

Stability in a Superpower-Dominated Global Economic System

*Oleg V. Pavlov,
Michael Radzicki,
and
Khalid Saeed*

The 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, and market perception of quality (Warren 2002). However, often researchers are hesitant to include qualitative variables in their models (Richmond and Peterson 2000, 9.1). System dynamics, which originated in the 1950s as an application of control theory to industrial and urban problems (Lane 1994), holds the 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 an integral part of system dynamics models. As an illustration, this paper provides a modified version of a model that was originally developed by Khalid Saeed to explain the relationship between civil liberties and economic development in Third World countries (1990). The model is reinterpreted for the global economic system.

The crux of the model is the idea that governments of powerful states, whether they are the old Roman Empire, England of the nineteenth 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, 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,

The authors are, respectively, Assistant Professor, Associate Professor, and Professor in the Social Science and Policy Studies Department at Worcester Polytechnic Institute, Massachusetts, USA. This paper was presented at the annual meeting of the Association for Evolutionary Economics in Philadelphia January 7–9, 2005.

technology, and so on—the influences form an intertwined complex web of cause-and-effect relationships (Wils 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 the 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). The appendix shows the rendition of the model completed in the computer simulation software package *Vensim DDS*.¹ A complete description of the model, including mathematical equations and computer code, is available from the 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 John D. Sterman (2000). Institutional economists may also find interesting an article by Michael Radzicki (1988) in which he drew parallels between institutional economics and system dynamics.

Model

The model (see appendix) assumes that the government distributes limited national resources between two sectors. On 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 the 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 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 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.

There exist several approaches within system dynamics for operationalization of soft variables. One approach has been articulated by Kim Warren (2002), who recommended expressing soft variables in measurable units. Then product quality can be

Table 1. Key “Soft” Variables in the Model

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

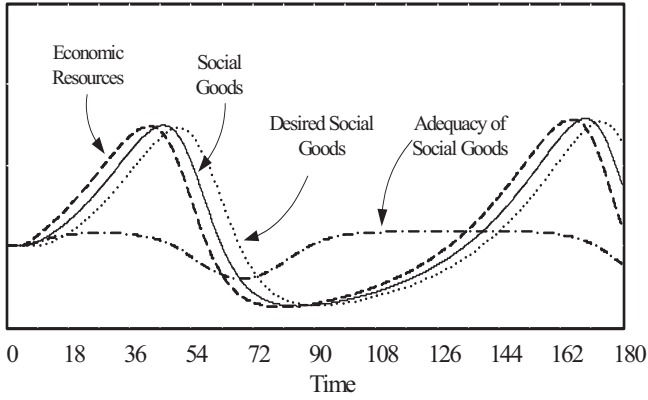
expressed as a reject fraction, and quality of a retail bank branch can be measured in terms of revenue it brings. This view is not unique to system dynamics. In an article on information overload, Herbert Simon (1971) suggested measuring attention in terms of time. The number of teachers and physicians and 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 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 (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

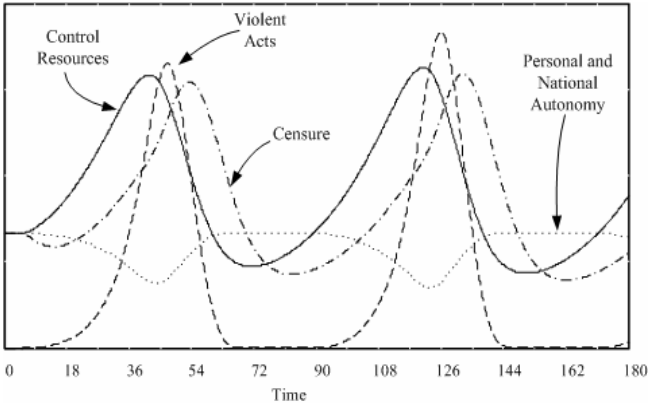
Figure 1 shows the base run of the model. The simulation starts in a steady state. In the steady state, economic resources (figure 1a) produce adequate levels of social goods; control resources (figure 1b) are also sufficient for the existing levels of censure and disenfranchisement. We disturb the system 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

Figure 1. Model Behavior during the Base Run



(a)



(b)

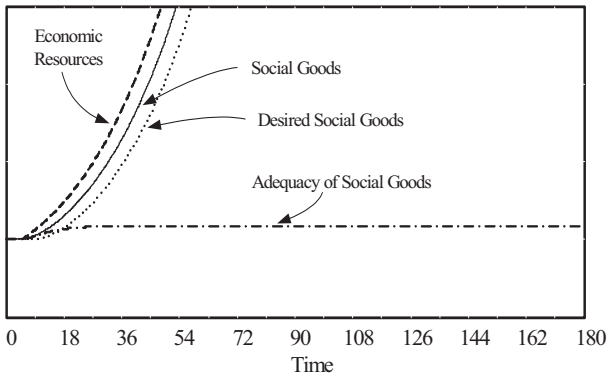
the two competing influences, censure initially declines only to increase again when the effect from control becomes stronger than from the availability of social goods (figure 2). Greater control leads to a decline in personal and national autonomy (figure 1b). This makes it more difficult to express 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 buildup (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. The economy becomes weaker as a relatively greater share of national resources is diverted to the con-

