Teaching US housing market principles with Game Theory

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Abstract

The board game *Welcome to your perfect home* (Turpin, 2018) is a competitive game in which players become architects trying to create the most valuable suburban neighborhood in the United States in the 1950s. This game was used in a pedagogical intervention designed to teach basic principles of the US housing market in two business oriented EFL courses in the spring semester of 2022. It is the supposition of this research that the game mechanics featured in this board game effectively serve as a microcosm of the US housing market through the interactions of the simplified housing market principles of housing value appreciation, depreciation, and zoning restrictions. The principles of Game Theory (Brandenburger & Nalebuff, 1995) were used to aid students in finding effective strategies within the context of the game. These emergent strategies were then used to structure lectures on how growth-restrictive zoning ordinances functionally limit access to affordable housing and what regulatory changes might be made in order to increase housing supply to meet demand within the US housing market.

概要

ボードゲーム「Welcome to your perfect home」（Turpin, 2018）は，プレイヤーが建築家となり，1950年代の米国で最も価値のある郊外の地域を作ろうとする対戦ゲームである。このゲームは，2022年度前期のビジネス志向の EFL コース 2 科目で，米国住宅市場の基本原理を教えるために考案された教育的介入で使用された。このボードゲームに登場するゲームの仕組みは，住宅価値の上昇，減価償却，区画規制といった単純化された住宅市場の原理の相互作用を通じて，米国の住宅市場の縮図として効果的に機能しているというのが，本研究の仮説である。ゲーム理論の原則（Brandenburger & Nalebuff, 1995）は，学生がゲームの文脈の中で効果的な戦略を見つけるのを助けるために使用された。そして，編み出された戦略をもとに，区画規制の条例が，いかに手頃な価格の住宅へのアクセスを機能的に制限しているか，また，米国の住宅市場における需要に見合った住宅供給を増やすために，どのような規制改革がなされうるかについて講義を構成した。

I. Introduction

The goal of this research was to explore effective pedagogical interventions for the instruction on United States (US) housing market principles within the context of university-level English as a foreign language (EFL) business administration courses in Japan. As the content of the pedagogical intervention described above was conducted in English and incorporated facets on the US economy that may have been wholly unfamiliar to the students who were all non-native English speakers and US non-residents, the simplicity (Rossell & Baker, 1996) and interactivity (Yeh & Lehman, 2001) of the pedagogical design were of utmost importance. In order to achieve an easy-to-understand, interactive pedagogical intervention which imparted some underlying principles of the US housing market, the board game *Welcome to your perfect home* (henceforth referred to as *Welcome to*) (Turpin, 2018), a competitive game which pits players against each other in a bid to build the most valuable neighborhoods in a 1950s suburban America setting, was used as an in-class instructional medium. A board game such as *Welcome to* was determined to be an ideal candidate for a simplified and interactive instructional medium due to the ability for games to generate microcosms of real-world social structures (Steinkuehler, 2006). In addition to playing *Welcome to*, the principles of Game Theory (Brandenburger & Nalebuff, 1995) were used to highlight how emergent strategies from a rule-based framework help shape the decisions made in and the direction of economic markets. The following section will introduce the basic game mechanics of *Welcome to* and establish how these game mechanics reflect basic principles of the US housing market.

II. US housing market principles reflected in *Welcome to*

Overview of game rules

As described above, the board game *Welcome to* is a competitive game in which players take on the role of architects trying to create the most valuable neighborhoods in order to win the game (*Rulebook*, 2018). The game mechanics, or otherwise the rules which govern all interactions within the context of the game, accommodate 1-100 players who play the game simultaneously. Each player is given three streets upon which they can construct a limited number of houses, fences (referred to in-game as surveying), pools, and parks as well as manipulate the value of groups of houses (referred to in-game as housing estates) with

