Assessing the Impacts of Location Change on Behaviour through Agent-Based Simulation

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The Influence of Economic Policy Instruments on Cooperation in Public Good Games

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Introduction

Our project uses an agent-based simulation COBWEB to model the public good game theory in economies which hold different attitudes. Public good or service can benefit the whole community and does not require all the people in the community to contribute. The maximum payoff in the collective interest can only be reached if everyone cooperates, but some individuals will not contribute, choosing to enjoy the good or service as free-riders, based on their own interests. Policy makers can try to implement a cooperative solution through the use of specific economic policy instruments which ought to increase social effectiveness.

Methods

In an agent-based simulation COBWEB, two cities with different economic policy instruments are set up as two islands on a grid. Agent types are considered as the citizens of each city and players of the public good games. One cooperative agent and one non-cooperative agent are in each city. Food distribution in each city reflects the government's policy. Energy acquired from different food would be considered a supplement to keep agents alive. One city promote cooperation (City 1) by providing additional food as an incentive. This gives a net increase in the cooperative agents' energy. The other city (City 2) punishes defectors, instead of rewarding cooperation. As a result, less food is given an less energy is generated. By enabling the prisoner's dilemma option to simulate game theory, we are able to model the change of agents' payoffs under public good game model. By the "Log" and "Report" file of COBWEB, we process the time series data from the log file and cross section data from report file to analyze how does agents' choice changes over time.

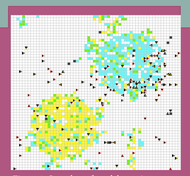


Figure 1: Snapshot of model running mid-cycle.

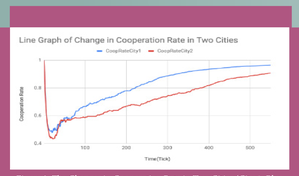


Figure 2: The Changes in Cooperation Rate in Two Cities (City 1: Blue, City 2: Red)

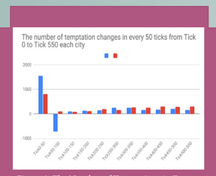


Figure 3: The Number of Temptations in Every 50 Ticks. (City 1: Blue, City 2: Red)

Results

Our results show that both economic policy instruments would increase the cooperation rate but at a different slope. In Graph 2, the cooperation rate in the city which offers extra payoff for cooperation(City 1, Blue) is higher than that in the city which sanctions non-cooperating citizens(City 2, Red). In Graph 3, the accumulated temptation count of every 50 ticks in City 1 fluctuates and gradually becomes lower than that in City 2. The higher cooperation rate and lower temptations in City 1 occur as time goes.

Conclusion

Our results show that both economic policy instruments would increase the cooperation rate but at a different slope. The cooperation rate in the city which offers extra payoff for cooperation is higher than that in the city which sanctions non-cooperating citizens. Our model indicates that policy encouraging cooperation would be more likely to increase social effectiveness in public good game theory.

The Effects of Key Factors Influencing the Success of Retail Businesses

Maggie Ma // ENV399

Introduction

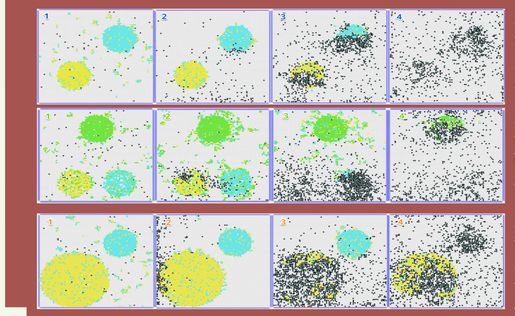
As online shopping continues to grow, 75,000 stores are forecasted to be closed by 2026 in the United States alone.1 Some experts refer to the catastrophic damage expected to the retail sector as "retail apocalypse" on the verge of an industry-wide permanent restructuring. Whether it is a large retail chain corporation planning on expansion or a small business looking to enter the market, it has become more critical than ever for the decision makers to understand what the key factors are in the complex location decision-making process that could drive the company forward with long-term profitability and sustainability. Research shows that the six most influential sub-criteria, including volume of passing trade (17.44%), visibility (14.62%), distance to competition (14.49%), size of potential market (9.75%), accessibility by car (9.71%), and accessibility by foot (9.17%) explain more than 75% of the success of a retail store. As a result, location and competition are the two most critical factors to the success of a retail business. In my research, I am interested in exploring the key factors influencing the success of retail businesses, more specifically in the format of physical retail stores. Using COBWEB, my goal is to simulate the retail environment and emphasize the role of location to the success of retail businesses.

Methods

The agents in the model represent customers. The islands represent physical landscapes of retail environments. By varying multiple parameters in COBWEB, such as altering the size of retail stores, varying distance from competition, and creating physical barriers around the stores, I am able to simulate whether each criteria indeed plays a vital role in the success or failure of retail businesses.

- Model #1: Baseline model. Two identical retail environments with identical source of customers. This is to test whether my model works.
- Model #2: Competition model. Three identical retail environments with one being isolated and other two closer to each other, both generating foot traffic and creating competition.
- Model #3: Size model. Two retail environments with one having more sales square footage.

