Economics Model with Wealth Distribution using Netlogo

New Mexico

Supercomputing Challenge

Final Report

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Team 05

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What is the project about?

Our team has been working on a program to model investments, but we soon realized that there are so many factors affecting economics. We put further investment to make a model of economics and our economics teacher suggested starting simple and focusing on a single factor and adding up one by one. The US is a good example of a capitalist economy and we gained multiple sources about the data of wealth distribution from 2019 and 2020. Debates are going on how the US should move its interest in economics. Some claim the government should tax the wealthy class more and increase the minimum wage, while some claim the government should repeal the regulations put on to the companies and make a fully free market. There is no right answer to this as some will benefit, while others will lose from such movement. History has proven anything radical and unstable will fail. The failure involves other government interventions in the society as a whole, but we want to focus just on economics. From the article "A Model of Wealth Distribution" by authors Pierre Pestieau and Uri Possen, we have discovered that there are multiple factors that determine the wealth distribution model in the economy and society. It explains how wealth is distributed as well changes over time referring Gibrat's law of proportionate effect. Moreover, it describes how stochastic factors, known as random variables, depend on time periods as huge factors that determine the model. For example, an individual's savings, bequests, and inherited wealth are some stochastic factors that elaborate to Gibrat's law of proportionate effect. The article also indicates how unpredictable the model is due to its randomness coming from stochastic factors since there is uncertainty about rates of return and how natural skills are dispersed to individuals. By absorbing this information from the article, we are planning to assign various factors to demonstrate how factors can vary the shape of the model.

How are you/do you plan to solve this problem computationally?

