Learning Real Estate Risk Management in a Simulated Game Environment

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“Risk comes from not knowing what you’re doing” — Warren Buffet
(Wikiquote.com, n.d.)

Teaching Portfolio Theory
As the famous saying goes, “Don’t put all your eggs in one basket.” This is the cornerstone concept of the portfolio theory, where investors construct a risk-minimising asset portfolio that takes into consideration the risk and return trade-offs among different asset classes. In a perfect market, investors are able to make a rational allocation of available resources to construct an optimal portfolio. They are also expected to balance their portfolios from time to time, when new information is obtained on the risk-return characteristics of the asset classes. It is not difficult to teach students the various optimisation methodologies that can be used to obtain portfolios on the efficient frontier (i.e. the optimal portfolios, located along the curve of the risk-reward graph, which have the highest expected returns possible for the given amount of risk). However, putting theory into practice requires students to have some real-life appreciation of what investment risks really mean and entail. In a market where information is never perfect, the process of deriving optimal portfolios is beset with uncertainties. The problem becomes more complex when investors do not have the same risk-aversion behaviour.

The wrong investment decisions can be costly in the real world. However, through this simulation game’s controlled setting, students can apply what they learnt in risk diversification to construct an efficient portfolio for individuals in a simulated market environment. The simulation game “Managing Your Own Portfolio” adds fun to learning, and at the same time, students pick up useful communication skills when they interact and exchange notes with other players. The game will also train them to be resourceful in their search for market information while formulating their stock picks and asset allocation strategies.

Use of IT in the Simulation Game “Managing Your Own Portfolio”
The use of information technology (IT) of various forms, including the Internet and the proprietary Integrated Virtual Learning Environment (IVLE) by NUS, was critical in enabling the simulation game activities. The IT use in the game could be grouped into three broad areas: information dissemination/search, analyses of portfolio performance and allocation, and reporting of investment outputs.

We used “real-time” data from the Singapore Exchange (SGX) website to provide price information on stocks. We also simulated the real estate price information using a randomised process which was not revealed to the players. All players had equal access to all the information online and via IVLE, and no one was made worse off in the game.

We also created a standardised accounting sheet with embedded rules in an excel spreadsheet. This was given to the players at the beginning of the game, to help them track and analyse the allocation and performance of their assets in each period. The embedded rules and formula also ensured fair play throughout the game.

The use of the IVLE platform was also important to facilitate the submission of investment reports by students at the end of each game period. We used IVLE to report the summary results and to announce housing prices during the game. The players could take advantage of the flexibility that online submissions offer to time their stock picks and real estate investment strategies at the end of each game period.

With advances in technology and particularly in the development of online networks, such IT tools could be further exploited to create more real time game scenarios with more complex options.

Learning Outcomes
Simulation games have been used increasingly by researchers to study the behaviours of economic agents in different controlled settings. In this case, the game “Managing Your Own Portfolio” was not meant for students to apply sophisticated trading strategies in their investments so as to outperform the markets. We do not expect students to become instant master chartists, expert stock traders or speculators after playing this game. In this study, the game, as its name implies, was designed to achieve three basic learning outcomes:

- As risk diversification was one of the main themes in the game, we hoped students would learn the concept of “not putting all [their] eggs in one basket.” They would learn about the correlation between different asset returns, and how they can minimise risks by putting assets of different characteristics in a portfolio.

- The second objective was to reinforce the principle of risk-return trade-off in portfolio theory. Students, when they are exposed to randomised house prices and real-time stock information, can better appreciate the risk characteristics in different asset classes. In our case, the stock market was highly volatile during the 2-week game period because it coincided with the US sub-prime crisis.
The State of The Art
Technology in Higher Education:

Students experienced volatile changes in their stock prices throughout the game and they also faced difficulty in predicting house prices, which were highly imperfect.

- The third objective was to expose students to current market and economics news, and for them to learn how they could create shocks to the real estate and stock markets. At least, through this game, it would stimulate their interest in current issues such as interest rate changes, rise in fuel prices and others. Students were also trained to be more resourceful in searching for information on stocks, through informal ways and/or by seeking professional input.

In this game, to discourage risk-taking behaviour, we did not place an overt emphasis on the final gains/losses students reported in their portfolios. However, we ensured that the game outputs were aligned with students’ assignment grade to ensure that they put in reasonable effort in playing the game. Last but not least, we hope the game can inject some “real-life” learning into the classroom.

The Structure of the Simulation Game

The simulation game was played by 106 students taking a real estate investment module in 2007 (RE3281 “Real Estate Asset Market II”). The game’s scenario, which applied to all participating students, was set up as follows: each player was given a cumulated sum of cash of $180,000.00 at the beginning of the game. They received an additional $25,000 per period at the end of period 1, and the cash amount increased by 10% per period throughout the game. The learning objective was for students to apply what they have learnt in their lectures to manage their own portfolios and evaluate investment strategies.

