DOCUMENT RESUME

ED 152 665 SO 010 819

AUTHOR Billings, R. Bruce; Agthe, Donald E.
TITLE Teaching Experience with a Housing and Land Speculation Game.
PUB DATE Apr 77
NOTE 21p.
AVAILABLE FROM Computer program and data input available from R. Bruce Billings, Department of Economics, University of Arizona, Tucson, Arizona 85721 (free)

EDRS PRICE MF-$0.83 HC-$1.67 Plus Postage.
DESCRIPTORS Business Education; *Consumer Education; *Economic Education; *Educational Games; Educational Objectives; Evaluation; Higher Education; *Housing; Instructional Materials; Investment; Land Acquisition; Landlords; *Land Use; *Learning Activities; Microteaching; Money Management; Property Taxes; Purchasing; Real Estate; Simulation; Student Attitudes; Taxes; Teaching Techniques

ABSTRACT

The Housing and Land Speculation Game provides students in college microeconomics courses with an opportunity to learn about market adjustment toward equilibrium and investment strategy. Students are divided into a land tax only group and a land and property tax group. They analyze the market situation and determine game strategy in accordance with data generated from a classroom housing and land market. The setting is a residential area that contains houses and vacant land. Each student receives an initial endowment of land and houses along with a debt and net worth position. Students change position by demolishing, building, buying, and selling. Sources of income to student landlords include rent, gain in land value, and interest on bank deposits. Costs to student landlords include property tax, capital losses, and depreciation. The winning student is the one with the highest net worth at the conclusion of the game. Response among students who have participated in the game through intermediate microeconomics courses has been generally favorable. Shortcomings of the game include hesitation of students to break away from an arbitrary initial land value and a tendency to ignore data generated in the game. The conclusion is that the game has the potential of helping students increase their understanding of issues related to buying and selling property. Suggestions for alleviating the game's shortcomings are offered. The computer program and data input are available from the author. (Author/DB)

TEACHING EXPERIENCE WITH A HOUSING AND LAND SPECULATION GAME

R. Bruce Billings
Department of Economics
University of Arizona

Donald E. Agthe
Planner, Pima Association of Governments

April 1977

Business and economic games generally serve the purpose of allowing students to test their ability to apply the knowledge they gain in the classroom to a simulated "real world" situation. The use of this housing and land speculation game as a part of the learning process in the teaching of micro economics provides the student an opportunity to learn about market adjustment toward equilibrium and some aspects of investment strategy by participating in the simulation of a simple economy.

The game contains several sets of data which are generated by the operation of the classroom housing and land market which can be used by the student to analyze the market situation and determine his game strategy. The concepts which the student may learn from the game include the application of discounting to future income streams, the evaluation of alternative investment strategies under limited uncertainty, land price formation, the impact of income taxes on the profitability of real estate investments, the effect of property (and/or land value) taxes on the desirability of holding vacant land and income earning real estate, and the impact of mild business cycles on investment opportunities.

In addition to the teaching goals already outlined, it was desired to find if students would react differently or follow different strategies if faced by different property tax systems. Thus, the micro economics class was divided into two equal subgroups with one group facing a property tax on both land and buildings and the remaining subgroup facing a tax on land only. The aggregate tax burden was the same for both groups.

Both groups faced identical income taxes that assumed a fifty percent tax bracket and no tax on capital gains. The students were, for income tax purposes, assumed to be land speculators and not land developers. A third objective of the study was to determine if the students could develop strategies based on the economic data given them (see appendix) and recognize the importance of this data in achieving success.

Since most students were juniors and seniors in the business college, this study may also provide some insight into the ability of our students to utilize the models and concepts presented to them in previous economics, accounting, and finance courses.

