A Simulation System of Social Economic

Mingxia Zhao

Dept of computer, Zhenjiang watercraft college of PLA

130 Tao Hua Wu Road, Zhenjiang 212000, China

Tel: 86-182-0610-5609   E-mail: sallyzhaojs@qq.com

Qiuyan He

Dept of computer, Zhenjiang watercraft college of PLA

130 Tao Hua Wu Road, Zhenjiang 212000, China

Abstract

Macro-control is an important system of regulation in the body of socialist market economy; it plays a significant role in the social economy. To make it come into play, it is necessary for us to avoid the grave twists in the economy development. For the past few years, the unbalance of our economy development and the speculation makes a negative effect to the normal development of socialist economy. To make sure the social economy will develop at the right direction, the government should not only renovate this effect with administrative and legal means, but also adjust it with macro-control.

In this essay, a simulation model, which emulates the change of middle class number in an economy environment after the government gives subsidies to the poverty, is made to infer the governmental macro-control's influence to the national economy. The result indicates that the government plays a significant role in achieving a balance of the rich and the poverty by levying tax.

Keywords: NetLogo, Simulation system, Macro-control

1. Brief introduction of NetLogo

NetLogo is a programmable modeling environment for simulating natural and social phenomena. It was authored by Uri Wilensky in 1999 and has been in continuous development ever since at the Center for Connected Learning and Computer-Based Modeling.

NetLogo is particularly well suited for modeling complex systems developing over time. Modelers can give instructions to hundreds or thousands of "agents" all operating independently. This makes it possible to explore the connection between the micro-level behavior of individuals and the macro-level patterns that emerge from the interaction of many individuals.

NetLogo has extensive documentation and tutorials. It also comes with a Models Library, which is a large collection of pre-written simulations that can be used and modified. These simulations address many content areas in the natural and social sciences, including biology and medicine, physics and chemistry, mathematics and computer science, and economics and social psychology. Several model-based inquiry curricula using NetLogo are currently under development.

2. Simulation system introduction

2.1 Main Entities of the model

The government, dealers and banks are the main entities of this system.

Dealers means buyers and sellers who are paired, they make a trade of a random price. In this system, the identity of dealers is also random; anyone can be a buyer or a seller. Only one trade happens everyday.

No cash involves in all trades, it reflects as the deposit in the bank. After every trade, the buyer's deposit becomes higher, vice versa as the seller. When a dealer is short of deposit, he can get a loan from the bank. Therefore, when buyer's deposit is not enough for a trade, his deposit will get into negative after a trade, means the bank provides him the rest of money. When the dealer has deposit, the bank will pay him interest; while the deposit is negative, the dealer pays interest to the bank because of the loan.

The government regulates the economic environment, when a trade happens, the one with income, the seller, pays the turnover tax. The middle class and the rich should pay property tax to government while the poverty could get subsidies from the government so that the gap between the rich and the poverty can be narrower.

2.2 Parameters of model

The number of dealers: 100

The initial endowment of dealers: 100 Yuan

The deposit interest: 0.3%

The loan interest: 0.5%

The turnover tax interest: 10%

The property tax interest: 5%

The standard of transfer payment: 10 Yuan are provided to the poverty as subsidies (this parameter is changed frequently to view the difference)

2.3 Description of model

The model runs circularly with a unit as "one day".

Everyday, 100 dealers are paired randomly and make a random trade (50 trades happen randomly with a buyer and a seller, the price is a random number form 1 Yuan to 20 Yuan). After the trade, buyer's deposit decreases while the seller's increases. The dealers with an income pay the turnover tax to the government according to the trade amount, the rich and the middle class pays the property tax to the government according to their deposit.

The government pays the subsidies to the poverty with the tax.

2.4 The output of the model

This model will output the number of the rich, middle class and the poverty.

The rich is who has a deposit more than 150 Yuan; the middle class is who has a deposit between 20 and 150 Yuan; the poverty is who has a deposit less than 20 Yuan.

3. The model design

This simulation model is implemented with NetLogo; it allows the developer pay more attention to the model itself than the language logic.

