Farmers, Bandits, and Soldiers:

A Model for Addressing Peace Agendas

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Abstract

This paper models an economy of farmers, bandits and soldiers. In addition to the economic factors affecting the economy studied by Saeed and Pavlov (2008), we examine also the effects of two psychological factors broadly categorized as exposure to violence and group identity. Within this environment, we conduct simulation experiments (1) infusing the economy with additional agents of each type under different assumptions about rational economic behavior, psychological influences and the writ of government, (2) changing the parameters representing the productivities and behavioral scaling factors in the economy, and (3) adding external flows to the incomes of each type of agent. Our experiments indicate that the optimal policy for promoting peace involves increasing farmer productivity, strengthening the writ of government, downplaying the prestige of soldiers and reforming institutions so corruption and the extraction of ransom from the public are reduced.

Key words: peace economics, political economy, conflict resolution, behavioral economics, psychology, public policy, system dynamics, computer simulation.

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Introduction

Drawing from a historical metaphor referred to as the "dynastic cycle" (Usher, 1989; Feichtinger and Novak, 1994; Feichtinger et al., 1996), Saeed and Pavlov (2008) modeled an economy as interplay of farmers, bandits and soldiers. Farmers grow crops, bandits plunder farmers and soldiers protect farmers. The allocation of resources among these three institutions determines levels of freedoms available to the public. Respective incomes of farmers and bandits define economic legitimacy. Figure 1 shows a state space characterization of various observed conditions. High levels of both freedoms and economic legitimacy in a community imply presence of a *de facto* people power.

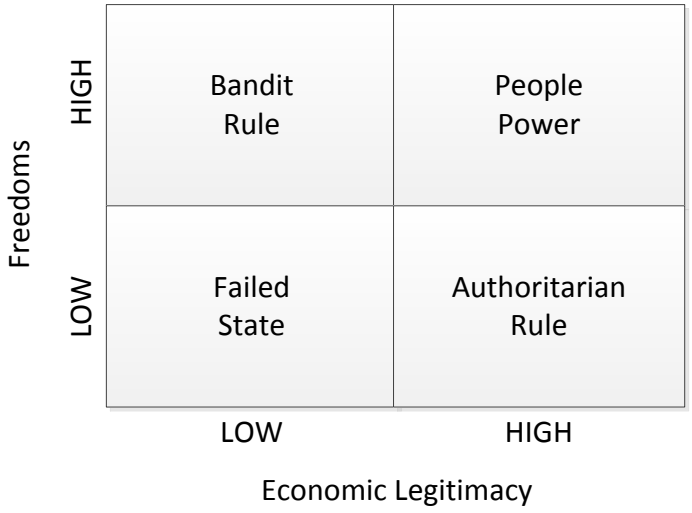

Figure 1: Manifestations of a generic political system

Societies can also be positioned in the remaining three quadrants of the state space. High levels of appropriations by a relatively small population of bandits from many working farmers imply a *de facto* bandit rule. Examples are states with pervasive corruption and rampant underground

economy (i.e. low economic legitimacy) with a weak and corrupt government. In such an economy, the public is freely exploited by corrupt officials and the mafia for ransom. A non-legitimate economy with a low level of freedoms is the feature of a failed state. Freedoms are limited due to the impositions made by the warlords and mafia leaders rather than by the government. An authoritarian rule is characterized by the presence of legitimate economy and a low level of freedoms. In an authoritarian system, the government exercises coercive imposition of authority on public. All three combinations represent a potential for conflict, which threatens political stability and peace.

Building on the metaphorical system presented in Saeed and Pavlov (2008), this paper attempts to understand why political systems might tend towards the observed variety of political and economic scenarios and what paths to change might exist. In addition to the purely economic forces considered in the original model of Saeed and Pavlov, here we also review behavioral factors and their impact on the dynamics of a political economy. The modified model allows us to differentiate between primary forces driving internal trends in the political economy and the influences which are mere facilitators of change.

Theories of social conflicts

Conflicts in social groups have been extensively studied by many disciplines and from various perspectives. The traditional approach to modeling social conflict – whether the conflict is political, economic, individual or military one – is to assume rationality of agents (Becker 1968; Dixit 2004; Cooter and Ulen 2000). A social conflict is then a Coasian bargaining by strategic adversaries (Bowles and Gintis 1990). This view reduces any conflict to a private cost-benefit

analysis by rational individuals. Faced with a choice between two activities -- production or rent-seeking (Bhagwati 1982; Baumol 1990) -- an agent chooses to engage in opportunistic behavior if the expected benefit from a criminal act is greater than the expected cost. In that context, a robbery is a private negotiation and exchange of life for some amount of money (Vahabi 2010).

Many formal models of political conflict have been proposed based on rational analysis. There also exist behavioral theories explaining irrational actions by social groups and institutions. In the following subsections, we review a subset of such models and theories that are relevant the model we propose.

Formal Models

There are several methodological approaches to modeling political and economic development and the associated conflicts. Cioffi-Revilla (1998) provides a formal theory of political uncertainty using propositional logic, set and probability theory, stressing the probabilistic nature of political events and their probabilistic causality. Political behavior is modeled in multiple dimensions. A war, for example, is described by the number of participating sides, the size of the armies, the duration of the conflict and the casualties. Individual micro-level events are aggregated to determine macro-level political behavior.

Acemoglu and Robinson (2006), in contrast, follow a game-theoretic approach, using methods of dynamic optimization, in their "economic incentives-based" study of political development. The rich, middle class and poor respond to economic incentives during conflict. The rich prefer a dictatorship that ensures their political and economic superiority, but may need to concede power to avoid the costs of being overrun by a revolution. Acemoglu and Robinson (2006) builds on

previous research (Acemoglu and Robinson, 2000) about why Western societies extended voting rights in the nineteenth century (one argument is that it was a strategic decision to avoid widespread social unrest). Relatedly, Acemoglu and Robinson (2001) develop a theory of political transitions, where the threat of revolution can force elites to democratize. Aghion, Alesina and Trebbi (2004) focus on the design of political institutions, modeling how much power societies delegate to their leaders. A key decision is choosing the size of a minority required to block legislation.

Hirshleifer's (1988) general equilibrium framework has become the pre-eminent approach in peace economics (Isard 1994; Caruso 2010), which focuses in the analysis of social conflicts. Agents with productive and combative technologies choose between productive activities that increase economic output and unproductive activities such as war and banditry. Many papers extend the Hirshleifer model of conflict (see Caruso 2010, note 2), showing that the allocation of resources between productive and unproductive activities and the relative sizes of the associated sectors have long term economic implications (Caruso 2010). For example, Hirshleifer (1995) writes about the breakdown of anarchy *in favor* of hierarchy, which leads to a higher proportion of resources being used productively. Skaperdas (1992) studies conflict in the absence of property rights, arguing that cooperation can occur if it is in the interest of all agents.

The system dynamics approach has also been used by several authors to study conflict. Relying on military documents and extensive studies on counterinsurgency, Anderson (2011) builds a factual system dynamics model of an insurgency conflict. While the model is calibrated to the data from the Anglo-Irish War of 1919-21, it allows to draw conclusions that are appropriate for

modern conflicts. Coyle (1985) offered a qualitative model of insurgency. Grynkewich and Reifel (2006) also treat insurgency using system dynamics. More general system dynamics models of conflict and political instability have been presented in Saeed (1986), Saeed (1990) and Pavlov et al (2005) that explain conflict as a function of role play by public, government and dissidents.

Behavioral Theories

Several different sociological theories explain the existence and purpose of conflict, criminal behavior, and violence. Hirschi (1969) argued in his control theory that our social bonds can prevent us from committing crimes. In particular, he argued that there are four types of bonds that are important. First, the more attachment we have to people and institutions, the lower the likelihood that we will engage in asocial activities. For instance, the more young adults identify with their parents or college institutions, the less likely they are to engage in criminal behaviors. Second, the more individuals are committed to conforming to societal norms (e.g., getting an education, getting a job, getting married, etc.), the less likely they are to engage in criminal activity. Third, the more involved in different activities individuals are, then the less likely they are to engage in criminal activity. And, fourth, the more people believe in the moral validity of social rules, then the less likely they are to engage in criminal behavior.

Some theorists argue that criminal behavior and social unrest are beneficial to society because it encourages social order (Durkheim, 1915/1966). More specifically, it is argued that criminal activities will strengthen the bonds and solidarity between the law-abiding citizens. In addition, it is argued that social unrest encourages and enhances conformity to socially "appropriate" or normative behavior because people do not want to be labeled as being deviant (Tannenbaum,

1938). Finally, social unrest can eventually induce social change. For instance, the negative and discriminatory behavior focused towards Blacks began to be questioned by Martin Luther King, Jr. and others. Initially, their attempts at civil rights were met with ridicule, violence, and even arrests. However, over time, with the Civil Rights Movement, there was social change.

In trying to understand why individuals shared unauthorized music online, it was found that if the societal norm was that sharing music was not unethical, than there was an increase in sharing behavior (Shang, Chen, & Chen, 2008). Relatedly, in terms of violence, the more immersed an individual is in violent and criminal acts, then the more "normal" those types of behaviors seen, and this too increases the likelihood that these behaviors will continue (Lee, et al., 2007; Logan, 2009; Sutherland, 1939; Wolfgang, 1958).

There has been growing evidence that real agents often do not act rationally (Sunstein 2000; Parisi and Smith 2005; DellaVigna 2009). Thus, while formal models typically do not subsume beliefs of agents, inclusion of cognitive aspects in formal models is likely to improve our understanding of conflict (Caruso 2010). Hence, our model extends the interaction between metaphorical farmers, bandits and soldiers (Saeed and Pavlov 2008) by incorporating the psychological influences. This modification allows us to extend our policy space to also include behavioral interventions.