Description of the Game

The setting is a residential area that contains three classes of houses and vacant land. Each student receives an initial endowment of land and houses along with a debt and net worth position. During the game each student changes his position by (1) demolishing homes, (2) building new homes at a fixed cost, (3) buying vacant land from other student landlords, and (4) selling land to other student landlords. Sources of income to the student landlords include (1) net rents from houses that decline as the houses age, (2) any gain in land values, and (3) interest earned on any landlord cash account showing a positive balance. All tax shelter income is credited to the student. Costs to the student landlords include (1) property taxes, (2) capital losses resulting from decreases in land values, (3) interest charged any landlord cash account showing a negative balance, and (4) depreciation of houses. Property taxes are assessed at a rate that keeps the revenue collected per capita

constant for the entire community. The interest rate is internally generated and is influenced by the cash balances of the student landlords. An eight year business cycle and population growth cycle is included to make students aware of the importance of these factors. The winning student landlord is the one with the highest net worth at the conclusion of the game.

Student Response to Game

The game was played in an intermediate microeconomics class. Two sections of the game were run, with about 30 students in each half. Group A operated with an ordinary property tax while group B operated with a land value tax. The property tax and the land value tax were set to raise exactly the same amount of revenue in each economy.

Most students appeared to enjoy playing the game, and most participated by handing in a decision sheet for all 12 plays of the game, which were collected at class time each Wednesday with the results returned each Friday for each week the game was run. To avoid "ending strategies," students were not informed of the date on which the game would end. However, by round 11 it was obvious that it had to end on one of the following two rounds. Student participation may have been good primarily because points were given for each play handed in, even if no action was taken. It is obvious that most students put very little time into analyzing their strategy and plays, even though any student beating the absentee landlord, a dummy entry that did nothing throughout the game, was given about 4% toward his grade and the top players were given small monetary rewards.

Results

Information was furnished the students as to the profitability of constructing new housing in each year. The data furnished was the present value of expected rents, net of property taxes, based on the current rents and interest rates. Assuming the keeping of a house until the 11th round, this information did not encourage students in the ordinary property tax group to construct housing before year 7 and before year 4 for the land tax group.

Table 2 shows that the land value tax group constructed 310 houses before year 4, with 53 percent of the students building more than 10. The property tax group built 743 houses before year 7, with 77 percent building at least 10 and 46 percent building more than 20. For both groups, housing construction became increasingly profitable in years subsequent to those of minimum profitability. Yet Table 2 shows a decrease in the number of students in both groups who decide to build homes after home building becomes profitable. The number of homes constructed also fell off in both groups after home building became profitable. This indicates that either students do not understand the use of discounted value of a future income stream or that they reacted to earlier losses and ignored the economic data presented to them or both.

Throughout the game, students continued to tear down dilapidated houses, even though they earned over $1500 net rent each year compared to vacant land. Subtracting the cost of holding the land under these

houses would still have left the students with positive net income from these houses during each year of the game. Since dilapidated houses retained a permanent value of $6,711, and the peak land price was $6,603, it was never profitable to tear down houses at any time in the game. Thus one indication of student unawareness of what was going on is given by the demolition orders placed. Although the number of students demolishing houses declined after year 7 in the property tax group and after year 4 in the land tax group, there were still significant numbers of demolitions occurring.

Both the number of houses demolished by year of play of the game and the number of students placing demolition orders is presented in Table 2. While demolition of dilapidated houses to sell the vacated land was never profitable at any time in the game, demolition to clear land for new construction would have been profitable for students during the last few years of play if no vacant land had been available in the market for this purpose. In fact, the opportunity cost of buying land was continually lower than the cost of demolishing a dilapidated house to obtain vacant land. The fact that the number of students placing demolition orders steadily declined after year 7 may indicate a growing awareness of the loss incurred through demolition orders. Despite all of this, many students appear to have persued a strategy which included demolishing dilapidated houses in order to build new houses apparently unaware that it was more profitable to buy land in order to build. This can be observed visually in Table 2 and is verified

by the simple correlation coefficients (significant at the 89% level) between the number of houses demolished and built by year of .79 in the property tax group and .65 in the land tax group.