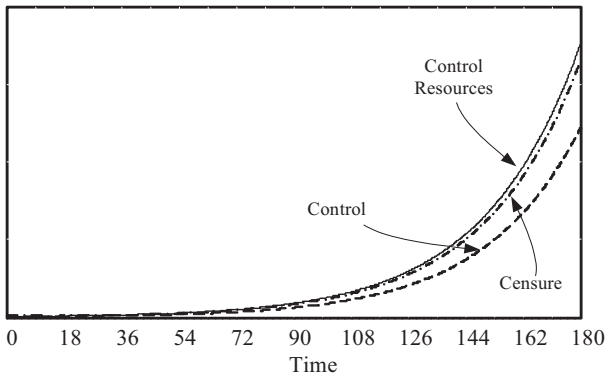
does not limit personal and national autonomy and thus does not suppress censure. This change can be traced in figure 2 as the elimination of the negative link (thick arrow) between control and personal and national autonomy. Figure 3 shows dramatically different trajectories for the new situation.

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

Figure 3. A Simulation for the Case of Protected Personal and National Autonomy



(a)



(b)

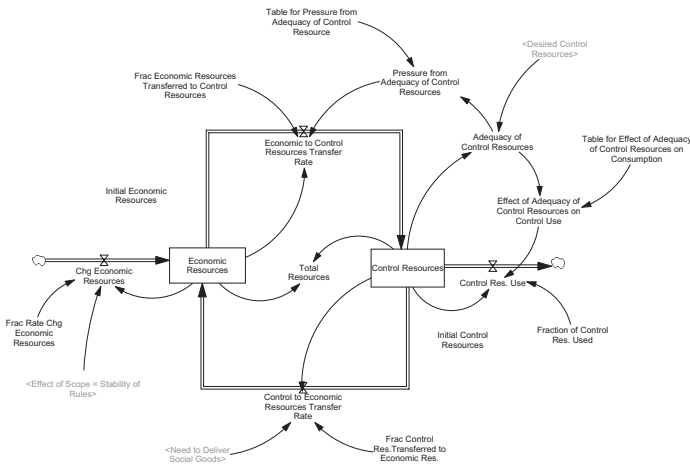
keeps foreign and domestic populations satisfied, which is expressed by the stable index called *adequacy of social goods*. Even though there is no active insurgency, additional resources are being allocated to control resources, which allow the control to grow (figure 3b). Greater military force increases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