We've gone through the history of how the wealth of the US has developed and the distribution differed. No matter what, it seems the overall trend in the economy affects both the wealthy and the poor class. We want to show different situations of how the wealth will be distributed using Netlogo. Our team found a sample code in the models library in Netlogo. It is called 'Simple Economy'. The wealth distribution fluctuates randomly but evenly. We are going to add more factors that move the economy such as government intervention and a free market. We decided to put our main focus on the Macroeconomics of how the wealth is distributed in each situation. As we went deeper inside the investigation, we learned about the Pareto distribution. The article "A Model Explaining the Pareto Distribution of Wealth," says Pareto distribution is a good model to show wealth distribution. We are trying our best to mimic his model with our program.
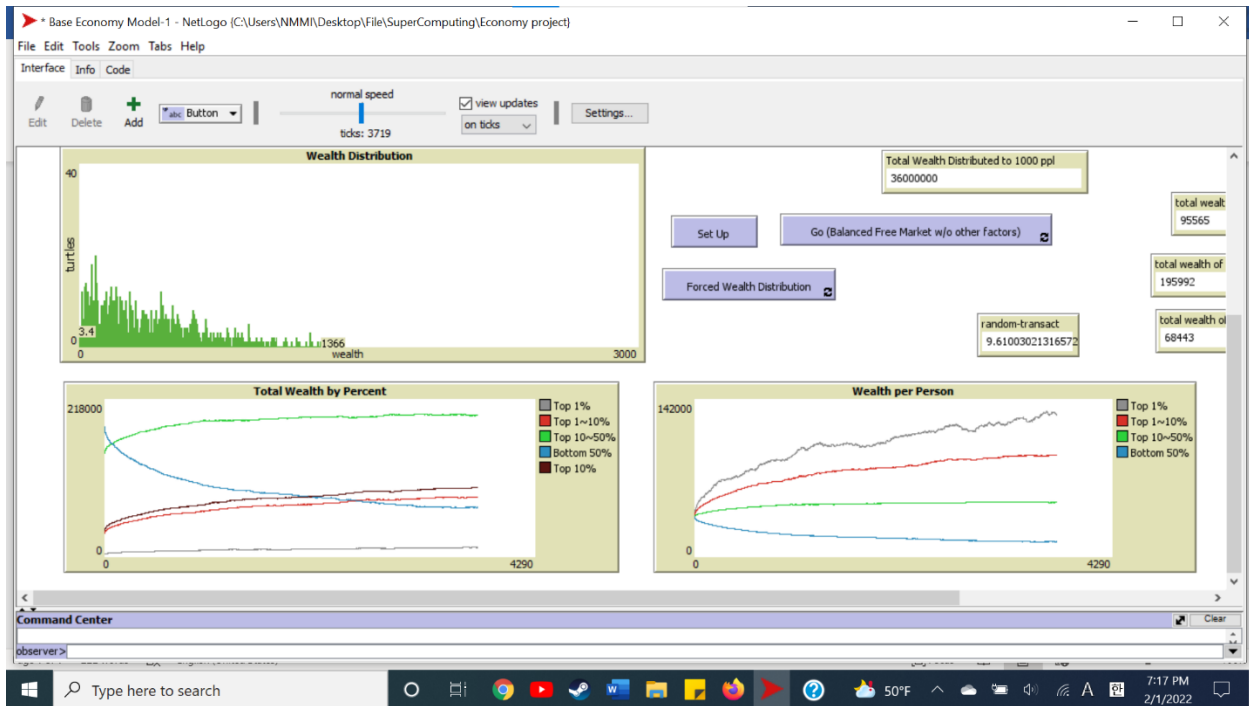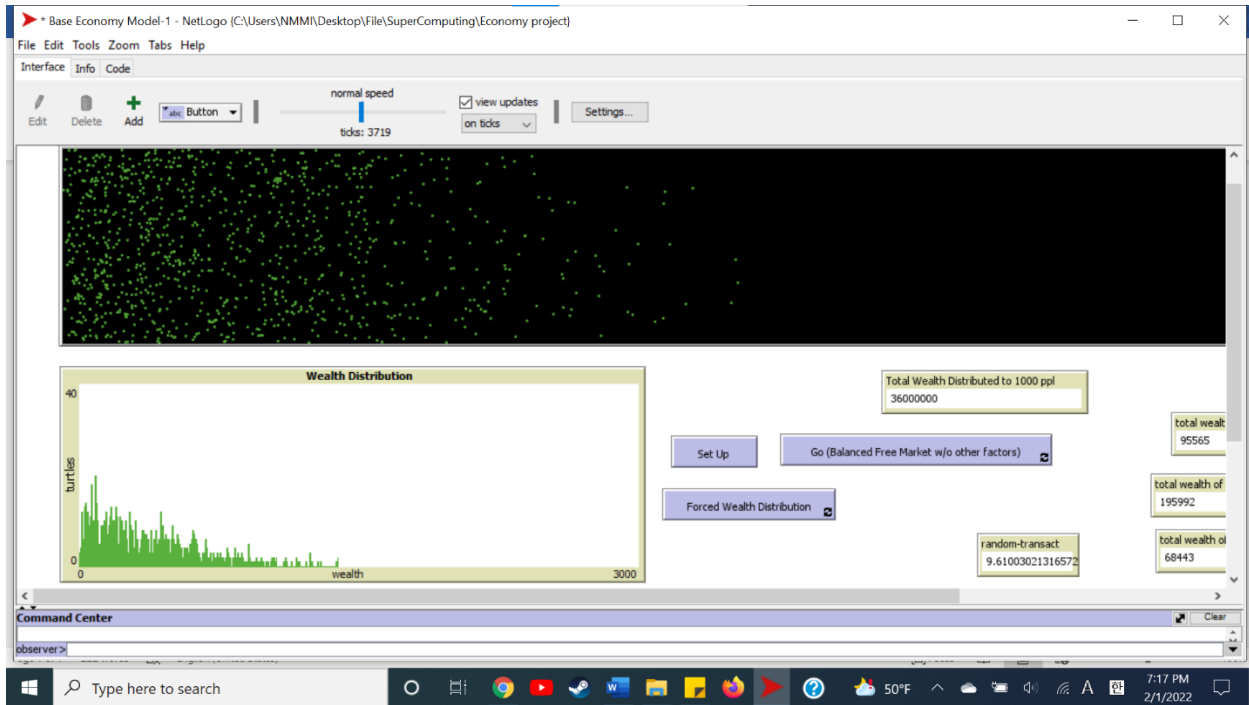
How does it work?

   This program disregards investments or inflation. It focuses only on the wealth distribution. The model creates 1000 turtles and each turtle start with $36000 in their pockets, which is about the average income. At every tick, a turtle will transfer the money to another

turtle. The amount of money varies from $100 to $1000. Since the program does not start with the wealth distributed like the real-life example, the actual simulation starts from around 3000 ticks, where the graph is constant. From that tick number, we apply the different situations.