real estate adjustments. Houses are constructed by writing the numbers of cards drawn at the beginning of each turn in the blank spaces on any of the three streets. Fences, pools, parks, and real estate adjustments are constructed/accomplished with effect cards also drawn at the beginning of each turn. At the beginning of a turn, three house number cards and three effect cards are drawn and paired with one another. Each player must then choose one of the three house number/effect pairings to construct one house and carry out one effect. The strategy of which house number/effect pairing to choose is partially determined or otherwise influenced by three "city plan" cards which are drawn at the beginning of the game. City plan cards are construction objectives which the architects attempt to carry out before the other players (e.g., constructing all houses on a specific street). Gameplay continues until a player completes all three city plans, all of the cards have been drawn, or a player is unable to construct a house for three turns. The value of each player's neighborhood is determined by how many city plans were completed and which effect cards were used. It is in this process of value determination that a number of basic principles of US housing markets emerge.

Housing value appreciation

With specific regard to the educational context of this research (namely university EFL courses in Japan), the principle of value appreciation within the US housing market is particularly relevant because housing values depreciate in Japan much faster relative to other developed economies (Kobayashi, 2016). In this sense, when teaching US housing market principles within a Japanese context, the concept that used/existing housing can appreciate in value is not necessarily common knowledge. Within the context of the game, housing value appreciation is accomplished by creating a housing estate (from one to six houses) and enclosing the house group within fences on either side of the outermost houses. After creating a housing estate, the house group translates into in-game points. This in-game point value can then be raised by using the real estate adjustment effect, which raises the value of specific housing estates incrementally with each employment of the effect. This game mechanic which allows for the value creation of house groups and appreciation through real estate transactions reflects the concept of value appreciation within the used/existing housing market in the US.

Housing value depreciation

Although housing appreciation of used/existing property in the US is very prevalent within the housing market, this value appreciation is far from certain and is dependent upon a myriad of confounding factors including, but not limited to, population growth, income, interest rates, construction costs, housing availability, and market fluctuations（Glaeser, Gyourko, & Saks, 2005; Jud & Winkler, 2002）. The housing market, just as with most other markets, is largely dependent on the principles of supply and demand. Therefore, when supply is high, housing value may be prevented from appreciating. In a Japanese context, high construction rates of apartment complexes in metropolitan cities such as Tokyo have had the effect of keeping the average cost of rent from increasing over the past two decades（Davis, 2019）. In the US, low levels of construction, especially for more affordable, multi-family structures such as apartment complexes, have worked to drive housing values up by keeping supply low even as demand rises in many metropolitan areas such as Los Angeles, San Francisco, and Denver（Durning, 2020; Metcalf, 2018）. Indeed, it is the very principle that increasing the supply of housing will elicit depreciatory effects on the value of housing which may be driving local communities of homeowners in US metropolitan cities to obstruct attempts to construct more multi-family housing, especially considering that, as described above, housing values appreciate at high rates in the US relative to other economies such as Japan.

Within the context of the game, the concept that rapidly increasing the supply of houses elicits depreciatory effects on the value of the surrounding houses is reflected through an effect which allows for the duplication of a housing number already constructed by the player （referred to in-game as "BIS"）. Using the BIS effect allows the player to functionally construct two houses instead of just one during a turn, the benefit of which comes from earning more points by completing city plans faster and establishing more housing estates. Using the BIS effect, however, elicits a drop in total points which increases incrementally with each use （i.e., the player must "pay" to use the BIS effect with their accumulated in-game points）. This game mechanic effectively disincentivizes players from using the BIS effect too often and mimics the real-world market depreciatory effects that rapidly increasing the supply of housing would elicit. From a pedagogical perspective, the BIS effect in *Welcome to* functions well to simplify and actively illustrate how the economic factors driving housing markets may actually disincentivize the construction of multi-family housing due to the depreciatory effect

that such construction would elicit on other houses in the area. Indeed, many home owners in value-appreciating neighborhoods in the US actively obstruct the construction of multi-family housing in order to preserve the value of their own homes (Ho, 2020).