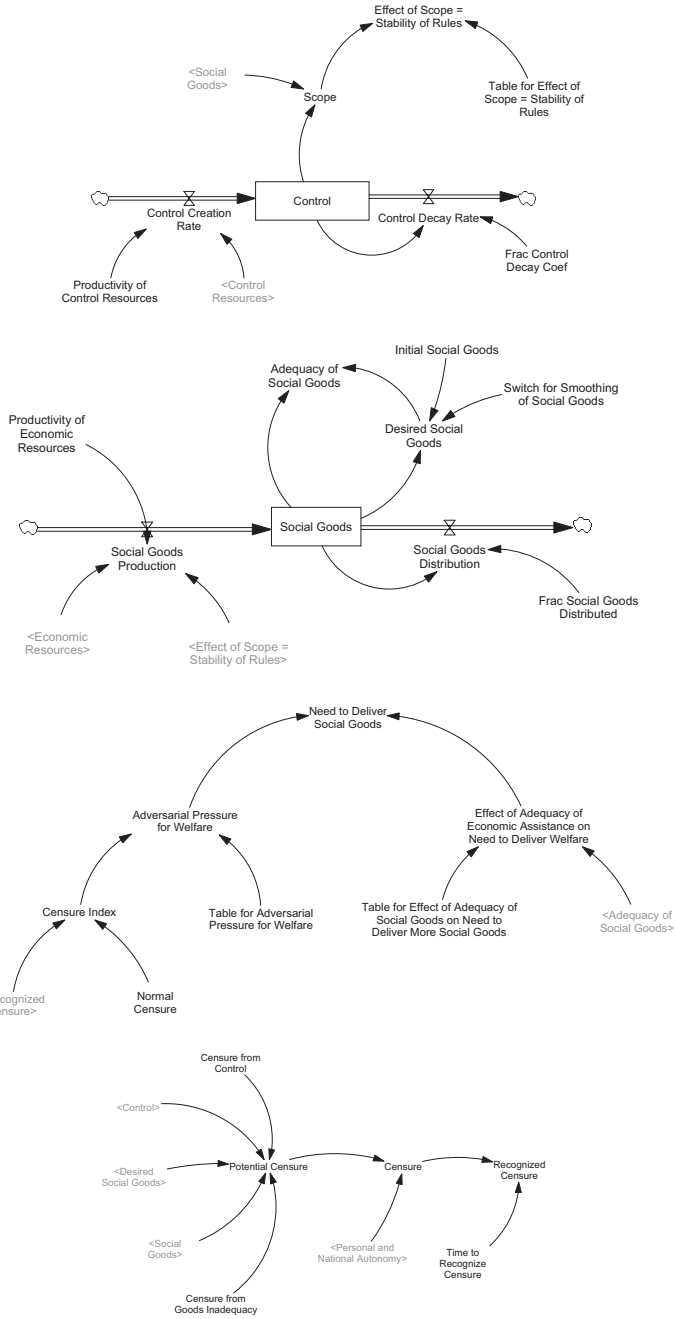
Conclusion

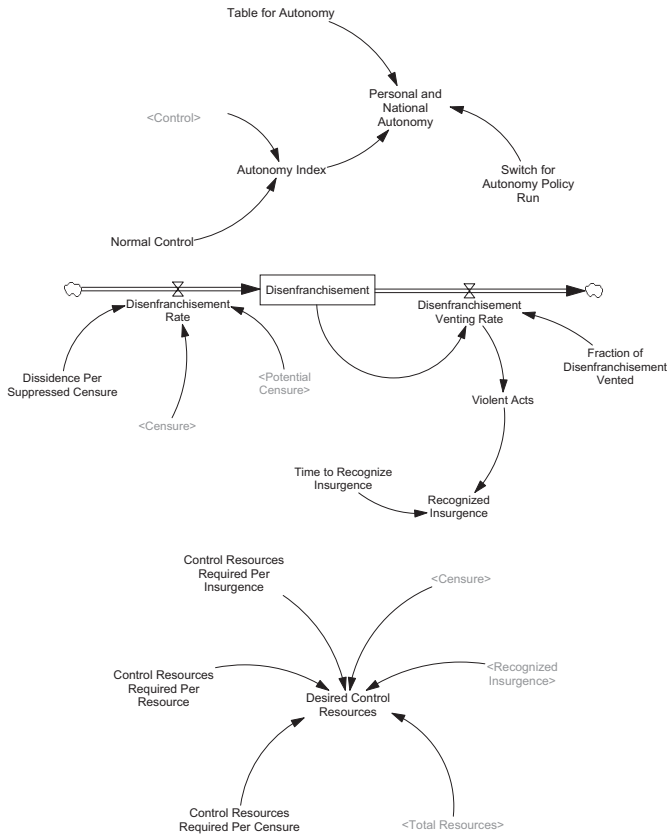
The purpose of this paper was to demonstrate the inclusion of soft variables in a system dynamics model. We provided a simple model of a superpower-dominant global economic system that incorporated many intangibles as indexes. A base case computer simulation showed the system is inherently unstable. As insurgency and censure increase, the superpower needs to dedicate a growing share of resources to the unproductive control sector, which eventually leads to a demise of the 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 the performance of additional policy experiments.

Appendix A System Flow Diagrams







Note

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

References

Brecher, Michael. "Introduction: Crisis, Conflict, War—The State of the Discipline." *International Political Science Review* 17, no. 2 (1996): 127–139.

Lane, David C. "With a Little Help from Our Friends: How System Dynamics and Soft OR Can Learn from Each Other." *System Dynamics Review* 10, no. 2/3 (1994): 101–134.

—. "Diagramming Conventions in System Dynamics." *The Journal of the Operational Research Society* 51, no. 2 (2000): 241.

Radzicki, Michael J. "Institutional Dynamics: An Extension of the Institutionalist Approach to Socioeconomic Analysis." *Journal Economic Issues* 22, no. 3 (1988): 633–666.

- Richmond, Barry M., and Steven O. Peterson. *An Introduction to Systems Thinking*. Lyme, N.H., High Performance Systems, 2000.
- Saeed, Khalid. "Government Support of Economic Agenda in the Developing Countries, a Behavioral Model." *World Development* 18, no. 6 (1990): 35.
- . "Testing Design of a Social Innovation—The Environmental Mitigation Banking System." *Journal of Economic Issues* 38, no. 4 (December 2004).
- Simon, Herbert. "Designing Organizations for an Information-Rich World." In *Computers, Communications, and the Public Interest*, edited by M. Greenberger. Baltimore, Md.: The Johns Hopkins Press, 1971, 38–52.
- Sterman, John D. *Business Dynamics*. McGraw-Hill, 2000.
- Warren, Kim. *Competitive Strategy Dynamics*. New York: John Wiley & Sons, Inc., 2002.
- Wils, Annabette, Matilde Kamiya, and Nazli D. Choucri. "Threats to Sustainability: Simulating Conflict within and between Nations." *System Dynamics Review* 14, no. 2/3 (1998): 129–162.