Several correlation coefficients were generated between the economic indicators and the build and demolish orders. The number of houses demolished showed a strong negative correlation with the aggregate growth of the economy, rents on new houses, and property tax rates but not land tax rates. Interest rates were positively correlated with both the number of houses built and demolished. The number of houses built was negatively correlated with the aggregate growth of the economy, rents on new homes and interest rates. In the property tax group, the number of homes built showed a strong negative correlation with the property tax rate, while in the land tax group these variables showed a weak positive correlation. The primary conclusion from the evaluation of these correlation coefficients is that most students were not utilizing the information provided to make profit maximizing plays in the game, since most of the correlations found are in the opposite direction from what was anticipated.

The students did not immediately perceive the difference in effects associated with each property tax system. Table 1 shows that the net cost of carrying a vacant lot is about $300 per lot per year greater in the land tax system. One would expect students playing in the land tax group to build more homes, thus covering vacant land with an earning asset, and to experience lower vacant land prices because of the capitalization of the additional taxes levied exclusively on land. Later in the

game, a difference in build and demolish decisions between the two groups appears. Table 2 shows that the group facing the land tax increased the housing stock by 163 units over the game while the property tax group decreased its housing stock by 56 units. Since at no time during the game was deomlition and replacement profitable for either group, the large numbers of demolitions do not make sense. Obviously, demolitions without replacement made even less economic sense in the land tax group. Land prices throughout the game were about equal between the subgroups. This indicates a lack of knowledge of carrying costs for vacant land. The earlier mentioned irrational demolition pattern tends to support this conclusion.

Students appear to have expected large land value increases, without making any effort to evaluate the prospects of profitably utilizing vacant land for construction of new houses. These expectations proved to be unrealistic, and after peaking in year 8 or 9 land prices began falling as students attempted to dump land on the market.

TABLE 1

Vacant Land Ownership Cost
PROPERTY TAX GROUP

Year	Property Tax	Interest	T	ΔP	Carrying Cost and Capital Gain
1	80	400	480	209	-271
2	84	421	504	606	+102
3	111	462	573	369	-216
4	124	487	611	518	- 93
5	143	519	662	81	-581
6	156	510	666	14	-652
7	157	499	656	598	- 78
8	179	544	723	190	-533
9	185	547	732	404	-328
10	180	480	660	0	-660
11	192	467	659	-248	-917
12	195	431	626	0	-626
13	213	408	621		

TABLE 1 (Cont)

LAND TAX GROUP

Year	Land Tax	Interest	T	ΔP	Carrying Cost and Capital Gain
1	428	400	828	860	+32
2	437	457	894	177	-717
3	453	458	911	-23	-933
4	461	441	902	839	-63
5	468	498	966	-273	-1239
6	474	463	937	410	-527
7	479	485	964	255	-709
8	487	500	987	-40	-1027
9	496	478	974	398	-576
10	511	495	1016	199	-817
11	522	424	946	-651	-1597
12	531	371	902	-390	-1292

TABLE 2

Student Demolish and Build Decisions

PROPERTY TAX GROUP

Year	Demolished # Students	Demolished # Houses	Built # Students	Built # Houses	Net Build by Year	Net Build Sum
1	11	96	15	103	7	7
2	12	106	17	152	46	53
3	17	121	13	135	14	67
4	10	90	11	95	5	72
5	13	141	13	136	-5	67
6	11	101	12	122	+21	88
7	12	111	12	102	-9	79
8	9	106	6	74	-32	47
9	7	124	8	88	-36	11
10	6	125	9	86	-39	-28
11	4	35	2	25	-10	-38
12	2	36	3	18	-18	-56
TOTAL	-	1192	-	1136	-	-56
% of beginning housing stock		44%		42%		-2%

TABLE 2 (Cont)

LAND TAX GROUP

Year	Demolished # Students	Demolished # Houses	Built # Students	Built # Houses	Net Built by Year	Net Built Sum
1	11	111	9	60	-51	-51
2	13	112	19	124	12	-39
3	11	111	15	126	15	-24
4	13	108	20	111	3	-21
5	9	99	15	122	23	+2
6	9	87	12	109	22	+24
7	9	103	15	124	21	+45
8	7	50	10	65	15	+60
9	7	62	10	71	9	+69
10	4	24	9	90	66	+135
11	6	104	11	147	43	+178
12	5	39	6	22	-17	+161
TOTAL	-	1010	-	1171	-	161
% of total beginning housing stock		34%		39%		5%

Evaluation of Game

At the beginning of the game students were given a sample year 0 output, landlord instructions, a decision sheet, and a line by line description in class of what each element on the sample printout represents. No further class time was devoted to analysis of the game as it progressed aside from answering specific student questions concerning its operation. Questions such as, "what is a winning strategy?" were ignored.

