

# Stability in a superpower-dominated global economic system

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## Abstract

This paper provides an example of a system dynamics model that incorporates soft variables. The model examines the challenges that a superpower faces while maintaining its position in the global economic system. The effects on aggregate welfare of the population at home and abroad, as well as, issues of sustaining authority in the long run are explored through experimentation with a computer model. This theory is an extension of the framework developed by Saeed(1990), which was used to understand political instability and the failure of the government to stay committed to welfare agendas in the developing countries. The present model captures the interaction between several institutional actors involved with the economic and the governance systems. They include the public, the authoritarian regime, the reformist movements that seek change within the existing framework, and the dissident movements that turn to violent methods.

## Introduction

Real world is awash with “soft” variables. At the personal level, we often refer to such amorphous concepts as self-esteem, fatigue, anger, and love. At the organizational level, companies value their intangible resources, such as brand recognition, trust of their market partners, market perception of quality (Warren 2002), and attention of its workers (Simon 1971). However, often researchers are hesitant to include qualitative variables into their models (Richmond and Peterson 2000: 9.1). System dynamics, which originated in the 1950s as an application of control theory to the industrial and urban problems (Lane 1994), holds a view that leaving soft variables out of a model is equivalent to stating that intangibles have zero effect within the modeled system (Sterman 2000: 854). Hence, qualitative variables are in integral part of system dynamics models. As an illustration, this paper provides a modified version of a model that was originally developed by Saeed (1990) to explain the relationship between civil liberties and economic development in Third World countries. The model is reinterpreted for the global economic system.

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The crux of the model is the idea that governments of powerful states, whether it is the old Roman Empire, England of the 19<sup>th</sup> century, the USSR, or the modern United States, allocate limited national resources between productive and nonproductive sectors. The nonproductive sector is the military and security forces; the productive sector is the economic sector. In reality, the matters of war and peace are affected by many factors (Brecher 1996). Additionally, because conflicts as well as sustainable development affect each other and in turn are influenced by the same set of forces and parameters – demographic pressure, environmental degradation, natural resources, technology, etc. – the influences form an intertwined complex web of cause-and-effect relationships (Wils, Kamiya et al. 1998). Due to its complexity and many intangibles, the problem is ideal for analysis using system dynamics methodology.

The paper is organized into following sections: model description, base run, a specific case simulation, conclusion, and Appendix. A characteristic feature of the system dynamics method is an extensive use of graphics to represent and communicate models (Lane 2000). Appendix shows the rendition of the model completed in a computer simulation software package *Vensim DSS*<sup>1</sup>. A complete description of the model, including mathematical equations and computer code, is available from authors upon request. Due to the brevity of this paper, we omit a methodology section and, instead, refer the reader to an excellent text on system dynamics by Sterman (2000). Institutional economists may also find interesting an article by Radzicki (1988), in which he draws parallels between institutional economics and system dynamics.

## Model

The model (see Appendix) assumes that the government distributes limited national resources between two sectors. On the one hand, the resources can be used for productive economic uses, but on the other hand they can be channeled to the stock of control resources. Control resources are used to produce *control*, which is, in this context, a generic variable that represents a combination of forces used to manage total national resources, fight insurgency, and contain censure. The resources are continuously redistributed between economic and control sectors based on the perceived need. Total national resources only grow through the activities in the economics sector. Using economic resources for production of *social goods* is also the only way to improve welfare of the population at home and abroad. Therefore, diverting significant national resources from productive economic activity limits growth in terms of resources and welfare. Potential censure, or the disagreement with the current *status quo*, grows when domestic and foreign populations are not provided with adequate social goods and are too actively managed through government *controls*. Potential censure can be freely expressed through legitimate channels; thus, *potential censure* becomes *censure*. However, high levels of government control limit *personal and national autonomy* and suppress *censure*. Unexpressed *censure* translates into *disenfranchisement* that leads to *violent acts*. With

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<sup>1</sup>Ventana, Inc. ( <http://www.ventana.com>) offers a simplified but still very capable free version of the software called *Vensim PLE*.

some delay *violent acts* are recognized as insurgency. Greater levels of *censure* and *recognized insurgency* result in greater levels of *desired control resources*; this triggers a redistribution of *total resources* in favor of *control resources*. Key “soft” variables are summarized in Table 1.