Zoning restrictions

Another fundamental point of contrast between US and Japanese housing markets used in the present pedagogical intervention was how zoning restrictions may influence the evolution and economic direction of housing markets. Zoning restrictions refer to the laws which govern what type of construction may be carried out on any given plot of land and have massive implications for the economic development of housing markets (Pogodzinski & Sass, 1990). In the US, zoning restrictions are determined by local ordinances and have been recognized as being a legal instrument which has allowed for economic and racial segregation by restricting access to affordable housing through making the construction of multi-family housing difficult or altogether illegal (Chakraborty, Knaap, Nguyen, & Shin, 2010). Zoning restrictions in the US often create a legal environment which incentivizes the construction of large-scale housing through size requirements such as in Boulder, CO (Castle, 2021) or limits construction to single-family housing such as in Atherton, CA (Ho, 2020). Furthermore, as zoning restrictions are determined locally, building ordinances may quickly become numerous and complex on a national scale, which makes it difficult for widespread housing reform aimed at increasing access to affordable housing to gain momentum.

In contrast to the US, Japan's zoning ordinances are determined on a national level, which affords greater control for initiatives aimed at increasing access to affordable housing to take root. Indeed, whereas housing construction in many metropolitan cities in the US has slumped to historic lows, metropolitan cities in Japan such as Tokyo are in a state of constant construction of multi-unit apartment complexes (Sorensen, Okata, & Fujii, 2010). One facet that has helped the continual effort to construct multi-unit apartment complexes in Japan is the comparatively streamlined zoning restrictions. The whole of Japan has a total of 12 zoning restrictions, whereas the city of Seattle, WA alone has 38 (Durning, 2021). From a pedagogical perspective, these differences in how zoning restrictions in both the US and Japan have affected their subsequent housing markets provided invaluable context for how to conceptualize the varying components of the complex social structures which are interwoven with housing markets.

Within the context of the game, *Welcome to* has a number of game mechanics which reflect how zoning restrictions influence both the strategies players employ to increase the value of their neighborhoods and what choices are even available for them to make. First and foremost, the in-game rule governing where houses can be constructed resembles zoning restrictions, especially as the game progresses and there are fewer and fewer options of where to construct new houses. As previously outlined, there are three streets with a predetermined number of empty plots of land upon which the player may construct one of three possible numbers which are drawn at the beginning of each turn. The player may, in principle, build a house on any of the empty plots of land on any of the three streets provided that the house numbers are built in ascending numerical order from left to right on each street. As the game progresses and the plots of land fill up, the more difficult it becomes to construct new houses in ascending numerical order. If, for instance, there was no rule governing the ascending numerical order for housing construction, players would functionally be able to use any combination of house number plus effect up until the very end of the game. However, the restrictions placed upon in-game housing construction with the ascending numerical ordering rule will ultimately force the player to make a construction choice they would not otherwise make when other construction options during any given turn become impossible.

Another in-game effect which resembles how zoning restrictions may work to appreciate the housing value of growth-restricted zones within a growing city is the surveyor effect. The surveyor effect, as previously outlined, allows the player to create housing value by grouping constructed houses into a "housing estate," which is accomplished by building a fence on either side of the outermost house within the group. This effect mimics how housing values appreciate in areas zoned only for single-family housing （i.e., keeping supply low） provided that the demand for housing continues to rise （i.e., through population growth）. Within the game, the value of the housing estate may also be incrementally increased through the employment of the real estate adjustment effect. This effect combination of surveyor with the real estate adjustment becomes even more important as the game progresses because both effects are easier to implement in the later stages of the game even with the ascending numerical ordering restrictions described above. This game mechanic of construction restrictions which incentivize overreliance on the creation/manipulation of growth-restricted zones mimics how zoning restrictions often incentivize the construction of large-scale single-family housing in many cities across the US.