At the end of the semester, students were forced to analyze the results of specific game decisions with a set of take home questions which counted as part of their grade. Students were also given the summary sheet and problems similar to those on the worksheet were presented in class. With this input, most students were able to arrive at more-or-less correct answers to the questions dealing with the results of various actions during specific years of the game as it occurred in class. When asked to describe the strategy used in the game, however, many students provided only vague answers such as, "At first I just experimented with what to do. Then I tried to keep as much money in building new houses in order not to lose money in taxes." Other students more accurately described a strategy which they had followed and which was clearly nonoptimal, such as, "I was demolishing 10 houses per year and building 20. I did this so as not to have houses collecting the lowest rental rates. I changed this strategy because I found I was demolishing houses even when I had enough empty land to build on."

The top six students clearly had formulated a more reasonable strategy from the beginning of the game. For example, "At first, I felt just buying

a few houses and sitting the game out would work. I found that buying land was profitable..." and "At the outset I was hesitant to build houses because the capitalized value of net rent figure after 15 years was only $32,202 whereas the cost alone was $40,000 to build. I tried to buy as much land as I could, although I rarely offered more than the market price....I felt no need to demolish houses, so I didn't."

The responses to the last question on the take home, asking students to formulate a monopolists housing strategy, were equally nebulous. No student fully utilized the available information on the housing stock and realized rents to formulate a strategy which would maximize landlord income. Many students failed to realize that the stock of new houses would fall to zero in only three years if no new construction took place. That is, they answered this question as if the rents in this hypothetical situation would be the same as in the actual game. A few students indicated an awareness of the general consequences of a monopoly control of the housing stock, but failed to utilize this to construct a specific profit maximizing strategy. This seems to indicate that students are generally unable to apply our profit maximizing models to real world situations where the data has to be inferred. That is, they would have had to construct a demand curve from the avialable data in order to determine profit maximizing strategy. No one did this. The best answers to this question indicated that new houses should be built on vacant land as soon as rents are sufficiently high to make this profitable. After that, dilapidated houses would be demolished and new houses built when the rent differential was sufficient to make this worthwhile, and in quantities which would tend to stabilize rents for new houses at a high level.

Suggestions for Future Use of Game

We believe that this game has the potential to be a useful adjunct in the teaching of microeconomics. Several specific changes in its use, however, would appear to be beneficial based on our experience with it during one semester. First, the initial land price quoted of $4000 tended to mislead students into believing that this was an equilibrium value, and hence even after 12 rounds of play they didn't completely break away from this initial arbitrary value. Giving no initial value would force students to search for some means of estimating the value of land in the game as an investment, and would demonstrate the information generating market mechanism which would eventually result in clear movement toward an equilibrium price. Second, many students made no attempt to utilize the data generated in the game, and a series of homework exercises to accompany the game as it is played would help them to develop sophistication in the use of discounting, estimation of future income from rents, tax and interest rate changes, etc. For example, along with the initial year zero sample output, students might be asked to formally evaluate the expected profitability of building a house. The following year they might be asked to evaluate the holding cost of vacant land, and they could be asked to project future changes in population, rents, and interest rates as the game progressed.

Several students have suggested that they were motivated to avoid becoming slum landlords, in the belief that building new houses and demolishing old ones is a socially valuable activity. This idea could be countered by some strong statements about making a profit, and also by some discussion of the filtering down theory of housing availability.

APPENDIX 1

Housing and Land Speculation Game

LANDLORD INSTRUCTIONS

Object of the Game: Buy and sell land and build and demolish houses which you as landlord rent out in order to maximize your net worth. Each landlord is given an initial endowment of houses and land, along with debt (or cash). Your objective is to make as much money as possible.

