

TJHSST Computer Systems Lab Senior
Research Project
First Quarter Research Paper
Economic Policy Simulation and Optimization
2008-2009

Peter Le

October 30, 2008

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.

Keywords: genetic algorithm, social modeling, agent based modeling

1 Introduction

1.1 Purpose

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.

1.2 Scope of Study

The idea is to model simple income and sales taxation and overall welfare (government provided services) over a short period of time. Assessments of each citizens health, wealth, happiness, and wealth assessment will be factored into their approval rating of the government. Similarly, the government will factor those assessments along with their approval rating to produce a value representing overall well being of the society. Economic cycles will have to be researched, and relatively realistic economic data will have to be obtained. Approval, happiness, wealth assessment, and health are relative and general trends will have to be researched. Perhaps some of these variables will have to be cut because of subjectivity. Once the model is feasible enough, a genetic algorithm may be implemented to determine optimal policy given a situation.

1.3 Expected results

I expect the project to model government/population economic relationships reasonably well and for the genetic algorithm to optimize data. Assessment data can already be printed out and represented in a graph over time using GNUPlot. Graphs showing the relationship between different variables and overall assessment can be made. This project data should lay some groundwork for policy makers, sociologists, and economists.

This project should be useful in a social/economic study sense as well as in learning more about computer modeling and optimization algorithms. Learning more about modeling and data optimization may prove to be useful in shaping public policy. The development of computer models and optimization are both relevant to this and many other fields.

2 Background and Literature Research

Research can make or break the simulation part of the project. I'm currently getting some data from the Census Bureau but probably need more sources. I've looked at economic data and some papers on the relationship between

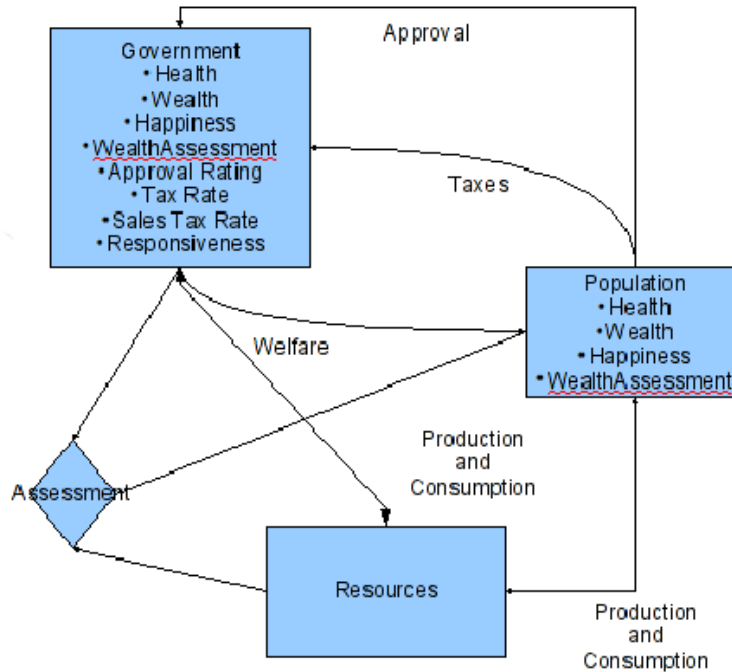


Figure 1: Project Flow Diagram

economics and approval/happiness. Tax burden and sudden changes in tax policy are detrimental to approval ratings according to Vermeir’s model [1]. 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, I must look at social causality as well as direct causality, as public opinion is just as much perception and relative thought as much as concrete. According to Mao and Gratch, responsibility and blame assessments must be made to model accurate social cause/effect. An agent based model is ideal because of the varying demographics in populations [?]. Most of the social models that were looked at had little to do with my project idea, although they did use agent-based models in some cases. I will look upon these other projects for implementation ideas, and hopefully to improve the economic cycle.

3 Procedures and Methodology

The simulation will continue to be written in Java using Jgrasp and other code editors. A basic project layout has been implemented. It is able to receive, process (using a preliminary economic cycle) and output data and can be modified relatively easily. The preliminary economic cycle uses somewhat arbitrary values, but more realistic data will be used in the future after some research. Input data should be taken from real data and perhaps modified to suit the program. Sources such as the Census Bureau may be used. Testing is already being done there are several outputs of data tracking different variables for further analysis and to pinpoint trouble spots in the program. This data can be plotted using GNUPlot or other graphing utilities. Itll also be compared to real data and judgments on the feasibility of the model will be made. Erratic or outstanding data would signal a faulty simulation. Once a feasible model is created (that doesnt necessarily have to be very accurate), the genetic algorithm part of the project can take shape. Of course, the result of running the algorithm should improve the assessment for the society.

4 Current Results

The program now runs through a 4 year economic cycle of consumer spending, government taxation, government welfare, and feedback. The program is heavily modifiable for future use. Results seem erratic and the feasibility of the model is off as approval ratings are in the extreme and erratic, meaning better input data and more realistic processes are needed.

References

- [1] Mao, W. & Gratch, J. "Evaluating a computational model of social causality and responsibility." *In Proceedings of the Fifth International Joint Conference on Autonomous Agents and Multiagent Systems Hakodate, Japan* May 12, 2006. AAMAS 2006. ACM, New York, NY, 985-992.
- [2] Vermeir, Jan. "Taxation and Presidential Approval: Separate Effects from Tax Burden and Tax Structure Turbulence?" *Paper presented at the annual meeting of the The Midwest Political Science Association,*

Palmer House Hilton, Chicago, Illinois, Apr 20, 2006 Online. 2008-10-26. http://www.allacademic.com/meta/p141062_index.html