The modified farmers, bandits, soldiers model

An aggregate view of our modified model is shown in Figure 2. It includes five sectors: political economy, economic influences, behavioral influences, control and performance. This structure resulted from: 1) reorganization of the Saeed-Pavlov model into a sector hierarchy and 2)

constructing a new sector incorporating behavioral influences. Following the norm in the original model, we have continued to use linear behavioral relationships instead of non-linear graphical functions, since there was no basis to justify any postulated nonlinear shapes. Also, as this model is rich in balancing loops, the range of variation around the normal operating points in the behavioral relationships is quite small and choosing linear behavioral relationships has little effects on the dynamics generated by the model. Model equations can be found in the Appendix. Each sector shown in Figure 2 is described below:

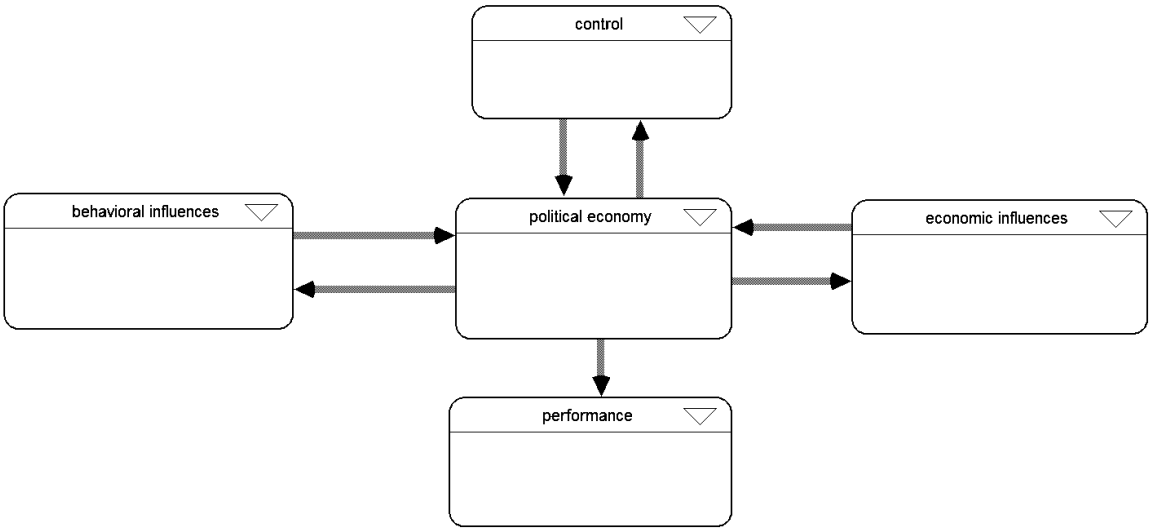

Figure 2: An aggregate view of the modified farmers-bandits-soldiers model

Political Economy Sector

The core of the model is the Political Economy sector (Figure 3). The economy is populated by three metaphorical cross-sections of individuals: farmers, bandits and soldiers. Farmers produce. Bandits loot. And soldiers defend farmers against bandits. Farmers may choose to become

bandits and bandits may choose to return to farming based on the relative income opportunities. Soldiers are recruited from the farmer pool. When soldiers retire, they return to farming.

Farmers grow produce. Their total productivity depends on the total farmer population and the amount of cultivated land. Bandits loot part of the farmer produce, and the amount of looting can fluctuate year to year. It is greater when peasants are doing well, and smaller when the economic conditions are poor. Besides looting, bandits extract rent through bribes and levies and engage in forbidden production and services, such as gambling, gun running, prostitution, smuggling and narcotic drugs. These are labeled in the model as *nonlegit produce by bandits*. Historic earnings create a perception of the income that a bandit can earn. We model the perception formation as a simple averaging process.

Existence of bandits poses threat to society. Soldiers attempt to control and limit the number of bandits. The threat to society posed by bandits dictates the desired size of the army. The desired number of soldiers is, however, constrained by the financial resources available for their support. By paying taxes, farmers support an army of soldiers. More taxes allow a larger army. The cost of the army determines the needed amount of tax. Tax collection can, however, deviate from the needed amount based on economic conditions.

Bandits come from the ranks of farmers. Some farmers are encouraged to turn to banditry when they perceive that banditry may provide them with better income than farming. Farmer disposable income is the produce grown by them, less taxes paid for maintaining the army and less the appropriations extracted by the bandits. The economic attractiveness of banditry is

measured by the farmer perceived relative income, which is given by the ratio of the perceived disposable income per farmer to the perceived disposable income per bandit. It is assumed that there are some normal flows between the populations of farmers and bandits, that is, there are always some farmers turning to banditry and some bandits who return to farming. In a steady state the two flows are balanced.

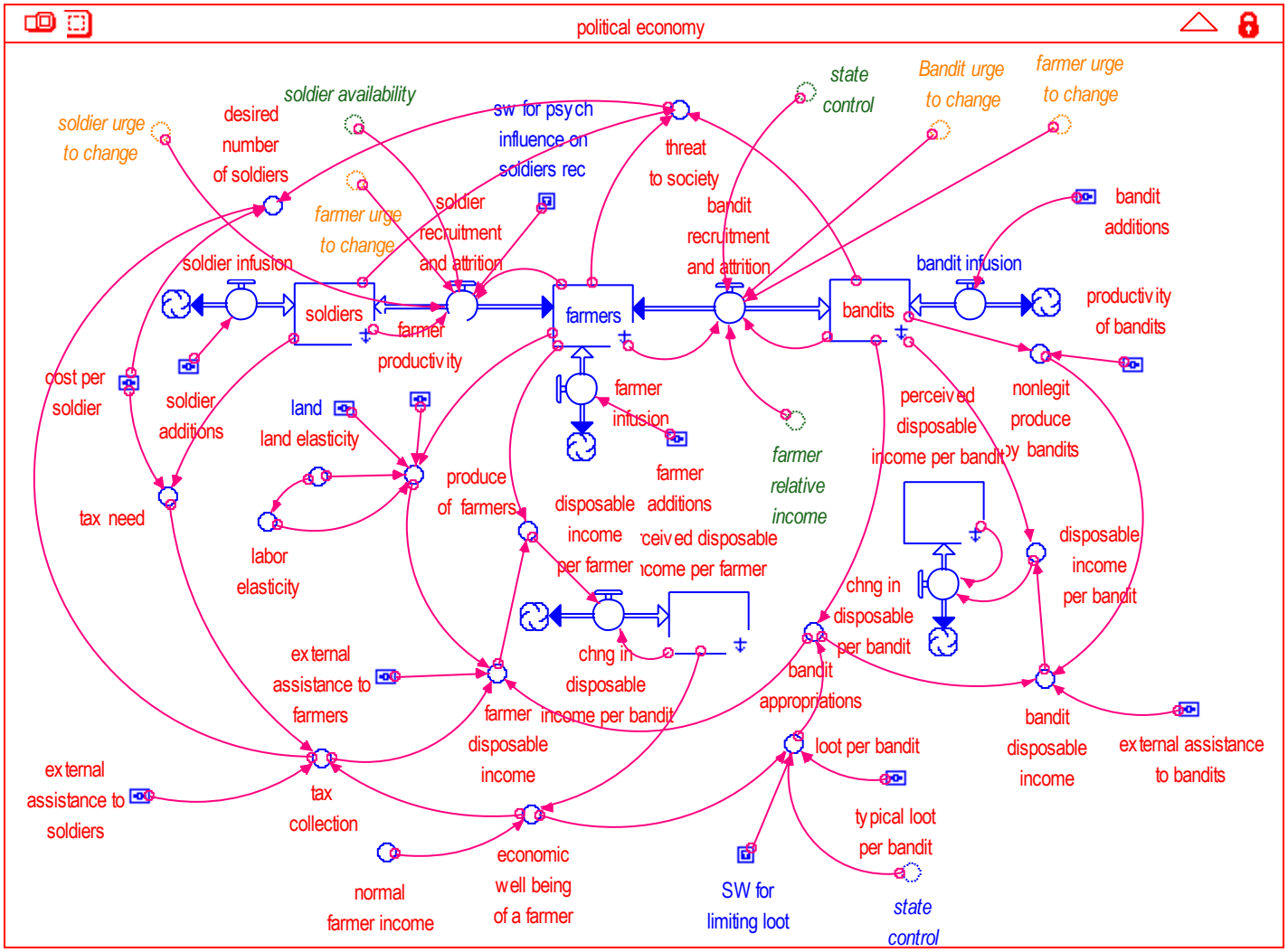

Figure 3: Political Economy Sector

Economic Influences Sector

The Economic Influences sector (Figure 4) defines rational economic factors that affect the flows between the populations of farmers and bandits. The variable farmer relative income is the ratio of the perceived disposable income per farmer to the perceived disposable income per bandit. The ratio captures the population's perception about the economic advantages of becoming and remaining a bandit.

The danger posed by bandits dictates how much of societal resources should be allocated to soldiers who maintain order. The need is expressed as the variable desired number of soldiers, as specified in the Political Economy sector. For a variety of reasons the true size of the army might be different from desired. The variable solder availability measures the discrepancy between the desired and true sizes of the army. It is coded as ratio of soldiers to the desired number of soldiers.