The decisions which you must make each year are:

DECISIONS:

A. Number of houses to build (if any) at $40,000 each. Orders to build more houses than the number of vacant lots you hold result in no houses being built during the year.

B. Number of houses to domolish (if any). Oldest houses are demolished first.

C. Offer to sell land: The number of lots (if any) you want to sell along with the price you are willing to accept for them. All lots are sold at the seller's offer price. Attempts to sell unowned or non-vacant land bar you from the land market for that year.

D. Offer to buy land: The number of lots (if any) you want to buy and the maximum price you are willing to pay for them.

In making your decisions you should make careful estimates of their anticipated impact on your income and net worth. Specific features of this game include:

Absentee Landlord: While one landlord will probably accumulate a greater net worth than any other, any student landlord who does better than an absentee player who takes no positive action but simply collects rent and uses the funds to pay off his debt and accumulate cash is considered a winner. By understanding the data provided and avoiding gross errors, every student can be a winner.

Demolition: Demolish orders are carried out at the beginning of each year. There is no charge for demolition, since the salvage value of the building is assumed to equal the cost of demolition. Cleared lots are available during the year for construction or possible sale. Demolition does reduce the book value of a dilapidated house from $6711 to 0.

Interest: Interest is earned on positive cash balances and paid on negative cash balances (debt) carried over from the previous year. The interest rate varies with the supply and demand for credit. Interest charged or credited this year is the current interest rate times your beginning cash balance.

Rent: All houses are assumed to be rented at market clearing rents each year, except those which are being built or demolished during the year, and are unavailable for use. For rental purposes, houses are grouped into 3 categories: modern, antiquated, and dilapidated. Rents vary with the supply and demand for each type of house.

Property taxes: A tax is levied on the value of all property held at the beginning of the year. The property tax rate varies directly with the size of the population and inversely with the total value of taxable property.

Land value tax: (This is an alternative to the property tax.) A tax is imposed on the value of all land held at the beginning of each year. Houses are tax free. The tax rate varies directly with population and inversely with the market value of land.

Land market: All sales take place at the seller's offer price. Therefore, all successful sellers will receive exactly their asking price while successful buyers may pay any price not exceeding their bid price. Each year one buyer is randomly selected to enter the market first, and attempts to fill his order for land starting with the lowest offer to sell. When his bid is satisfied to the extent possible from the existing offers to sell, a second buyer is selected to enter the market, etc. Landlords may not sell land to themselves in an attempt to change land values. When all transactions have been completed, the average land sale price is computed, averaged with the value of land from the previous year, and is considered to be the value of the land. The initial land price is $4,000.

Houses: New houses may be built on vacant land for $40,000. Houses do not receive rent during the year in which they are constructed.

Income tax option: If used, your net income will be taxed at the 50% rate and you are assumed to have enough additional income to place you in this marginal tax bracket. Remember that depreciation is deducted in addition to the already mentioned costs in figuring net income. Any tax shelter income resulting from the assessment of income taxes will be credited to cash.

Capital gains tax option: If used, any capital gains resulting from changs in land value are taxed each year at a 25% rate. Any tax shelter created by capital losses is credited to your cash.

Depreciation of houses: Each house becomes one year older each year after rents are calculated but before new houses are completed. A house built during Year 1 is new at the beginning of Year 2, and one year old at the end of Year 2. This house will draw rent as a modern house for three years (Years 2, 3, and 4) and as an antiquated house for 3 years (Years 5, 6, and 7) and as a dilapidated house thereafter. The book value of a house depreciates at a rate of 20% of remaining value for each of 8 years, after which it is valued at $6,711.

Original endowment: Each landlord is given 10 houses of each of the following ages: new, 1, 2, 3, 4, 5, 6, 7, 8, and 10 empty lots. Thus in year 1 you will (unless you demolish some houses) draw rent on 30 houses in each rent category. You also are given a negative cash position of $1,000,000. Last year's rents (net of maintenance cost) were: modern, $6,000; antiquated, $4,000; and dilapidated, $2,000.