3.1 The design of dealer entities

Dealers in this economic environment can active freely, pair randomly; therefore, dealers can be set as turtle. In every trade, there is a buyer and a seller; two different colors are used to distinguish these two characters. At the beginning, all turtles are green, then pick up 50% of them randomly, set these turtles as red. We assume the red as buyers and the green as sellers.

Every dealer has a bank account; as a result, the deposit amount is an attribute of a dealer, which should be designed. The dealer's deposit will increase or decrease after a trade. If a dealer's account is positive, he has a deposit in the bank, otherwise, he gets a loan from the bank.

Table 1 reveals the main attributes of dealers

3.2 The design of bank entities

In this economic system, trades carry out without cash involved but the bank account.

However, the bank is not a visible entity, but a participative part, which effects the simulation with its attributes. The rate-of-bank-deposit and the rate-of-bank-loan is the attributes of the bank just as Table 2 shows.

3.3 The design of government entities

This simulation system mainly aims at researching how the government's macro-control influences the whole national economic. Government is an invisible entity as the bank; it affects the simulation by its attributes. Rate-of-turnover-tax, rate-of-property-tax, subsidy-to-poor and revenue is the attributes of government just as Table 3 shows.

3.4 The design of simulation activities

The following activities are involved in the dealer's trades:

Set-again: this activity aims at set half of the 100 dealers as buyers and set the other half as sellers, so that the

trades can carry on.

Pair-trade: after the set-again, this activity will pair one buyer and one seller, and then create a random number between 1 and 20 as the trade price to conduct a deal. After the trade, the buyer's account will decrease with the seller's increases.

The bank goes through the following activities in this simulation:

The bank pays interest to those dealers who has positive deposit in the bank, and gets interest from those dealers who have negative deposit (loan) in the bank.

The following activities are belonging to the government:

The government gets turnover tax from the side that has an income during the trade (seller), gets property tax from the middle class and the rich in the economic environment, and provides the subsidies to the poverty in the economic environment.

4. The enforcement of the simulation system

The enforcement of simulation system interface shows as Figure 1.

The following Table 4 shows the specific widgets and their usages.

5. Result of the simulation

5.1 Result without the macro-control

According to the simulation assumption, the result without the macro-control (no tax and subsidies) is shown as the following figures.

Analysis: as the picture shows (Figure 2), if the government let it goes, no tax is gotten, no subsidies are provided, only the bank and dealers are involved in the economic environment, we can find that a gap between the rich and the poverty emerges after 100 days' simulation. Approximately half of the dealers are belonging to the rich, some of them are the middle class, and a few are poor. Specific statistic is: 52% is rich, 39% is middle class, 9% is poor. No tax is involved under this assumption.

Analysis: the figure (Figure 3) displays that: if the government does not participate in the economic activity: no tax is paid to the government, no subsidies are provided to the poverty; only the bank and dealers play roles in the economic environment. After 785 days, an obvious rich-poor gap turns up: most of dealers are rich while others are poor, very few are in the middle class. Specific statistic is: 77% is rich, 3% is middle class, and 20% is poor. No tax is involved under this assumption.

5.2 Result with the macro-control

When government implements the macro-control: the government charges the sellers turn-over tax ,charges the middle class and the rich property tax, provides subsidies to the poverty, the results are shown as the following figures:

Analysis (Figure 4): this time, the government participates in the economic activity with the macro-control, turnover tax and property tax is collected, subsidies are provided. After 100 days simulation, we can figure that all dealers in the economic environment are middle class. The poverty showed in the process, but they turn into middle class soon after the government's assist. In addition, since the government charges the rich property tax to lessen the disparity between the rich and others, very few dealers are rich. Specific statistic is: when the system sets the rate of turnover tax 10%, the rate of property tax 5%, the subsidy 10 Yuan per day, after 100 days, the poverty and the rich is none, all dealers are middle class. The revenue of government is 3.19. The revenue was very high at the beginning, with providing subsidies to the poverty, it was declining to 3.19.

Analysis (Figure 5): this time, the government participates in the economic activity with the macro-control, turnover tax and property tax is collected, subsidies are provided. After 786 days simulation, we can figure that all dealers in the economic environment are middle class. The poverty showed in the process, but they turn into middle class soon after the government's assist. In addition, since the government charges the rich property tax to lessen the disparity between the rich and others, very few dealers are rich. Specific statistic is: when the system sets the rate of turnover tax 10%, the rate of property tax 5%, the subsidy 10 Yuan per day, after 786 days, the poverty and the rich is none, all dealers are middle class. The revenue of government is 2.53. The revenue was very high at the beginning, with providing subsidies to the poverty, it was declining to 2.53.