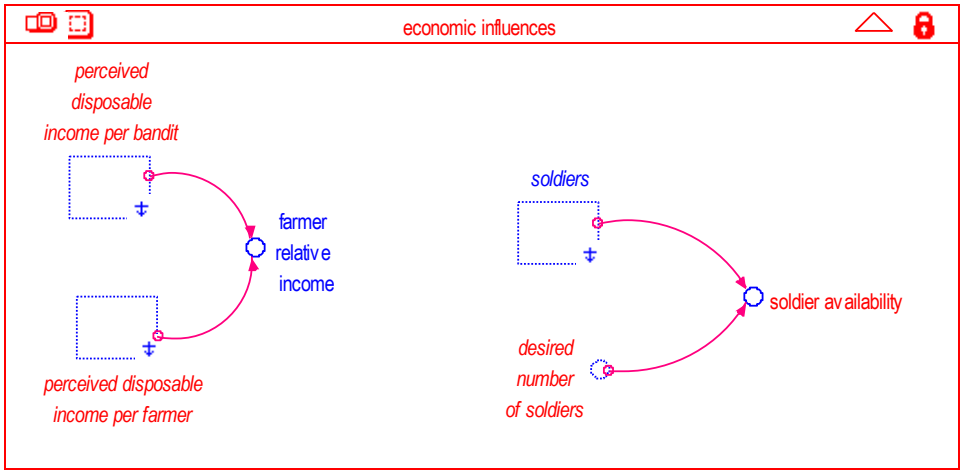

Figure 4: Economic Influences Sector

Behavioral Influences Sector

The behavioral influences sector (Figure 5) captures the psychological effects of violence and group identity. The behavioral sector feeds into the political economy sector by affecting agents' desires to change their status (farmer to a bandit or farmer to soldier). As this sector incorporates new structure added to the model, we attempt to explain its logic in detail.

The larger the offending group, the larger the likelihood that violence will ensue. Consequently, the magnitude of the threat is determined by the size of the threatening group (i.e., bandits) in relation to the other parties (i.e., farmers and soldiers). Bandits pose a threat to society because they commit violent acts as they appropriate loot from farmers. The amount of actual violence in the society plays a role in the perceptions of threat.

Regardless of the actual amount of violence that occurs, and irrespective of the size of the different societal groups, another factor that can influence the perceptions of the level of threat is how accessible information about violent and threatening acts is on one's mind (Krueger, 2000; Tversky & Kahneman, 1973; Watt & Larkin, 2010). If incidents of bandits getting caught more readily come to mind, then the perception will be that banditry is more risky than it might be; whereas, if incidents of bandits getting away with their acts come to mind, then the perception will be that banditry is less risky than it might be in actuality (Riddle, 2010). Thus, in our model, the information effect captures the amount of information people receive about the occurrence of violence. The time it takes for people to form a perception of violence is inversely related to the information effect. The change in perceived violence is inversely related to the time it takes to

form a perception of violence indicating that as the time it takes to perceive violence decreases, the change in perceived violence increases and vice versa.

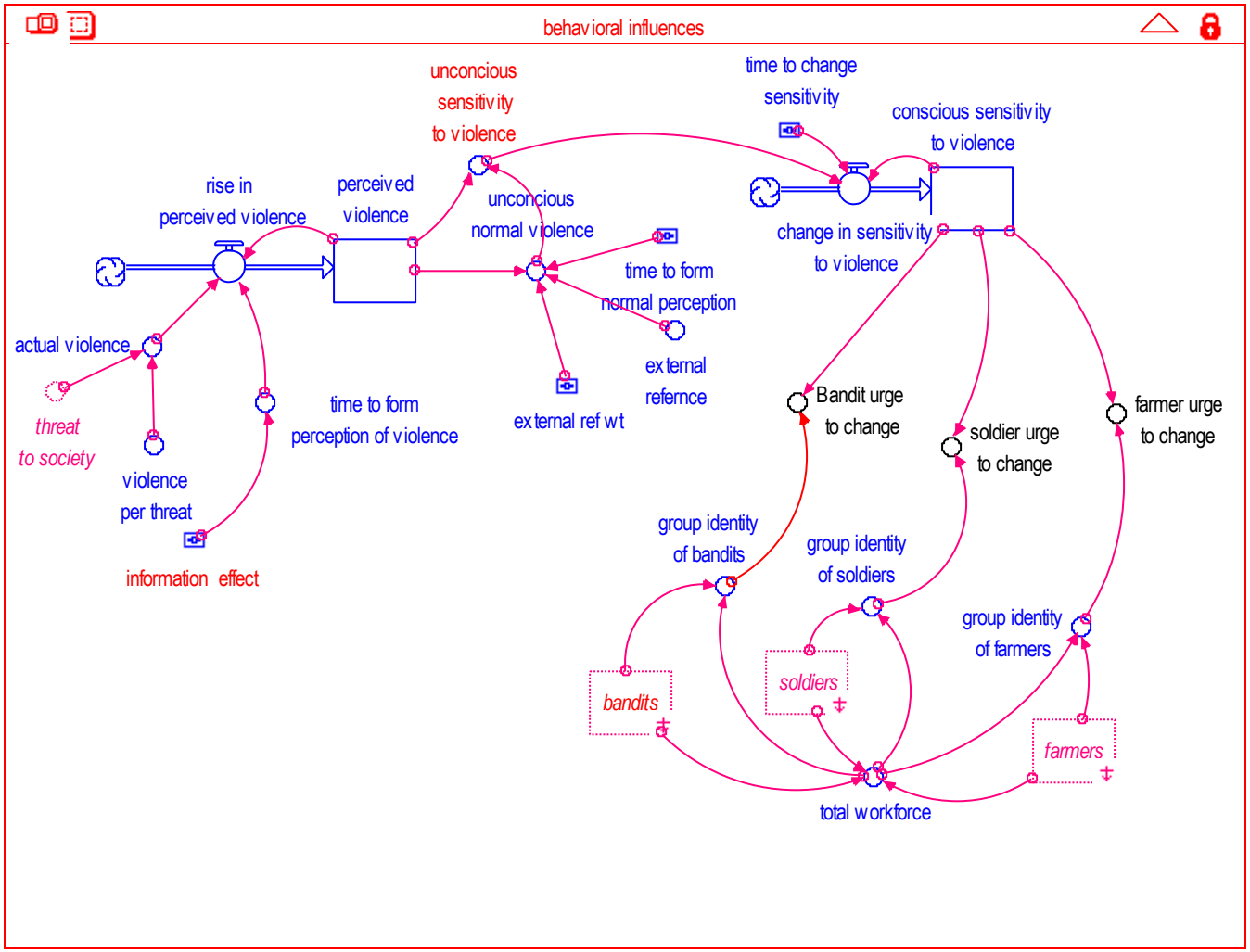

Figure 5: Behavioral Influences Sector

Desensitization towards a stimulus or behavior occurs once the stimulus or behavior is no longer novel. With increased exposure to a stimulus or behavior, the stimulus or behavior becomes less and less novel, and subsequently individuals are more likely to become desensitized (or less likely to experience a strong reaction to the stimulus or behavior). The more desensitized an individual becomes towards a stimulus or behavior, then the chances of being more approving or accepting of the once-arousing stimuli or behavior increase. For instance, in one study half the participants played a violent video game (e.g., Mortal Kombat) or a non-violent video game (e.g., Tetris; Carnagey, et al., 2007). After playing the video games, all participants viewed videos of real violence (e.g., shootings, physical fights, etc.), and the experimenters measured participant's arousal as they watched these violence scenes using galvanic skin response (a measure of emotional arousal) and heart rates. Those who had played the violent video games showed much less arousal when watching the violent scenes than those who had played the non-violent video games, suggesting that the previous exposure to violence via the violent video games desensitized participants in this condition toward the violent images viewed later.

Increased desensitization also leads to increased acceptance of the once arousing stimulus or behavior, and may even lead to an increased likelihood of behaving in a manner consistent with the once-arousing stimulus. For example, Anderson and Murphy (2003) found that participants who played violent video games were more likely to behave more aggressively to an opponent in a subsequent task (by delivering more loud blasts of noise towards the opponent) than participants who played non-violent video games. The findings of this research suggest that once individuals become desensitized, they may be more willing to act in manners that coincide with the once-arousing stimulus.

To model desensitization, we start with unconscious normal violence. Unconscious normal violence is a function of the perceived level of violence. Unconscious sensitivity to violence is proportional to perceived violence and inversely proportional to unconscious normal violence. This captures the idea that as perceived violence rises, so too does unconscious sensitivity to violence, but as unconscious normal violence rises over time, people unconsciously become less sensitive to violence.

Increased exposure to an arousing stimulus or behavior (e.g., violent attacks on farmers), will lead to increased desensitization towards this once arousing behavior. This increased desensitization will make this once arousing stimulus – the violence against farmers -- seem more acceptable. Gradually, conscious sensitivity to violence in society will be adjusted to the levels of unconscious sensitivity levels. Subsequently this acceptance of violence will result in more acts of violence against the farmers.

Each type of agent (farmer, bandit or soldier) has a sense of group identity associated with being of a particular type. The extent to which individuals identify with their group can vary (Hogg, 1996). According to Social Impact Theory (Latane, 1981), several key factors play a role in how strongly one identifies with and will conform to their group. First, the size of the group matters; identity and conformity increase along with group size (Bond, 2004; Gerard, Wilhelmy, & Conolley, 1968; Rosenberg, 1961). Second, the immediacy of the group plays a key role in identity and conformity. Physically close groups result in a higher sense of group identity and conformity. For instance, research looking at gang behavior shows that gang members have a

heightened sense of identity and cause more havoc when they are close to one another. However, when gang members start to distance themselves from one another (e.g., get married, get a job, go to prison, etc.,), then the sense of identity and level of conformity drops (Goldstein, 1994). To measure group identity, the strength of that group identity is inversely related to the share of agents in the economy that are of the relevant type. So, if the share of farmers is small, their group identity is strong, and so forth.

