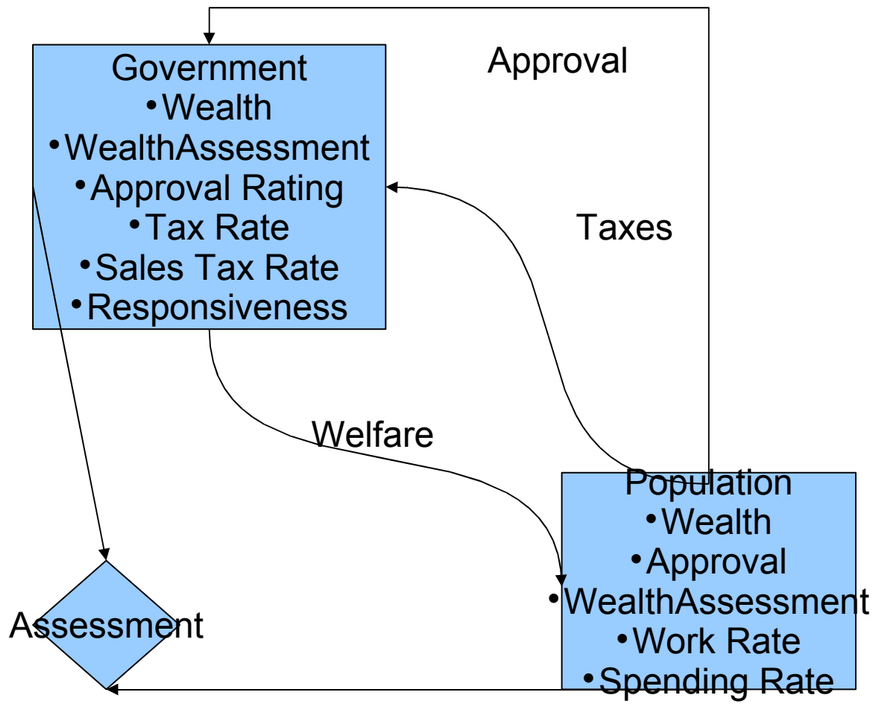
Economic Policy Simulation and Optimization

Peter Le
Computer Systems Research

Abstract

There are several variations on gubernatorial economic policy around the world. Given different populations and demographics, economic policy changes. How can we best predict the ramifications of a given policy? Can we produce an optimal policy? Computer simulations and optimization using genetic algorithms may be able to provide policy makers with the data to answer these questions. An iterative model of the relationship between the government, econonmic policy, and the governed and optimization processes involving genetic algorithms were tested in an attempt to further this research.