Results



Model #1: Customers approach two identical retail stores within reasonable distance of each other at identical speed.

Model #2: Customers are more likely to visit the stores closer to each other before shifting their attention to the stand-alone store further away.

Model #3: Customers are more likely to visit the bigger store first if there are two otherwise similar stores within reasonable distance of each other.

Discussion

The simulation of success factors of retail stores was successfully modeled. My simulation validates the hypothesis that location, competition, and the establishment itself are all critical contributing factors for the success of physical retail stores. Similar retail businesses located closer to each other have a higher probability of success than a stand-alone business. As for similar businesses close to each other, having more sales square footage will more likely to be successful than a smaller sized store.

21st Century Rice Farmers in the Philippines: Current Trends and Ways to Alter Results

Angelica Tagadtad // ENV399

Introduction

Our research project focuses on the study of the 21st Century Rice Farmers in the Philippines, the current trends, and possible ways to alter its results. The decreasing number of ageing Filipino farmers and the lack of upcoming farmers from the newer generations is a problem the country currently faces. The average Filipino farmer is aged roughly 57 to 59 years old. Considering the average 75-year life span in the Philippines, we only have a decade and a half to tackle this issue. The farmers play a significant role in the country's survival and growth, meaning that this problem will have adverse and drastic effects in the Philippines and its inhabitants. If the population of the rice farmers continue to decrease, some of the consequences that would prevail are food insecurity, malnutrition, and inflation of the agricultural products' prices.

Methods

In order to represent the study clearly on COBWEB, we've decided to create two models.

Model #1 - a simulation model of the declining number of farmers and its consequences.

Model #2 - A simulation model of the proposed rate of new farmers needed in order to contribute to local agricultural growth.

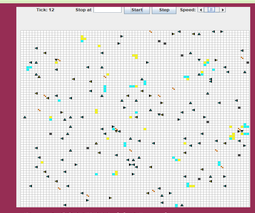


Figure 1: COBWEB Model #1 Legend:
Blue and Yellow Boxes – Imported Products/Resources
Yellow Triangular Figures – Agent #1: Rice Farmers
Blue Triangular Figures – Agent #2: General Population
Brown Figures – Resources produced by Rice Farmers

	A	B	C	D	E	F	G	H	I	J	K	L	M	N
1	Tick	FoodCount 1	AgentCount 1	AveAgentEnergy 1	AgentEnergy 1	Tick	FoodCount 2	AgentCount 2	AveAgentEnergy 2	AgentEnergy 2	Cheat 2	Coop 2	Diseased 2	Toxicity 2
2	0	20	30	100	3000	0	20	100	100	10000	0	0	0	
3	1	20	30	99	2970	1	22	100	98.99	9899	0	0	0	
4	2	22	30	97.933	2938	2	21	100	98.94	9894	0	0	0	
5	3	22	30	96.933	2908	3	22	100	97.92	9792	0	0	0	
6	4	24	30	96.767	2903	4	24	100	96.9	9690	0	0	0	
7	5	25	30	95.7	2871	5	27	100	95.88	9588	0	0	0	
8	6	26	30	94.633	2839	6	27	100	95.87	9587	0	0	0	
9	7	28	30	93.567	2807	7	30	100	96.18	9618	0	0	0	
10	8	30	30	92.5	2775	8	32	100	95.16	9516	0	0	0	
11	9	31	30	91.467	2744	9	33	100	94.25	9425	0	0	0	
12	10	32	30	90.467	2714	10	34	100	93.23	9323	0	0	0	
13	11	34	30	89.433	2683	11	35	100	92.22	9222	0	0	0	
14	12	34	30	88.4	2652	12	40	100	91.21	9121	0	0	0	
15	13	35	30	87.367	2621	13	42	100	90.32	9032	0	0	0	
16	14	39	30	86.3	2589	14	44	100	89.55	8955	0	0	0	
17	15	42	30	85.2	2556	15	46	100	88.53	8853	0	0	0	
18	16	43	30	84.167	2525	16	50	100	87.69	8769	0	0	0	
19	17	44	30	86.467	2594	17	53	100	86.67	8667	0	0	0	
20	18	45	30	85.433	2563	18	54	100	86.04	8604	0	0	0	
21	19	46	30	84.433	2533	19	54	100	86.01	8601	0	0	0	
22	20	47	30	83.433	2503	20	59	100	84.99	8499	0	0	0	

Figure 2: This Excel spreadsheet is the statistical data analysis for COBWEB Model #1.

Conclusion

Rice farmers, among other farmers, continue to decrease in number and suffer from challenging issues such as high cost of inputs, low price of palay, lack of capital, labor problem, lack of postharvest facilities, pest and diseases and irrigation system (Agris 2010). In our study, we've concluded that in order to maintain a viable agricultural sector of the declining number of rice farmers, there should be an increase in the population of younger farmers in the Philippines. In addition, we've presented several options to attract younger farmers.