Each agent's urge to change is proportional to conscious sensitivity to violence and inversely proportional to group identity, since stronger group identity makes people less willing to changes. Urge to change feeds into the economic sector by affecting the flows between farmers and bandits in a way that recognition of violence encourages both farmers and bandits to change while it enhances prestige of soldiers motivating farmers to be recruited as soldiers and encouraging soldiers to continue.

Control Sector

In the section on the Political Economy sector we discussed that the stock soldiers influences the bi-flow between the stocks bandits and farmers. The control is included in the bi-flow rate formulation as a ratio of the stock of soldiers to the sum of all non-soldier populations, i.e., the sum of soldiers and bandits. We named the ratio state control (Figure 6) to signify the functional role of soldiers in the model.

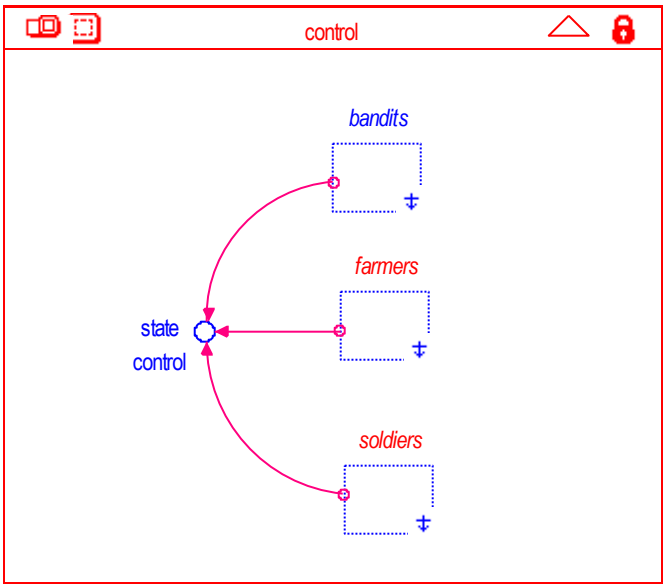

Figure 6: Control Sector

Performance Sector

There are two performance measures, "freedoms" and "economic legitimacy" (Figure 7). Freedoms is an indicator of political power that farmers have in the society. It is approximated as a ratio of farmers to the sum of bandits and soldiers:

$$\text{freedoms} = \alpha * \text{farmers} / (\text{soldiers} + \text{bandits})$$

Here parameter $\alpha = 1 / \left(farmers^* / (soldiers^* + bandits^*) \right)$ is a normalization constant, which ensures that the value of the index is one in the steady state. Starred variables denote steady state values. The steady state value of freedoms measures the status quo distribution of political power between the societal groups. As the distribution of power changes, the index can either rise or decline.

The economic legitimacy index compares the volume of economic activity by farmers to the scope of the economic activity of bandits:

economic legitimacy = β * produce of farmers / bandit disposable income

The normalization factor $\beta = bandit\ disposable\ income^{*} \big/ produce\ of\ farmers^{*}$ ensures that the index is equal to one in the steady state. Starred variables denote steady state values. The economic legitimacy index captures the relative scope of productive and unproductive activities within an economic system, which is an important measure. The relative size of productive and rent-seeking sectors has strong long-term political and economic implications (Mehlum et al 2003; Caruso 2010).

A phase plot of these two indices (Figure 1) defines the economic and political health of a society or an organization. The lower left corner of the phase plot represents low economic welfare and low level of freedoms as in a failed state; the upper right corner of the plot represents higher economic welfare and higher level of freedoms as in a state enjoying people power. The transition from one homeostasis to another may exhibit better-before-worse or worse-before-better behavior when we simulate this model.

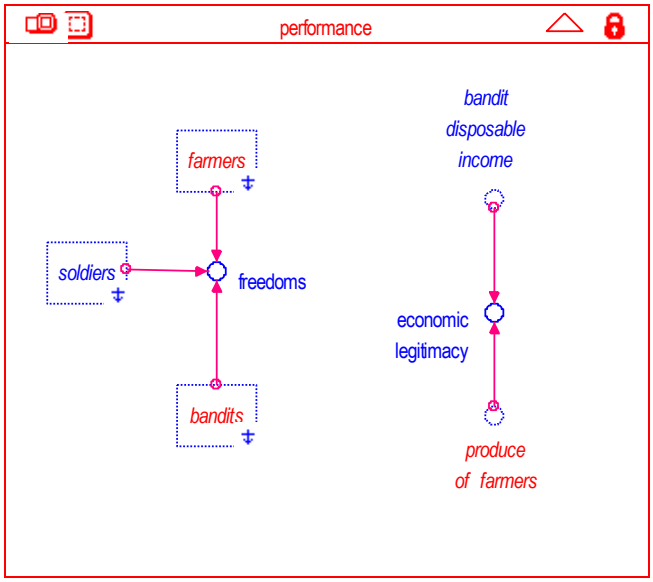

Figure 7: Performance Sector

Experiments with the model

The model is initialized in equilibrium which is disturbed in three ways for simulation experiments: a) by infusing a fixed number of additional members into the various population stocks and activating progressively the assumptions about rational economic behavior, psychological influences and the writ of government; b) by changing the parameters representing the various productivities and scaling factors; c) by adding external flows to the revenues of the three institutions in the system; and d) collecting a set of interventions for best performance. While the first set of experiments is primarily aimed at understanding the internal dynamics of the resource allocation system, the later sets provide insights into the key entry points for change. All sets can, however, be interpreted in terms of the related policy interventions.

A farmer infusion in the first set would correspond to population growth with fixed resources in a political economy. Soldier infusion would imply expansion of government's role in a political economy. Bandit infusion would imply an externally supported growth in insurgent activity or a growth of parasitic sub-economies subsuming corruption and illegal production of goods and services. Similarly, changing productivities and scaling factors, both in the economic and behavioral contexts, would translate into policy interventions that stimulate respective technologies or influences role-playing.

External infusion of actors into the system

Figure 8 shows the phase plots resulting from infusing new members into the respective population stocks with the flows between the stocks being governed only by gravity, i.e., each flow is proportional to the stock it emerges from and no other influences exit in the system. This system attempts to re-level itself as connected water troughs would so the population proportions in each stock return to the same level – resulting in a homeostasis that delivers more or less the original levels of economic legitimacy and freedoms. Adding soldiers, however, slightly improves welfare in the short run before reverting towards original equilibrium.

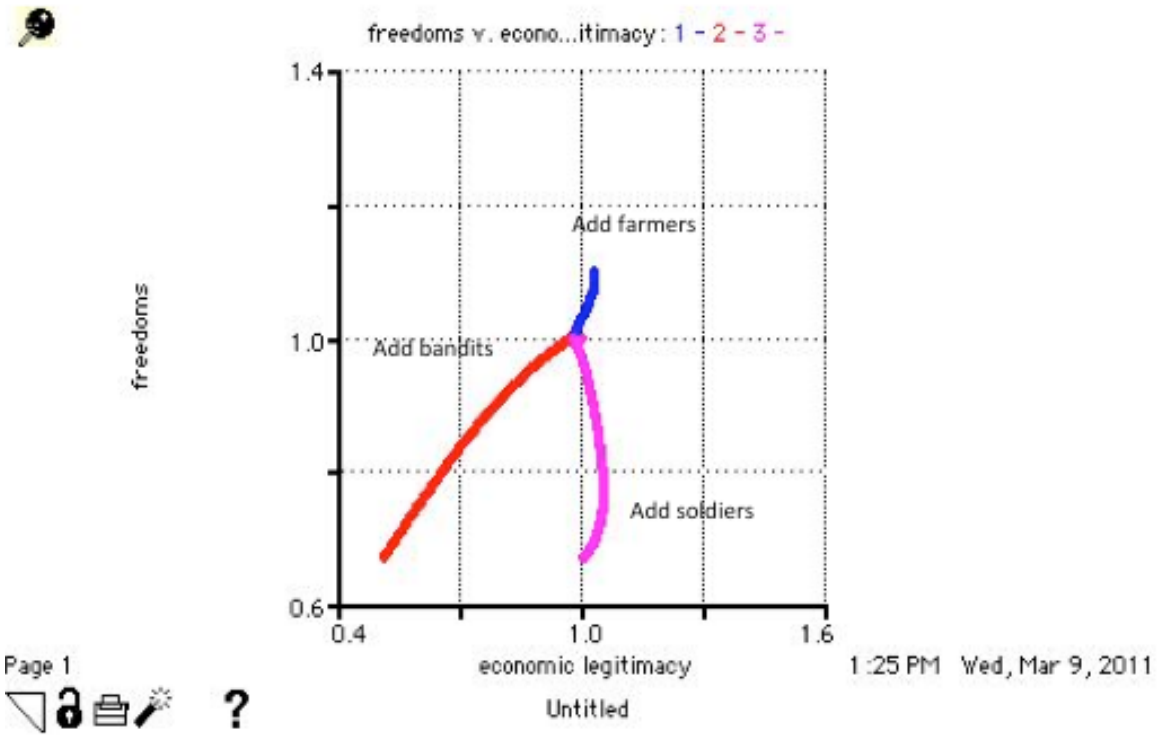

Figure 8: Restoration of initial equilibrium when flows between populations are driven by gravity

Figure 9 repeats the first simulation experiment after activating the economic influences. Now, actors decide whether or not to choose banditry based on the relative income. The soldier pool is adjusted in response to soldier availability for containing the threat to society posed by the bandits. In this simulation, not only the new homeostasis occurs at a lower level of legitimacy and freedoms, the paths to it also become more complex, longer and to some degree exhibiting greater differences in short-term and long-term impacts. Thus adding soldiers improves our performance indices in the short run, but worsens them in the long run. Adding bandits worsens performance indicators in the short run, but improves them in the long run. In all instances, the system ends up in an equilibrium that is of lower than the first equilibrium since the structure and

parameters have not been changed and a higher population has to be supported by the same amount of resources.