**Table 1:** Key “soft” variables in the model

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Stability of rules
Economic resources
Control resources
Control
Social goods
Potential censure
Censure
Disenfranchisement
Violent acts

There exist several approaches within system dynamics for operationalization of soft variables. One approach is articulated by Warren (2002), who recommends expressing soft variables in measurable units. Then product quality can be expressed as a reject fraction, and quality of a retail bank branch can be measured in terms of revenue it brings. This view is not unique to system dynamics. In an article on information overload, Herbert Simon (1971) suggested measuring attention in terms of time. The number of teachers and physicians, government spending on education and health may serve as economic and social development indicators (Saeed 1990). However, this approach may be misleading. If arable land, for example, were used as a resource measure, then a Middle Eastern country would appear to have few resources even though in reality it is rich in oil (Wils, Kamiya et al. 1998). To avoid such difficulties, some authors opt for a different technique. For example, Saeed (see e.g. 1990, 2004) chooses to express soft variables as dimensionless indexes. Index measures do not have cardinal meaning and are only significant in terms of ordinal comparisons (Saeed 1990). In the current model, soft variables, such as resources, censure, disenfranchisement, and perceived social goods adequacy are presented as positive integer indexes.

## Base run

Figure 1 shows the base run of the model. The simulation starts in a steady state. In the steady state, *economic resources* (Figure 1a) produce adequate levels of *social goods*; *control resources* (Figure 1b) are also sufficient for the existing levels of *censure* and *disenfranchisement*. We perturb the system out of its steady state by increasing the *fractional rate of change for economic resources* (see Appendix). Greater *economic resources* (Figure 1a) allow providing additional *social goods*. With some delay, better levels of social goods become the norm and are expected by the population at home and abroad. The change is captured by the variable *desired social goods*. The general

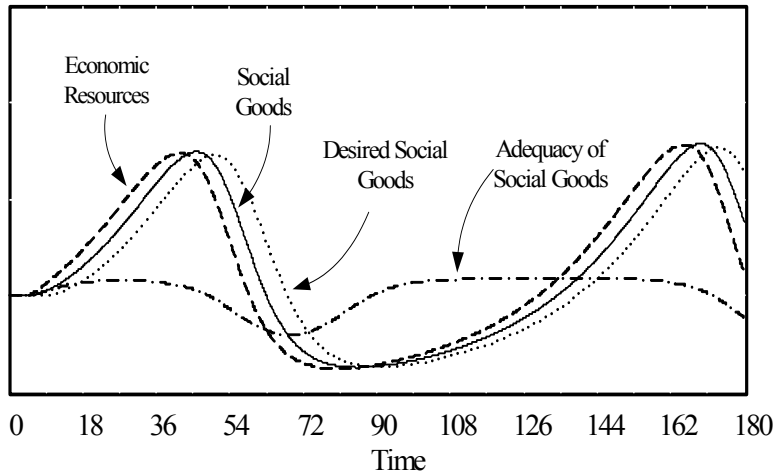
satisfaction with welfare is captured by the *adequacy of social goods* index, which is the ratio of the current level of social goods to the desired level.

Greater economic resources allow greater flow of resources to the control sector (Figure 1b), which includes defense and internal security forces. Increasing supervision angers some population, thus increasing *potential censure* (see Figure 2). The effect is balanced by the *voluntary acceptance of the superpower agenda* (Figure 2). As a result of the two competing influences, *censure* initially declines only to increase again when the effect from *control* becomes stronger than from the availability of social goods (Figure 2). Greater *control* leads to a decline in *personal and national autonomy* (Figure 1b). This makes it more difficult to express views opposing the superpower, thus increasing the *disenfranchisement* (Figure 2). Growth of disenfranchisement leads to more *violent acts*, which in turn stimulate further military presence build up (Figure 2 and Figure 1b).