Debt Limit: If your end-of-year debt exceeds 80% of the value of your property, you will receive a warning. If it exceeds 100%, you are bankrupt.

Ways to Make Money: Note there are three ways to accumulate wealth.

1. Speculate successfully in the land market, buying land below market price (present or future) and selling land above market price. But note that holding land incurs an opportunity cost in property taxes paid and the interest cost of the invested funds.

2. Rent existing houses: Continue to rent out houses in the initial endowment. The rents from these houses decrease as they age, but offsetting this is decreasing property taxes and declining depreciation. Note that houses stop depreciating after 8 years, and the final $6,711 of value of each house is retained indefinitely unless the house is demolished, at which time its owner incurs this additional depreciation expense.

3. Build new houses: New houses may be built at a cost of $40,000 on already owned vacant land. The desirability of building new houses should be evaluated by comparing the opportunity cost of foregone interest earnings on the $40,000 (or interest payments on borrowed funds) with the rents net of depreciation and taxes which can be obtained from a house over its lifetime.

LAND SPECULATION GAME
Decision Sheet

Bruce Billings

Name: _____

YEAR	Build	Demolish	LAND MARKET		
			QUANTITY OFFERS TO		PRICE OFFERS TO
			Buy	Sell	Buy Sell
1					
2					
3					
4					
5					
6					
7					
8					
9					
10					
11					
12					
13					
14					
15					
16					
17					
18					
19					
20					

Operating instructions for Housing and Land Speculation Game

The game may be played by anywhere from 5 to 38 students and for up to 20 years. (these limits may be increased by changing the dimension statements)

An absentee landlord is included as the first player, and all other students are provided with his results to see how well they do compared to a player who takes no action during the game but simply collects the rents.

The game deck contains job cards, the fortran program, and the game data cards, described below. Each category described contains one or more cards for each run of the game.

1. The number of separate games being run. A number punched in col. 1-3.
2. The number of copies of the instructor's summary sheet. col. 1-3, of student output col. 6.
3. Business cycle card, showing growth rate of population and income, for up to 8 years. If game is run more than 8 years, replace card or cycle will repeat with the same growth rates as during the first 8 years.

Year 1	population growth, Col. 1-3	Income growth Col.	4-6
Year 2	7-9		10-12
Year 3	13-15		16-18
4	19-21		22-24
5	25-27		28-30
6	31-33		34-36
7	37-39		40-42
8	43-45		46-48

4. Random number card, for first landlord allowed to buy land each year. Starting with column 1, use three columns for each random number, up to 20 different values.

5. Options Card. a) number of students playing game, including absentee landlord col. 1-3. b) income tax option: 0 = no income tax; 1 = 50% income tax; 2 = 50% income tax plus 25% capital gains tax. These taxes are symetrical with respect to positive and negative income. col. 6. c) property tax option: 0 = ordinary property tax; 1 = site value tax, houses exempt. col. 9.

6. Card set for names. card 1, Absentee Landlord. Then one name card for each student. Then one card for instructor's name. Col. 1-20 on each card.

7. Year. year number, starting with 1, in col. 1-3.

8. History card (s). An initial history card plus one card for each year game is run. Initial card is supplied, subsequent years are punched by computer.

9. Building array card set. One card for each student, plus the absentee landlord. Omitted in year 1; punched by computer in subsequent years.

10. Landlord order cards. 1 blank card for the absentee landlord, then one order card for each student.

Landlord number	Col. 1-3	Number of lots offered for sale	13-15
Build orders	4-6	Price bid for lots (each)	16-21
Demolish orders	7-9	Price asked for lots (each)	22-27
Number of lots bid for	10-12		

Repeat card(s) 3 through 10 for each separate name being run at the same time. For year 1, all cards except card set 9 must be prepared. For later years, cards 1 through 6 remain the same, and the computer punches out a new set of cards 7 through 9, which replace those previously used. You must also punch out a new set of student orders each year card set 10.