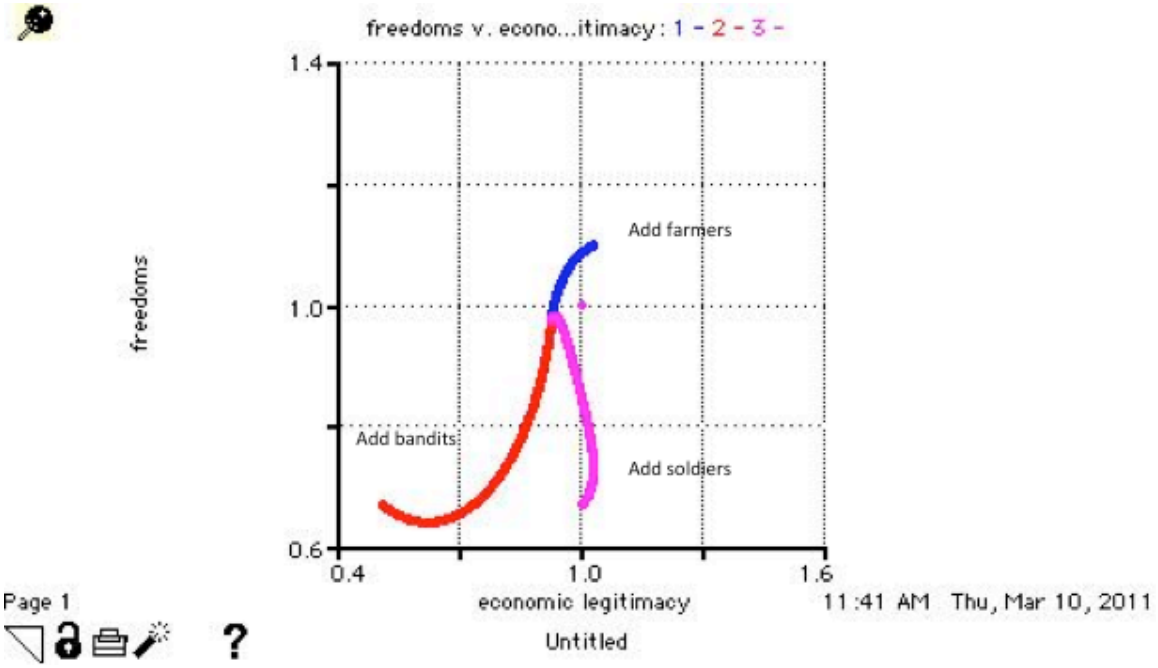

Figure 9: Paths towards new equilibrium when economic influences are added to the model

If we add the impact of the writ of the government that would force bandits to reform and check farmers from becoming bandits, the end homeostasis is as at an even lower level of welfare and the adjustment paths become even more complex exhibiting greater oscillatory behavior as shown in Figure 10. This happens as the conflict between economic and control forces builds up leading to an overshoot and eventual adjustment to a new equilibrium.

Addition of behavioral mechanisms due to group identity and sensitivity to violence speeds up adjustment and reduces overshoot. As shown in Figure 11, behavioral influences also slightly

improve the quality of the new homeostasis in the process as they provide alternative paths of adjustment to a less conflict-prone reality.

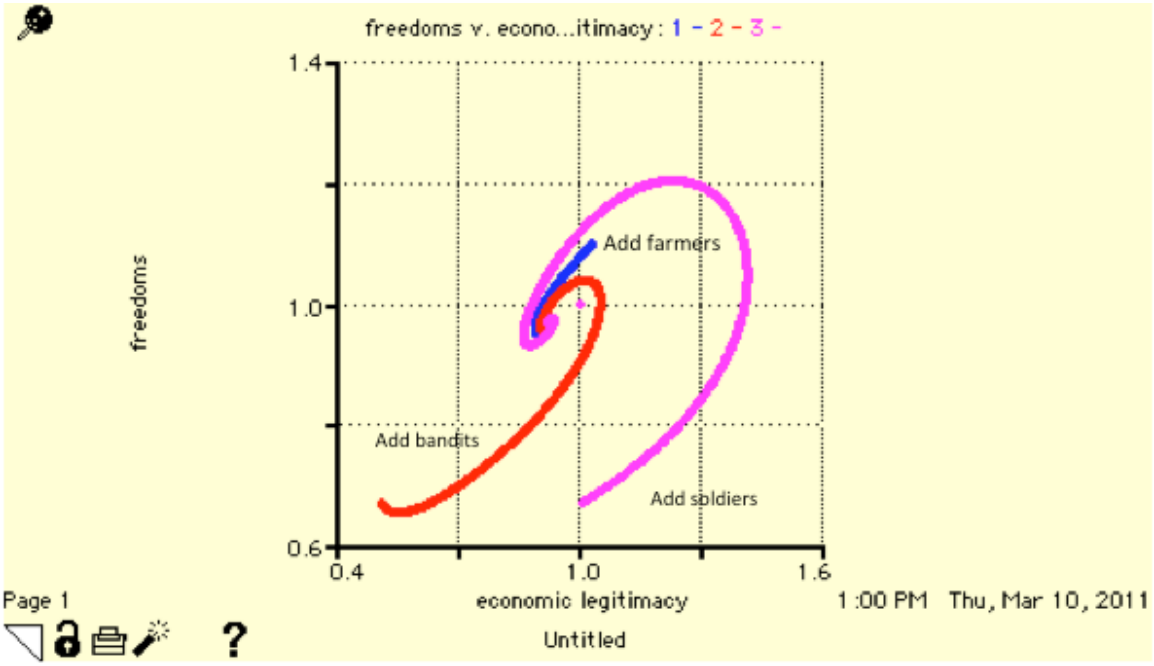

Figure 10: Adjustment to a new homeostasis with gravity, economic and government writ added to the model

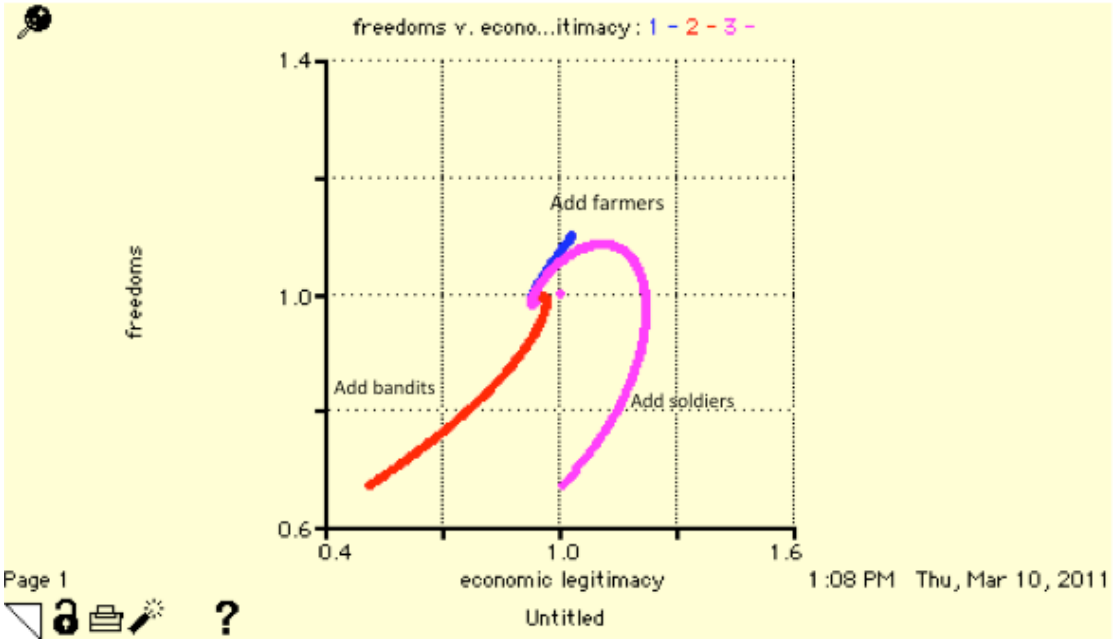

Figure 11: Adjustment to a new homeostasis with gravity, economic, government writ and behavior mechanisms added to the model

It should be noted however that, adding only behavioral influences to the gravity mechanisms as shown in the simulation of Figure 12 has only minor influence as the paths of adjustment do not change substantially from those with flows driven only by gravity. While the basic gravity model may provide a natural adjustment path in a physical system, all three social factors pertaining to economic motivators, governance, and psychological influence are important parts of reality and although they moderate one another's influence they offer potential intervention points for change. The following experiments explore such entry points