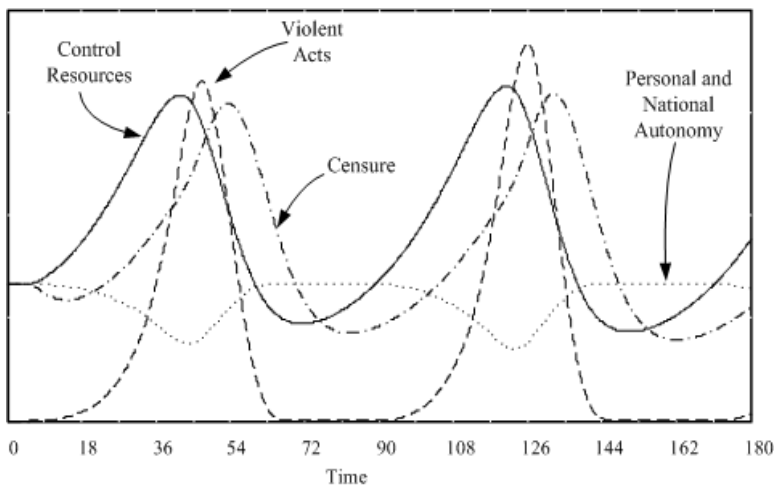
Violence continues to grow until the superpower runs out of resources and can no longer provide adequate *control resources* to curtail the insurgency. Economy becomes weaker as relatively greater share of national resources is diverted to the control sector. Eventually, defending its interests becomes beyond what the superpower can bear. Pulling out Soviet troops from Afghanistan in 1989 is an example of this dynamics. As control declines so does the potential censure and the *violent acts* due to *disenfranchisement* (Figure 1b and Figure 2). After some time, *economic resources* of the superpower recover (Figure 1a), and the cycle begins all over again (Figure 1a and Figure 1b).

Experiments show that the system is robust to parameter changes. To alter the cyclical nature of dynamical paths, the system structure needs to be modified. The following section examines a possible case.

Figure 1: Model behavior during the base run



(a)



(b)

## The case of pluralistic global order

Insurgency is one of the main drivers for the expansion of *control resources*. Insurgency and violence emerge due to the lack of politically accepted means to express *censure*. Disenfranchisement that leads to insurgency can be reduced if the superpower does not limit *personal and national autonomy*, thus does not suppress *censure*. This change can be traced in Figure 2 as the elimination of the negative link (thick arrow) between *control* and *personal and national autonomy*. Figure 3 shows dramatically different trajectories for the new situation.

In this case, opposition is not suppressed and thus there is little incentive for insurgency. This frees up resources that are directed toward productive activities, allowing for a

continual increase of *social goods* (Figure 3a). Continuous growth of *social goods* keeps foreign and domestic populations satisfied, which is expressed by the stable index called *adequacy of social goods*. Even though there is no active insurgency, additional resources are being allocated to *control resources*, which allow the *control* to grow (Figure 3b). Greater military force increases *censure* (Figure 3b). But because autonomy is not suppressed, *censure* is expressed through accepted legal channels, and therefore does not lead to violence.