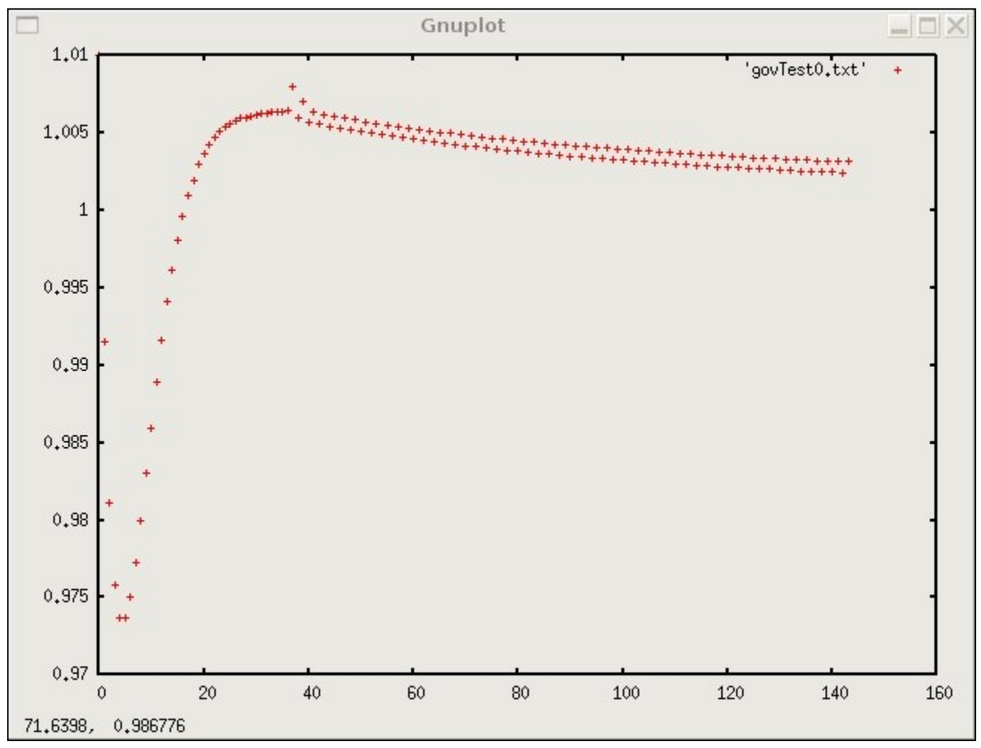
Purpose and Methodology

The core of this project is an agent based model system to provide data of government and population economic and subjective satisfaction over time. Changing demographics and complicated economic systems may obstruct desired outcomes in certain economic policy, disrupting social order. Computer models can provide prediction data quickly and at a low cost to economists, businessmen, and policy makers. Data from the model and perhaps from the genetic algorithm based optimization can guide those involved in economics.

The project will be coded in Java using JGrasp. Over a 12 year cycle, a population will consume and produce, and an authority ("government") will tax and implement welfare programs. The economics and relative health of the population and governing body will be assessed. Data from the model will be analyzed, and run through a genetic algorithm. The genetic algorithm mixes attributes of government policy to create new policy. New policies are tested and analyzed, and the process is repeated.

Data and Results

Currently using varied data, there is an overwhelming trend of the total civilian wealth plummeting and leveling out, while the total government wealth continues to go up. The assessment, which is defined as the current wealth divided by the previous month's wealth for the total civilian population averaged with the same assessment for the government wealth, is mostly erratic. Currently the assessment is not optimal, but the optimization stage that will be implemented may mitigate poor data. The genetic algorithm process is finished, but tweaking is needed to get better results.



Sample Assessment Data Over 12 "years"

Background

Tax burden and sudden changes in tax policy are detrimental to approval ratings according to Vermeir's model in Taxation and Presidential Approval: Separate Effects from Tax Burden and Tax Structure Turbulence?. The formula for their approval rating depends on more factors but can be modified or serve as a base example for my approval rating system. To weight factors into my final assessment, social causality as well as direct causality must be taken into account, as public opinion is just as much perception and relative thought as much as concrete. According to Mao and Gratch in Evaluating a computational model of social causality and responsibility, responsibility and blame assessments must be made to model accurate social cause/effect. In A Review of Economic Sustainability Indicators, several types of assessments were discussed. Currently the assessment is based on relative wealth with respect to time, but a Gini Co-efficient assessment may be implemented later.

An agent based model is ideal because of the varying demographics in populations. This way, multiple situations can be simulated with ease.

As for optimization, there are several approaches to attain the "best" policy. The assessment determined in the model and other data will be put under optimization algorithms. One possible algorithm is the genetic algorithm. In Optimization in a Distributed Processing Environment using Genetic Algorithms with Multivariate Crossover, a genetic algorithm is employed to find the best result of a multi-faceted problem. By "breeding" data, one may find the best result, similar to the process of natural selection in biology. More heuristics and possibly "variable neighbor search" techniques can improve data output as found by researchers in Minimizing makespan in permutation flow shop scheduling problems using a hybrid metaheuristic algorithm. In On the Application of Hierarchical Coevolutionary Genetic Algorithms: Recombination and Evaluation Partners, researchers concluded partnering strategies all had strengths depending on the type of problem. Possible strategies are pairing based on attraction, fitness, or randomized partnering. This project is using pairing based on fitness currently.