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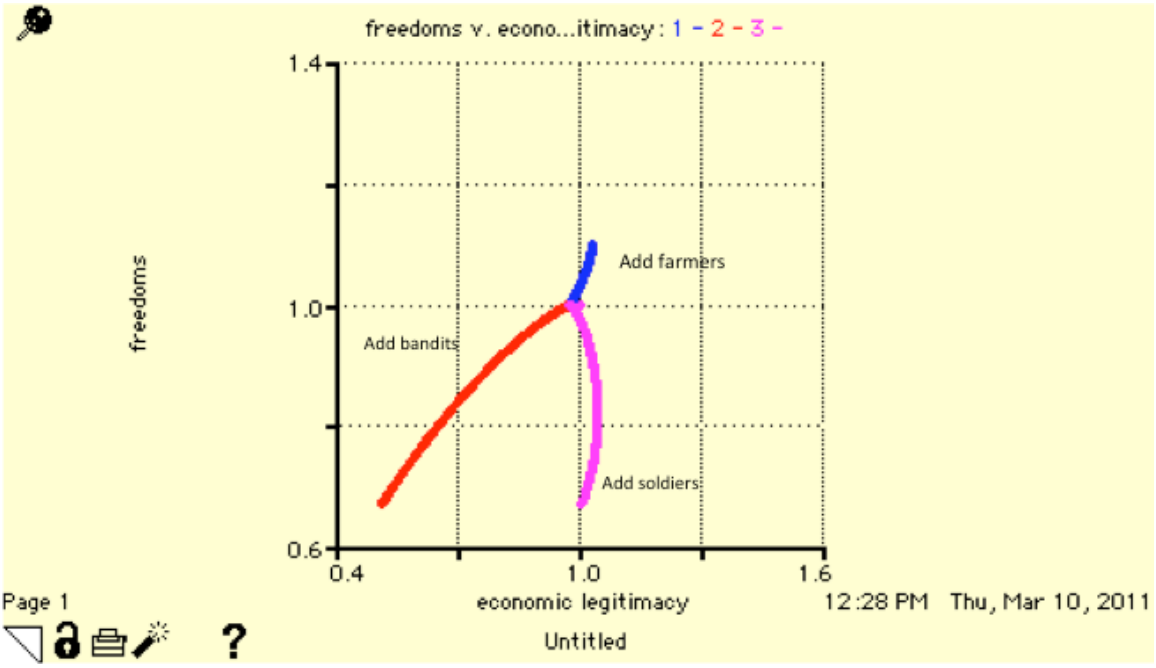

Figure 12: Recovery to almost original equilibrium with behavioral influences added to the gravity flows

Changing productivities and scaling factors

Saeed and Pavlov (2008) reported policy experiments involving changing productivities and scaling factors with their original model that did not incorporate behavioral influences. They reported that while increasing farmer resources and productivity moved homeostasis towards the upper-right people-power quadrant, increasing soldier pay and facilitating bandit loot and productivity moved the equilibrium towards anarchy. Our experiments with the model subsuming also the behavioral influences did not change this inference as shown in the phase plot of Figure 13. However, when farmer resources and productivity were improved concomitantly with reducing prestige of becoming a soldier, the new homeostasis is pushed

further into the people-power quadrant since it did not unnecessarily engaged resources into soldiers and thus both freed them up for farmers while also increasing their freedoms, which is shown in Figure 14. The prestige of being a soldier is embodied in the "farmer urge to change" that encourages soldier recruitment and "soldier urge to change", which discourages soldier attrition,

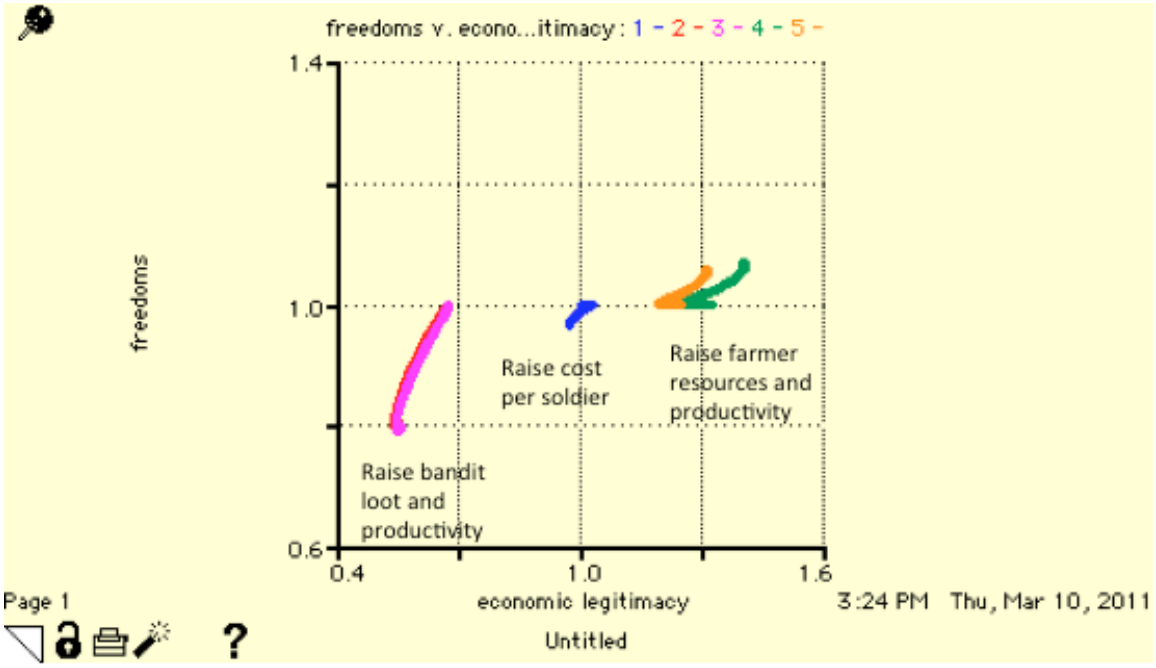

Figure 13: Paths of change and new equilibria in complete model from changing productivities and scaling factors

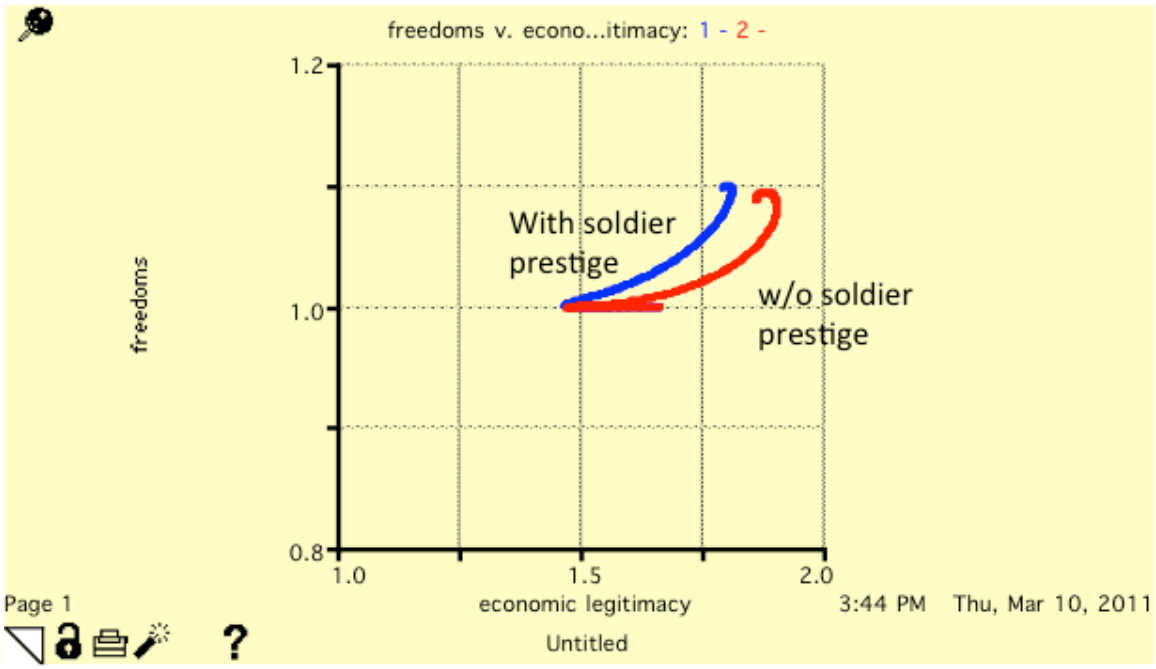

Figure 14: Increasing resources and productivity of the farmers with and without emphasis on soldier prestige

External assistance to actors

The third set of experiments was aimed at determining how external assistance would affect paths to peace. These experiments are particularly relevant to foreign relations and stimulation of democratization process that civil society aspires to spearhead. Figure 15 shows the impact of external assistance in the form of a revenue stream respectively to farmers, bandits and soldiers in our default models, which attaches a degree of prestige to the work of a soldier, so farmers have a preference for being recruited for the job and those in the profession are reluctant to leave. Giving external assistance to Farmers translates into helping civilian projects, which slightly improves welfare right away, although it falls back to the original conditions. Increased income of the farmers creates some bandit conversions, while it also enhances the opportunities for the bandits to loot and soldiers to tax. The subsequent crowding of the farmer sector together with

the increase in its taxation both by farmers and soldiers draws down any increase in its income that is now siphoned away by bandits and soldiers.