Figure 2: Causal logic of the model

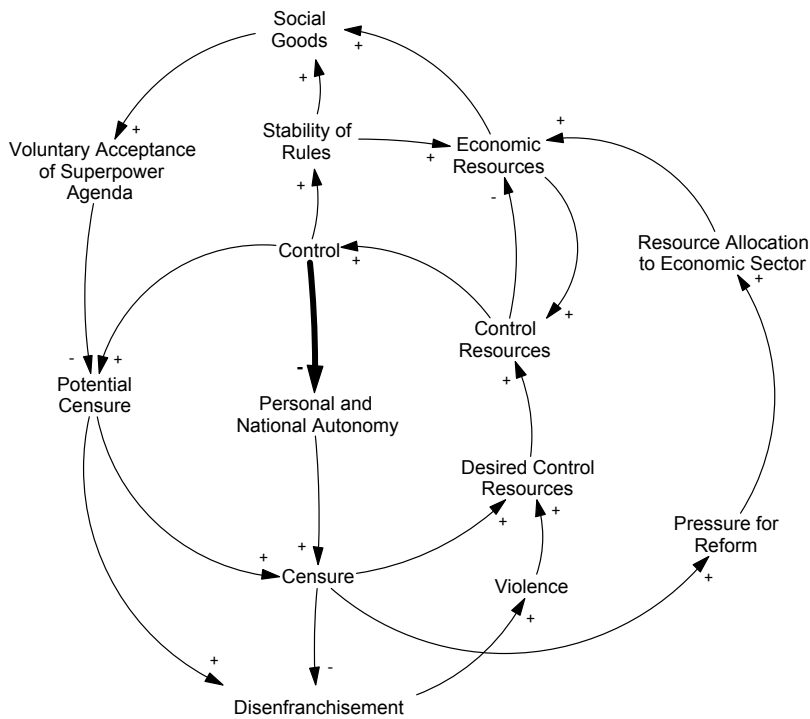
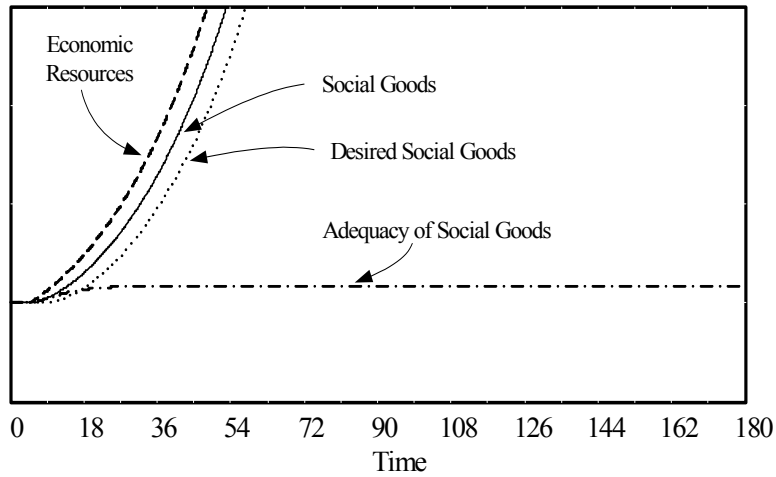
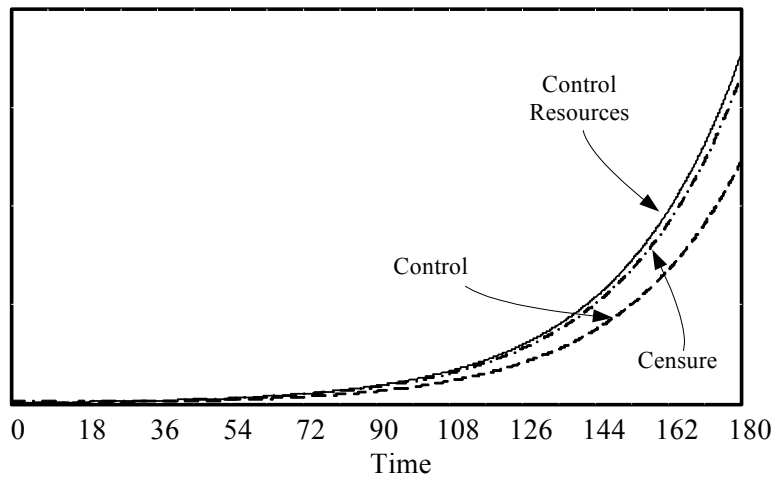


Figure 3: A simulation for the case of protected personal and national autonomy



(a)



(b)