III.　Simplicity, interactivity, and Game Theory as pedagogical tools

Concepts covered in class

The three US housing market principles reflected in the game mechanics of *Welcome to* (i.e., housing value appreciation, housing value depreciation, and zoning restrictions) were used in conjunction with Game Theory to create the present pedagogical intervention. The study was carried out during the 2022 spring semester in two business oriented EFL courses. A total of nine students participated in the present pedagogical intervention for a total of seven 90-minute lessons. The goal of the intervention was to help students conceptualize the state of the US housing market, the factors which influence housing value, and how the US can increase access to affordable housing. Game Theory was used to help students analyze the rules of the game, how these rules affect which strategies they employ, which strategies are the most effective within the context of the game, and how these interactions between rules and game strategy can be used to analyze real-world housing markets in the US. In conjunction with playing *Welcome to* in class, lectures were provided on the US housing market principles described above. The game mechanics helped simplify the instruction of US housing market principles by providing concrete examples of said principles in a context which they could interact with and manipulate to objectively refine their conceptions of effective game strategies. The following sections will describe which game strategies were found to be the most effective as well as how these strategies may be used to address how to analyze the issue of access to affordable housing in the US.

Effective strategies to win the game

The most effective game strategies that were employed in this study were those that prioritized the creation of housing estates and the manipulation of their value (i.e., with the surveyor effect and real estate adjustments). This game strategy proved to be particularly effective because, as previously outlined, the construction limitations imposed by the ascending numerical ordering of houses made the employment of other strategies less viable as the game progressed. There are, for instance, other avenues available to create housing value within the game. The construction of parks (i.e., through the landscaper effect) and pools are other examples of in-game effects that players may use to increase the value of their respective neighborhoods. However, both of these avenues of value creation are more restric-

tive in terms of how the effects must be used. In the case of the landscaper effect, the park must be built on the same street as the house with which the effect is paired. Similarly, the pool effect allows the player to build a pool（which creates housing value）, but only on designated spaces, therefore the house number with which the pool effect card is paired must fit into the ascending numerical order surrounding the pool-designated plot. Both of these avenues of value creation become increasing difficult as the game progresses because the ascending numerical ordering rule governing housing placement gradually makes the use of the landscaper and pool effects less possible.

In contrast to the restrictive placement rules observed with the landscaper and pool effects, both the surveyor effect and the real estate adjustment are not paired to the house numbers with which they are drawn. This means that as long as the player is able to construct whatever house number the surveyor effect/real estate adjustment are paired with somewhere in the neighborhood, then the player may use that effect somewhere else in the neighborhood. Therefore, as the game progresses and the in-game zoning restrictions work to functionally decrease the possibilities for housing construction, value-creation strategies which are less susceptible to zoning restrictions（i.e., the surveyor/real estate strategy）are more effective. This strategy of creating growth-restricted housing zones within an area which is still growing in size in order to manipulate their market value is strikingly similar to what is happening to many US housing markets. As the zoning restrictions limit what is legally able to be constructed, builders often will prioritize large-scale single-family units in order to maximize profit within the growth-restricted market which is experiencing high demand and low supply（Castle, 2021）.

Another effective game strategy that was employed in this study was avoiding a premature end to the game by purposefully not completing all three city plans. As previously outlined, there are three city plans with specific construction objectives which are drawn at the beginning of the game. Players get points by completing these city plans and the game may be ended as soon as at least one player completes all three city plans. However, the amount of points that may be generated by completing all three city plans is not as many as can be generated by playing the game until all the cards are drawn while capitalizing on other value-generating effects such as the surveyor/real estate adjustments. This strategy is also mirrored in the US housing market. In a bid to increase access to affordable housing within their respective municipalities, a common strategy used by municipal governments in the US has

been to focus on economic subsidies and rent control (Metcalf, 2018). However, these municipal government interventions often fail to significantly impact the problem of rising housing costs in the face of for-profit builders acting to maximize profit within markets generated by growth-restricted zoning (Metcalf, 2018). This economic reality of the US housing market is reflected nicely in the emergent strategy of ignoring city plans in order to maximize the value of the neighborhood in *Welcome to*.