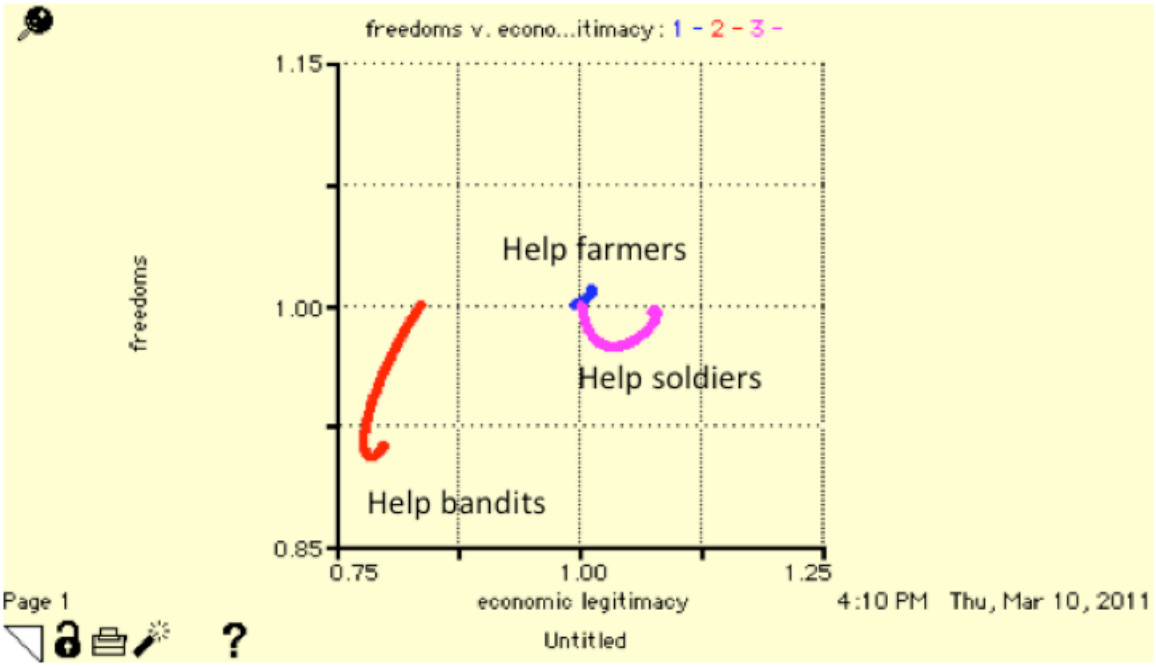

Figure 15: Effect of external assistance to actors

Giving external assistance to bandits amounts to helping insurgent groups to wage resistance against the government. This also makes banditry attractive to farmers who defect towards it. More bandits not only loot the populace they also create justification for increasing taxes to hire more soldiers to contain banditry. These actions decrease both freedoms and economic legitimacy, thus moving the political system considerably towards a homeostasis of anarchy.

Giving external assistance to soldiers has a surprisingly benign effect in the long run by moving the economic system to greater legitimacy, although in the short run, it would usurp some of the freedoms since soldiers impose more controls. This is shown in the simulation of Figure e8.

These controls force bandits to reform and check farmers from defecting into banditry. Thus, military and law-and-order-related assistance to government in fact does seem to be more effective than economic aid in terms of its impact on enhancing people power.

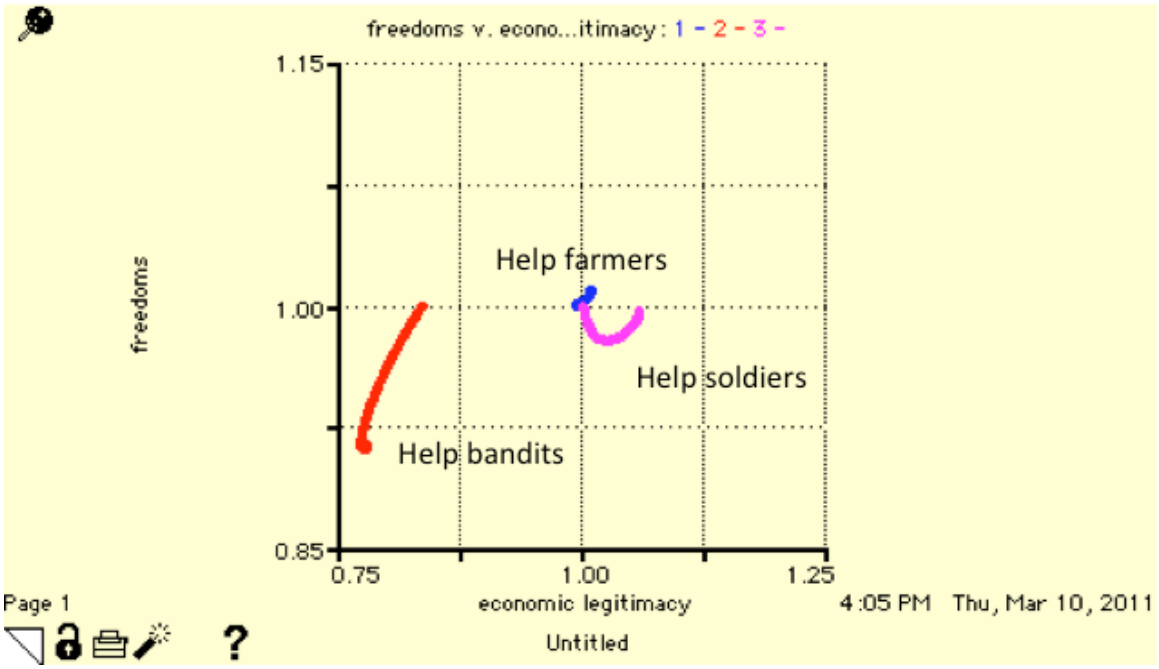

Figure 16: Effect of external assistance to actors with high soldier prestige

The impact of assisting with law and order is further enhanced when less prestige is attached to being a soldier as shown in Figure 16, since this guards against maintenance of excessive soldier force that would reduce farmer income through taxation while also attracting them to defect to banditry. Assisting bandits along with attaching prestige to soldiering however slightly checks the slide to anarchy, since the two policies implemented together counterbalance the defections to banditry by creating higher levels of recruitment to and lower level of layoffs from the soldier pool.

Best policy set for creating a path to peace

Above experiments point to the futility of a variety of common sense measures deemed useful for dealing with conflict in an unstable political economy. A small policy set, namely improvement in productivity, assistance to strengthen law and order institutions and downplaying the psychological prestige often attached to the role of law and order institutions appear to help the path to people power. These policy options are further experimented with in Figure 17. Productivity can be raised by the transfer of new technologies and creating an organization for promoting participation of large cross-sections of the public in the economy as discussed in Saeed (1994). Raising productivity alone (1), that immediately increases farmer revenue, might however only enhance the opportunities for appropriations by bandits in the short run. In the long run, bandits defect from their ranks to become farmers for economic reasons and this raises economic legitimacy. As the defection also reduces the burden on law and order institutions, they can be scaled back, thus enhancing freedoms too.

In this situation, assistance to strengthen law and order institutions that discourage farmers from defecting to banditry and encourage bandits to become farmers (2) will limit initial plundering opportunities and further enhance freedoms in the long run. Downplaying the prestige often associated with the law and order roles in the chaotic situations (3) will additionally limit oversubscription to law and order ranks that enhances the role of farming thus further improving people power. Last but not least, when law and order is also directed at reducing corruption and ransom extraction from public through exemplary and vigilant role played by law and order institutions (4), the path to peace is further facilitated.

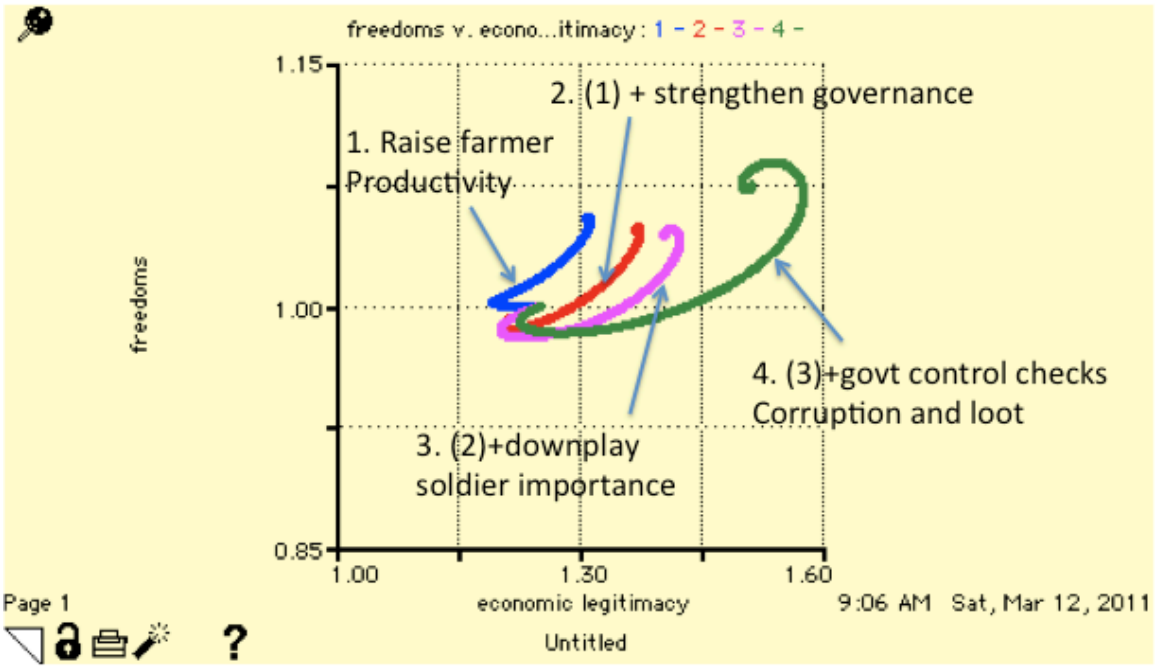

Figure 17: Effective policy sets for paths to peace

Conclusion

In this paper, we model an economy populated by farmers, bandits and soldiers. In addition to the economic factors affecting flows between the three roles, as analyzed in Saeed and Pavlov (2008), we consider psychological factors. Specifically, exposure to violence and group identity affect people's decisions regarding the role they select for themselves. The extent to which violence is perceived depends on the amount of information people receive about the occurrence of violent acts, and sensitivity to the violence is a function of the amount of violence that people believe to be "normal." Individuals with a high reference level of violence are less sensitive to the violence they perceive. As far as group identity, people have a sense of belonging from being members of a particular group. The strength of the effect is inversely related to the group's share of the total population, so group identity is decreasing in the group's share, capturing the idea

that small minority groups often have a stronger sense of group identity than members of the majority.

Within our environment, we conduct three kinds of simulation experiments. First, we infuse additional agents of each type under different assumptions about rational economic behavior, psychological influences and the writ of government. Second, we change the parameters representing the productivities and scaling factors in the economy. Finally, we add external flows to the incomes of each type of agent. All three kinds of experiments produce results useful for creating policy aimed at promoting a desirable combination of freedoms and economic legitimacy.