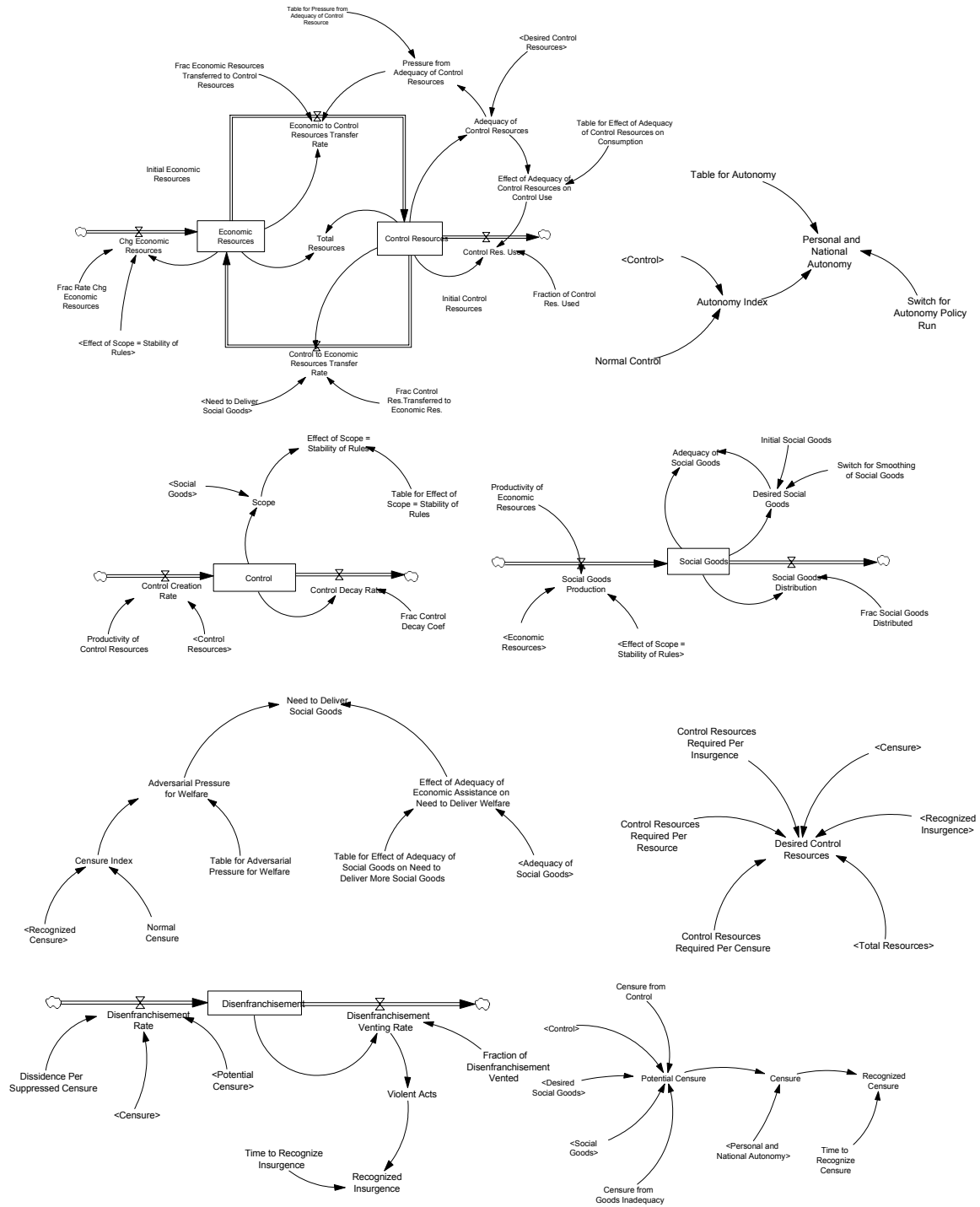
## Conclusion

The purpose of this paper was to demonstrate the inclusion of soft variables in a system dynamics model. We provided a simple model of a superpower-dominant global economic system that incorporated many intangibles as indexes. A base case computer simulation showed the system is inherently unstable. As insurgency and censure increase, the need to dedicate greater resources to the unproductive control sector, and therefore leads to a demise of a superpower. The analysis shows that preserving legal means to express censure eliminates the main motivation for the reformist groups to turn to violence. Peaceful opposition limits the need for control and sustains the superpower's strength and position in the long-term.

The model omits many variables that have been determined to be important in matters of conflict and long-term sustainable development. However, it demonstrates the limitations imposed on growth by the need to allocate resources to control domestic and foreign disenfranchisement. Extending the model would allow to perform additional policy experiments.



# Appendix: System Flow Diagrams



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