On adjusting the game rules to address US housing market issues

During class discussions of how effective strategies in *Welcome to* may help contextualize the issue of increasing access to affordable housing within the US, two primary lines of discussion emerged: increasing construction through the simplification of zoning restrictions and incentivizing the quantity of municipally dictated construction. Within the context of the game, students were asked how the construction of housing could be increased. Most student responses included suggestions to change the in-game zoning restrictions such as by eliminating the ascending numerical order rule (i.e., allowing housing construction anywhere in the neighborhood regardless of housing number) and making all empty plots of land capable of pool construction. Adjusting the game rules in such a way would make it significantly easier for all players to generate value with all in-game effects and fundamentally impact the dominance of the surveyor/real estate adjustment strategy. Similarly, if zoning restrictions in US housing markets were altered to make it easier for builders to construct more multi-family housing regardless of the neighborhood, then this would fundamentally change how builders generate profit as well as depreciate the value of single-family housing by increasing supply to meet demand.

Students were also asked how the game rules might be altered to incentivize the construction of more houses and the completion of more city plans. As the game only makes use of one effect which allows for the construction of more than one house during any given turn (i.e., the duplicate BIS effect), this was the only game rule which could be altered to mimic the construction of multi-family housing. Along these lines, most student responses included suggestions to change the point rules to allow for the incremental accumulation of points with each BIS use instead of the incremental reduction in points. In so doing, players would be incentivized to use the BIS effect in order to generate value from the BIS effect itself as well as from the faster creation of more and larger housing estates. In order to incentivize

the completion of more city plans, most student responses included suggestions to increase the point rewards for completing city plans. In so doing, the dominance of the city plan avoidance strategy would be effectively challenged by providing equivalent points for the completion of the city plan as would be obtained by avoiding completing all three city plans and ending the game. These rule adjustments may also be applied to how to conceptualize some of the primary issues of increasing access to affordable housing in the US housing market. The US federal government is currently working to create grants to incentivize municipalities to alter growth-restrictive zoning ordinances (Brey, 2021). Such incentives may provide US municipalities with an economic route to overcome housing obstructionism in order to change zoning restrictions in such a way that would shift the housing market to make the construction of multi-family housing more financially appealing to for-profit builders.

IV. Discussion

Games as microcosms of real-world social structures

The US housing market is a complex system that is based on the convergence of a multitude of economic factors and regulations. With that in mind, the limitations of a board game such as *Welcome to* are such that it cannot accurately simulate or model real-world housing markets. However, what the game *Welcome to* has accomplished very effectively in the present pedagogical intervention is the recreation of a limited range of real-world housing market principles in an easy-to-understand framework. This simplification of US housing market principles such as housing value appreciation, housing value depreciation, and the market influence of zoning restrictions provided non-native English speakers not only with concrete examples of how these housing market principles interact with one another but also an avenue to interact with and modify various strategies to maximize profit within the context of that housing market microcosm. Through in-class discussions of Game Theory and how the game rules affect strategy, a number of effective strategies emerged during the study interval which also helped students understand which aspects of the US housing market have to be altered in order to generate a market in which supply meets demand.

Conclusion

Games can be very powerful pedagogical tools in the way that they can help us simplify complex social structures, identify effective strategies for navigating said structures, and ul-

timately comprehend said structures more fully. In EFL contexts, this simplification and interactivity also takes on new levels of importance because it provides students with feedback （i.e., through point systems） as to how well they are understanding the linguistic input from the game. With an appropriate level of pedagogical structure around the implementation of a game in an educational context, truly transformative learning may take place. The ludic functionality of games also plays a critical role in how successful such pedagogical interventions may be. The students who participated in this study truly seemed to enjoy interacting with the game mechanics in *Welcome to*, which, in and of itself, is one of the most important aspects of providing effective instruction. The task of educators is not to talk about a topic but to inspire the students to intellectually engage with a topic of their own accord.

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