one year time, multiply by the *Fraction of becoming offender*. This parameter shows the number of victims who would possibly become offenders.

Disturbed (person/month):

Number of multi violated child victims*Fraction of becoming offender in severe cases divided by the *Transformation time*

Tormented (person/Month):

Total number of assaults per month*Average percentage of assaults to women

Becoming adult (person/Month):

Children/Age of consent

Supported (person/Month):

DELAY1(Number of child victims*Fraction of supported children, Protection process delay)

Unknown offender sent to jail (person/Month):

MAX(Total number of convicted offenders per month-known offender sent to jail, 0)

Known offenders released (person/Month):

Offenders in jail/Average conviction time

"loss of sexual activity-known" (person/Month):

Known offenders at liberty/Average sexually active period

"loss of sexual activity-unknown" person/Month):

Unknown offenders at liberty/Average sexually active period

Out of critical time zone (person/Month):

Number of female victims/Average critical time for female victims

Child suicide (person/month):

Number of multi violated child victims*Child suicide rate/Critical time zone

Birth (person/Month):

Adults*Birth rate

Death (person/Month):

Adults*Death rate

Parameters

Chance of getting caught (Dimension less):

This parameter has a direct relation with the *corruption of the police,* Masculinity *factor effect* and *Relative media effecting social nuisance*. So the equations is the multiplication of these factors and the original estimated *Chance of getting caught* (0.05)

Corruption Perception Index (Dmnl):

Equals *Country Corruption Index divided* by the 10 in order to have the ratio between zero and one

Corruption of the police (Dmnl):

Since this parameter is used in order to calculate the *chance of getting caught,* the factor it equals to 1-*corruption Perception Index.* This factor shows the percentage of the police force that is not corrupted and therefore participates in the investigations process of the sexual harassment cases.

Relative media effecting social nuisance (Dmnl):

Third order SMOOTH function of *Relative media attention* with *time delay of social nuisance*

Relative media attention (Dmnl):

LOOKUP function with input equals to *Accepted ratio of victims* multiply by *Normalized proportion number of victims*

Fraction of supported children (1/month):

The MAX function of *Support rate* minus *Fraction of supported children in severe cases* and 0. The *Support rate* consists of fraction of supported children in both individual assault incidents and multiple victims, so an increase in one would result into an decrease in the other, that's why a Max function is used.

Total number of assaults per month (person/month):

Total number of possible offences per month divided by the *Relative difficulty of committing assault*. The number of assaults has an inverse relation with the difficulty of committing crime, more difficult it is for the offenders to assault, fewer offences would happen.

Proportion of number of victims to the population (Dmnl):

Total number of victims divided by the total number of population at the time, divided by 100

Known offender sent to jail (person/month):

Total number of convicted offenders per month multiply by the *Proportion of known to unknown offenders at liberty*

Total number of convicted offenders per month (person/Month):

DELAY3(Total number of assaults per month*Chance of getting caught*Chance of conviction, Average investigation time)

Percentage increase of new offenders (1/Month):

RANDOM NORMAL(1/200, 1/50 , 1/100 , 1/100 , 1234)

Proportion of known to unknown offenders at liberty (Dmnl):

Known offenders at liberty/(Known offenders at liberty + Unknown offenders at liberty)

Seasonality (Dmnl):

SMOOTH(1+0.3*PULSE TRAIN(6, 1, 12, 240), Smooth time)

Total number of possible offences per month (person/Month):

((Known offenders at liberty*Average number of offenses per known offender at liberty) +(Unknown offenders at liberty*Average number of offenses per unknown offender at liberty))*Seasonality