6. Conclusion

This emulational economic system runs under some assumptions, the dealers conduct trades by using the bank

deposit, no cash is involved. Assume their deposits are the whole assets of dealers, and are the standards of judging their classes. In this simulation system, buyer and seller are set randomly. After the setting, a trade of random price carries out. One's deposit turns to negative automate when his deposit is not enough for the trade, it means that the bank provides a loan to the buyer; the trade carries on just like that.

After a trade, the seller pays turnover tax to the government, the middle class and the rich pays property tax to the government, the government provides subsidies to the poverty. Dealers who have deposit in the bank get interest from the bank while those who get loan from the bank pay interest to the bank. All these processes goes day after days.

We can figure out that, in this simulation model, the government conducts macro-control to the social economic through providing subsidies to the poverty, getting property tax from the middle class and the rich, charging turnover tax from the seller during the trade. Through these methods, the gap between the rich and the poverty can be narrower. We can also observe that the economic environment is mainly composed by the middle class because the change of the parameter (the government pays the poverty subsidies). The disparity between the rich and the poor can be dispelled because of the government's macro-control. Thereby the influence to the social economic of the government's macro-control is apparently acknowledged.

References

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Table 1. Main Attributes of dealers

attribute	description
shape	person
color	red: the dealer is buyer
	green: the dealer is seller
deposit	>0: has a deposit
	<0: get a loan

Table 2. Main attributes of bank

attribute	description
rate-of-bank-deposit	the rate of deposit interest
Rate-of-bank-loan	the rate of loan interest

Table 3. Main attributes of the government

attribute	description
rate-of-turnover-tax	The rate of turnover tax
rate-of-property-tax	The rate of property tax
Subsidy-to-poor	The subsidy given to the poverty
revenue	The tax that government gets