Results and Conclusion

The wealth distribution is less extreme compared to the real data, but we can compare the results within the program and conclude from the different results. We applied different situations and see how the economy fluctuates in each situation.

	wealth of top 1% per person 139250
total wealth of top 10% 97754	wealth of top 1~10% per person 93143
total wealth of middle 10-50% 200597	wealth of top 10-50% per person 50149
total wealth of bottom 50% 61649	wealth of bottom 50% per person 12330
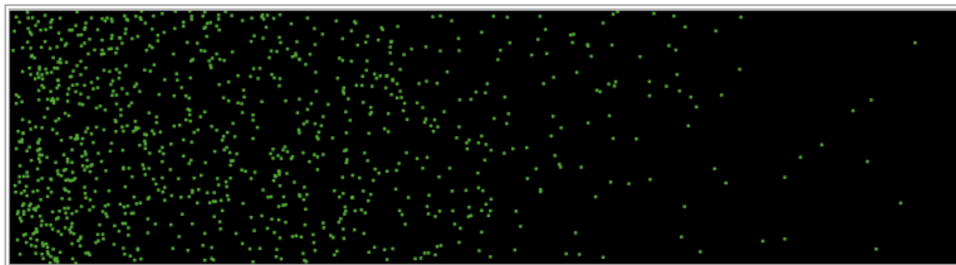
Low wealth   High Wealth

This is the base economy. From here we applied multiple scenarios. There are some exceptionally rich turtles, and it becomes more packed as it displays the lower wealth.

wealth of top 1% per person
166000

total wealth of top 10%		wealth of top 1~10% per person
110379		104199

total wealth of middle 10-50%		wealth of top 10-50% per person
188088		47022

total wealth of bottom 50%		wealth of bottom 50% per person
61533		12307
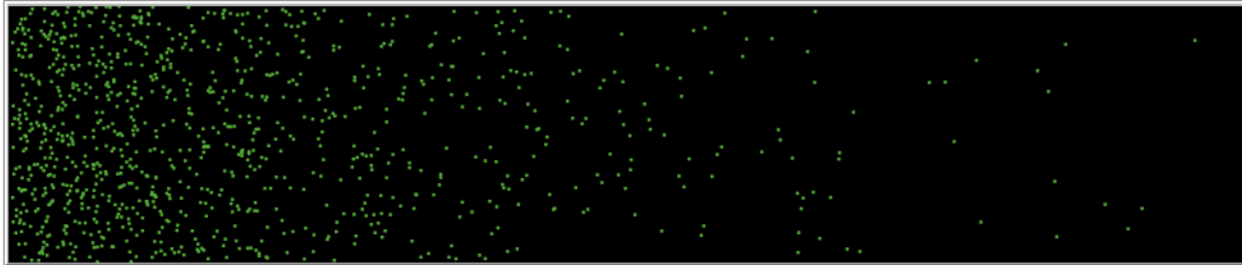
This is the deregulated economy. The wealth gap Increased as more transactions occurred between the turtles. There were some turtles who were able to get exceptional amount of money.

wealth of top 1% per person
74480

total wealth of top 10%		wealth of top 1~10% per person
70900		70502

total wealth of middle 10-50%		wealth of top 10-50% per person
201965		50491

total wealth of bottom 50%		wealth of bottom 50% per person
87135		17427
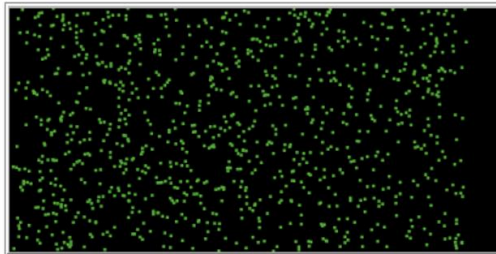
We applied a radical change here with forced wealth distribution and it doesn't allow the rich to have over 75000. The gap within the top 10% decreased greatly as there were no anomalies allowed. However, the wealth of the poor didn't increase as much as we expected. We were expecting a double in increase, but only 40%.

The economy has so many factors that it is hard to change the overall interaction unless it is a radical change. Adam Smith's invisible hand has been proven to be true as the economy can function itself with Laissez Faire economy on our model. That doesn't mean we should deregulate the economy as there are a lot of factors in real life economy that can change the shape of how the economy functions. Putting too much regulation isn't a good idea either as it would cause a stagnation within the economy. Our experiment will be continued with other economic models and hopefully we can apply more factors at once to see how it interacts with each other.

Works Cited

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