For instance, we find that when flows between stocks are governed only by gravity, in the short term, adding farmers increases freedoms, adding soldiers decreases freedoms, and adding bandits decreases freedoms and economic legitimacy. In the long term, however, the equilibrium is the same. When economic influences are activated, long term economic legitimacy declines, but freedoms are unchanged when agents of any type are added to the economy. Activating the writ of government creates a more complex adjustment path to an equilibrium with somewhat lower freedoms and economic legitimacy. Finally, activating the behavioral influences causes the adjustment to the new equilibrium to occur more quickly by reducing the tendency for the economy to overshoot the new equilibrium.

Regarding the productivities of the three agents in our economy, changing the cost per soldier has minimal impacts on the long run equilibrium. Increasing bandit loot and productivity, on the

other hand, leads the economy to an equilibrium characterized by anarchy, as both freedoms and economic legitimacy decline. Raising farmer resources and productivity, in contrast, pushes us into the "people power" quadrant, where freedoms and economic legitimacy are higher.

As far as providing external assistance to each of the three types of agents, helping farmers slightly improves welfare right away, but then it quickly falls back close to the initial equilibrium. This is the case with both high and low soldier prestige. Providing help to soldiers creates increased economic legitimacy in the long run at the expense of short run losses in freedoms. Helping bandits pushes the economy toward anarchy, although the effect is somewhat less pronounced when there is prestige attached to being a soldier than when there is not.

Thus, our experiments suggest the following approach to policy promoting peace. Initially, it is optimal to raise the productivity of farmers, taking the economy to an equilibrium where freedoms and economic legitimacy are higher. However, this is not enough. Increasing farmer productivity must be accompanied by strengthening the writ of government and then downplaying the importance of soldiers. Finally, institutions must aim to reduce corruption and the extraction of ransom from the public.

While the results of our experiments provide numerous useful policy recommendations and a literal "how-to" guide for achieving greater freedoms and economic legitimacy, we identify two potential paths for further research. The first involves modeling the longer term psychological impacts of exposure to violence. In our model, violence has important psychological effects, but we do not explicitly capture the long-term resentment that can build up after sustained conflict

between groups. Such resentment has the potential to propagate violence, perhaps with retaliatory acts, long after the effects of the initial perturbations from the equilibrium have run their courses.

Another extension is endogenizing the adoption of new technologies by farmers. In our model, initial productivities are taken as given and any technological change is exogenous. The extension would involve allowing farmers to make optimal choices regarding the use of new technologies according to individual cost / benefit analysis. In such a model, looting by bandits would reduce the incentive for adopting new technologies, reducing economic legitimacy from the first best solution where farmers have established and enforced property rights and maximize the amounts they produce.

In sum, we build upon a past model (Saeed and Pavlov, 2008) in order to understand why political systems might, at times, tend towards different scenarios. In addition, we extend the past model by investigating the impact that psychological factors have on the behavior of the political economy. The results show that while economic factors primarily determine the distribution of soldiers, bandits, and farmers, psychological factors can affect the speed of change thus providing another policy lever to influence the transition form problematic distribution to a healthier one.

Appendix: Model Equations

behavioral influences

conscious_sensitivity_to_violence(t) = conscious_sensitivity_to_violence(t - dt) + (change_in_sensitivity_to_violence) * dt
INIT conscious_sensitivity_to_violence = 1
INFLOWS:
change_in_sensitivity_to_violence = (unconcious__sensitivity_to_violence-conscious_sensitivity_to_violence)/time_to_change__sensitivity
perceived_violence(t) = perceived_violence(t - dt) + (rise_in__perceived_violence) * dt
INIT perceived_violence = 1
INFLOWS:
rise_in__perceived_violence = (actual_violence-perceived_violence)/time_to_form_perception_of_violence
actual_violence = threat_to_society*violence_per_threat
Bandit_urge__to_change = conscious_sensitivity_to_violence/group_identity_of_bandits
external_refernce = 1
external_ref_wt = 1
farmer_urge_to_change = conscious_sensitivity_to_violence/group_identity_of_farmers
group_identity_of_bandits = 1/((bandits/total_workforce)/(INIT(bandits)/INIT(total_workforce)))
group_identity_of_farmers = 1/((farmers/total_workforce)/(INIT(farmers)/INIT(total_workforce)))
group_identity_of_soldiers = 1/((soldiers/total_workforce)/(INIT(soldiers)/INIT(total_workforce)))
information__effect = 1
soldier_urge_to_change = conscious_sensitivity_to_violence/group_identity_of_soldiers
time_to_change__sensitivity = 2
time_to_form_normal_perception = 5
time_to_form_perception_of_violence = 1/information__effect
total_workforce = bandits+farmers+soldiers
unconcious_normal_violence = SMTH3((1-external_ref_wt)*perceived_violence+external_ref_wt*external_refernce,time_to_form_normal_perception)
unconcious__sensitivity_to_violence = perceived_violence/unconcious_normal_violence
violence_per_threat = 1

control

state__control = (soldiers/(bandits+farmers))/(10/(110))

economic influences
farmer_relative__income =
perceived_disposable__income_per_farmer/perceived_disposable__income_per_bandit
soldier_availability = soldiers/desired__number__of_soldiers

performance
economic_legitimacy = (produce__of__farmers/bandit_disposable__income)/(120/10)
freedoms = (farmers/(soldiers+bandits))/(100/20)

political economy
bandits(t) = bandits(t - dt) + (bandit__recruitment_and_attrition + bandit_infusion) * dt
INIT bandits = 10
INFLOWS:
bandit__recruitment_and_attrition =
((farmers*.01*farmer_urge_to_change)/(farmer_relative__income*state__control))-
(bandits*.1*(farmer_relative__income*state__control*Bandit_urge__to_change))
bandit_infusion = PULSE(bandit_additions,0,10000)
farmers(t) = farmers(t - dt) + (farmer__infusion - soldier_recruitment__and_attrition -
bandit__recruitment_and_attrition) * dt
INIT farmers = 100
INFLOWS:
farmer__infusion = PULSE(farmer_additions,0,10000)
OUTFLOWS:
soldier_recruitment__and_attrition = .01*farmers*(IF
sw_for_psych_influence_on_soldiers_rec=1 THEN farmer_urge_to_change ELSE
1)/soldier_availability-.1*soldiers*(IF sw_for_psych_influence_on_soldiers_rec=1 THEN
soldier_urge_to_change ELSE 1)*soldier_availability
bandit__recruitment_and_attrition =
((farmers*.01*farmer_urge_to_change)/(farmer_relative__income*state__control))-
(bandits*.1*(farmer_relative__income*state__control*Bandit_urge__to_change))
perceived_disposable__income_per_bandit(t) = perceived_disposable__income_per_bandit(t -
dt) + (chng_in__disposable_per_bandit) * dt
INIT perceived_disposable__income_per_bandit = 1
INFLOWS:
chng_in__disposable_per_bandit = (disposable_income__per_bandit-
perceived_disposable__income_per_bandit)/2
perceived_disposable__income_per_farmer(t) = perceived_disposable__income_per_farmer(t -
dt) + (chng_in_disposable_income_per_bandit) * dt
INIT perceived_disposable__income_per_farmer = 1
INFLOWS:

chng_in_disposable_income_per_bandit = (disposable__income__per_farmer-perceived_disposable__income_per_farmer)/2
soldiers(t) = soldiers(t - dt) + (soldier_recruitment__and_attrition + soldier_infusion) * dt
INIT soldiers = 10
INFLOWS:
soldier_recruitment__and_attrition = .01*farmers*(IF sw_for_psych_influence_on_soldiers_rec=1 THEN farmer_urge_to_change ELSE 1)/soldier_availability-.1*soldiers*(IF sw_for_psych_influence_on_soldiers_rec=1 THEN soldier_urge_to_change ELSE 1)*soldier_availability
soldier_infusion = PULSE(soldier_additions,0,10000)
bandit_additions = 0
bandit_appropriations = bandits*loot_per_bandit
bandit_disposable__income = bandit_appropriations+nonlegit_produce__by_bandits+external_assistance_to_bandits
cost_per__soldier = 1.5
desired__number__of_soldiers = (tax__collection/cost_per__soldier)*threat_to_society
disposable_income__per_bandit = bandit_disposable__income/bandits
disposable__income__per_farmer = farmer__disposable__income/farmers
economic_well_being_of_a_farmer = perceived_disposable__income_per_farmer/normal__farmer_income
external_assistance_to_bandits = 0
external_assistance_to_farmers = 0
external_assistance_to_soldiers = 0
farmer_additions = 0
farmer__disposable__income = produce__of__farmers-tax__collection-bandit_appropriations+external_assistance_to_farmers
farmer__productivity = 1.2
labor_elasticity = 1-land_elasticity
land = 100
land_elasticity = .7
loot_per_bandit = typical_loot__per_bandit*economic_well_being_of_a_farmer/(if SW_for_limiting_loot=1 then state__control else 1)
nonlegit_produce__by_bandits = bandits*productivity__of_bandits
normal__farmer_income = 1
produce__of__farmers = farmer__productivity*((farmers)^labor_elasticity)*((land)^land_elasticity)
productivity__of_bandits = .5
soldier_additions = 0
SW_for_limiting_loot = 0
sw_for_psych_influence_on_soldiers_rec = 0

tax_need = soldiers*cost_per__soldier
tax__collection = tax_need*economic_well_being_of_a_farmer+external_assistance_to_soldiers
threat_to_society = (bandits/(farmers+soldiers)/(10/110))
typical_loot__per_bandit = .5

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