Table 4. The introduction of system interface widgets

| Name of widget	Type of widget	usage
setup	button	System initial
go	button(forever)	Loop the simulation
rate-of-bank-deposit	slider	Adjust the rate of bank deposit (Between 0 and 10%)
rate-of-bank-loan	slider	Adjust the rate of bank loan (Between 0 and 5%)
Subsidy-to-poor	slider	The standard of subsidy
rate-of-turnover-tax	slider	The rate of turnover tax
rate-of-property-tax	slider	The rate of property tax
rich	monitor	Monitor the number of the rich
middle	monitor	Monitor the number of the middle class
poor	monitor	Monitor the number of the poverty
day	monitor	Display the number of days in the simulation system
revenue	monitor	Display the change of government revenue
result	plot	Show the number of the classes of the society and the change through a line chart
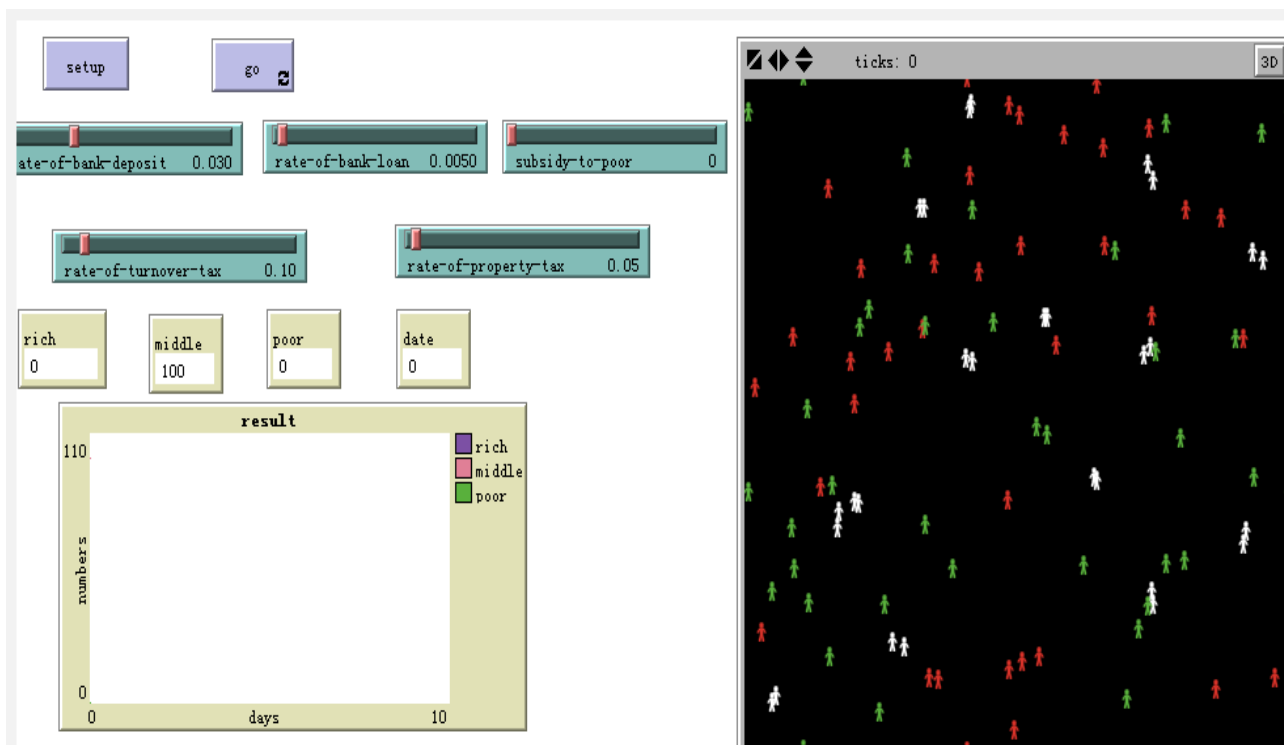
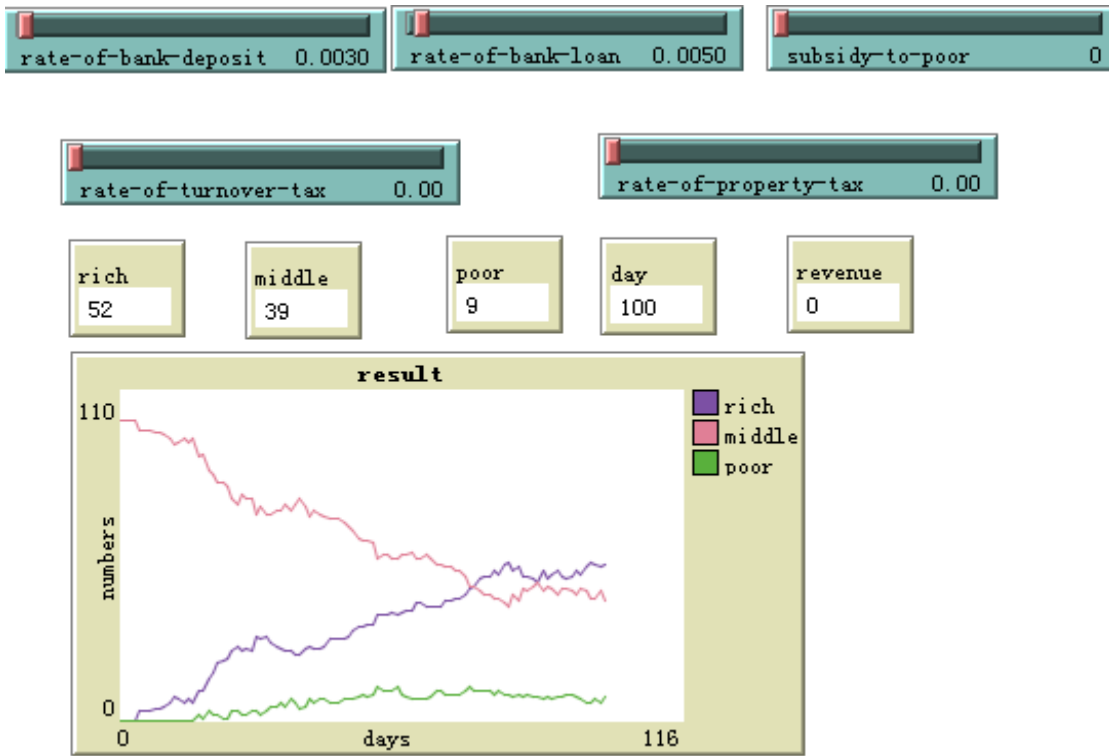Figure 1. The enforcement of simulation system interface

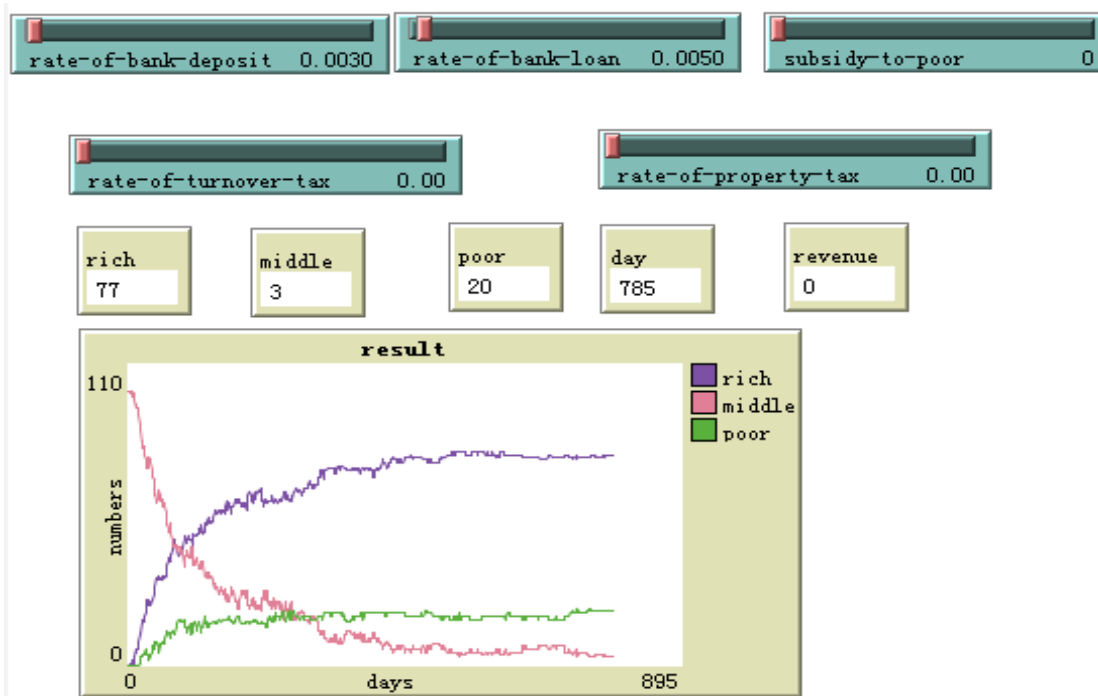Figure 2. The situation after 100 days simulation

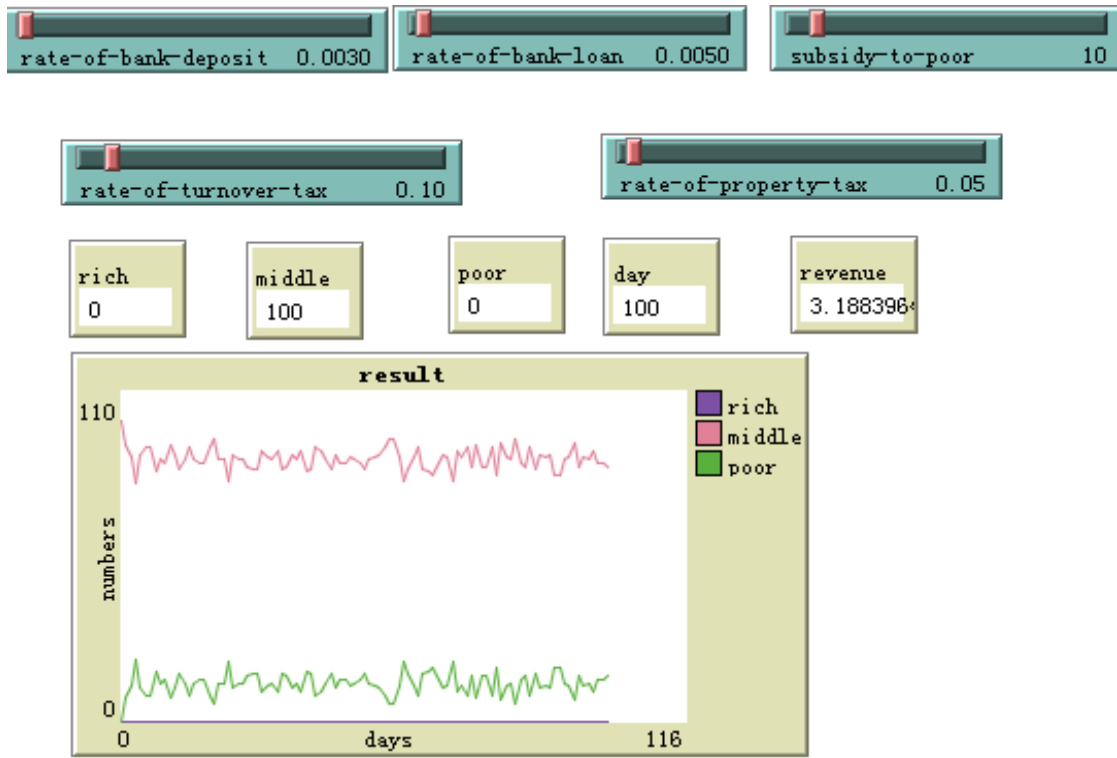Figure 3. The situation after 785 days simulation
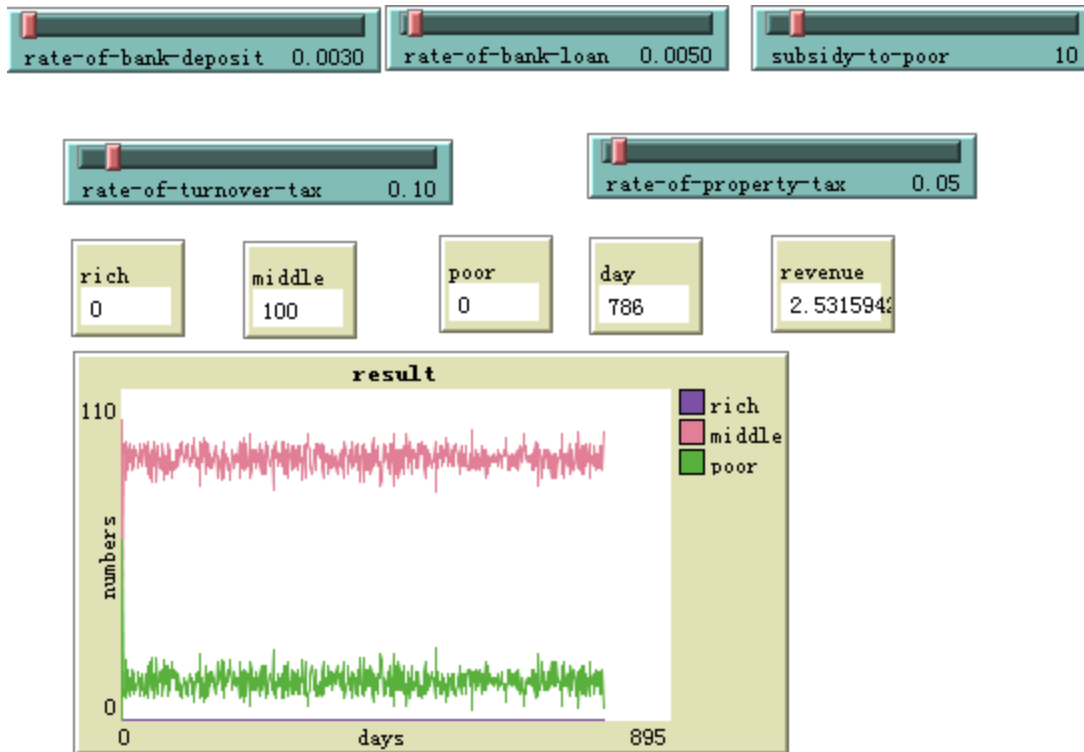
Figure 4. The situation after 100 days simulation

Figure 5. The situation after 578 days simulation