Other than the allocation by broad asset classes, students were also required to construct hypothetical portfolios by investing their cash in any of the following asset classes (see Table 1):

To discourage students from being passive during the game (i.e. not doing anything), they will be penalised with a rental expense of $12,000 per period (if they did not own any real estate), and they earned zero interest rate if they put their unused cash in savings rather than in fixed coupon bonds. The game simulated different price revelation processes to reflect information uncertainties across asset classes. The real estate information was imperfect as prices were arbitrarily determined and the price generation process was not disclosed to students. Bond returns, on the other hand, were fixed by a constant coupon yield. Stock prices in the game reflected market sentiments and fundamentals.

The game was played for four periods, each of which spanned over one week. For tracking purposes, each player was given a standardised spreadsheet which captured data on their investment activities and portfolio compositions. All players had to upload their spreadsheets to a specially created Workbin in the IVLE at the end of each game period. The asset weights, which were based on the aggregate values for each game period, were announced before the start of the next game.

At the end of the game, the players had to compute the values of their respective portfolios based on the closing prices of the assets. They then had to compute their gains and losses throughout the game, based on the difference between the initial and final values of their portfolio. They were required to submit the results together with a report explaining their investment and portfolio strategies, and describing the lessons they learnt from the game.

<table>
<thead>
<tr>
<th>Asset Class</th>
<th>Real Estate</th>
<th>Stocks</th>
<th>Bonds</th>
<th>Cash</th>
</tr>
</thead>
<tbody>
<tr>
<td>Investment option</td>
<td>HDB or private condominium</td>
<td>All listed stocks on the SGX</td>
<td>Fixed coupon bond in multiples of 5,000 units</td>
<td>Savings</td>
</tr>
<tr>
<td>Price</td>
<td>Prices were randomly fixed and announced at the beginning of each period.</td>
<td>Prices were based on the real-time transactions between the two game periods.</td>
<td>Price was fixed at $1 per unit.</td>
<td>All unused cash in each period.</td>
</tr>
<tr>
<td>Income / Expenses</td>
<td>Owner occupied. If a player did not own a property, he/she paid a rental expense of $12,000 per period.</td>
<td>Stocks acquired from the previous period, and still remained in the portfolio earned a dividend at a uniform rate of 7% per period.</td>
<td>Bonds in the portfolio earned a 5% coupon yield per period.</td>
<td>Zero interest on unused cash.</td>
</tr>
<tr>
<td>Acquisition</td>
<td>Buy only 1 unit of real estate (HDB or private condo) per player in each period.</td>
<td>Buy stocks based on the closing day’s price at the end of each period.</td>
<td>Buy bonds at the end of each period.</td>
<td>Not applicable</td>
</tr>
<tr>
<td>Disposal</td>
<td>Sell only 1 unit per period. No short-selling.</td>
<td>Sell stocks based on the closing day’s price at the end of period. No short-selling.</td>
<td>Must hold for at least 1 period, or forgo the coupon, if sold at the beginning of the period.</td>
<td>Not applicable</td>
</tr>
<tr>
<td>Financing</td>
<td>Fixed rate mortgage of 25 periods at 5% per period, subject to a maximum loan-to-value (LTV) of 80%.</td>
<td>Not applicable</td>
<td>Not applicable</td>
<td>Not applicable</td>
</tr>
</tbody>
</table>

Table 1. Asset classes and the game’s investment rules.
Some Results from the Simulation Game

At the end of the game, the aggregate values of assets held by the players were computed. The results in Figure 1 showed a well diversified portfolio at the aggregate level. The students applied some degrees of diversification in spreading their investment risks across different asset classes. Figure 1 also showed that real estate assets constituted about a third of their portfolio weight at the aggregate level, and only 3.8% of the students did not include real estate in their portfolios. Most of the students bought at least one property so that they would not incur the $12,000 rental expense. Some invested in more than one property, hoping to reap potential capital gains at the end of the game.

Figure 1. Asset allocation by aggregate values at the end of the game.

It was also observed that the students allocated about 42.8% of their aggregate investments in stocks (see Figure 1). Stock investments were more complex, and students were also required to plan their stock selection strategies. Some relied on professional analysts’ reports to make their stock picks. One student adopted a contrarian strategy by picking the “Top Losers” stocks, believing that “what have gone up must come down” and vice versa.

Others followed informal rules and relied on news from the proverbial grapevine in picking their stocks. The information sources they used included friends’ recommendations and tips from friends with “insider news”, playing “herd mentality” behaviour. One of them wrote in the report that:

- “In this game, I have also relied on the “Brokers’ Take” section of The Business Times … for free investment advice. However, there were several occasions where the forecast and predictions were wrong…instead of making profits, losses were made.”

Bonds constituted about 24.2% of the aggregate portfolio values, and this asset class was used by the more risk-averse students to minimise the risk exposure of their portfolios. However, for students who were more risk-inclined, the “bond yield of 5% was unattractive”, so they adopted a zero bond portfolio strategy.

When we measured the changes in values which occurred between the initial and final periods, we found that the group’s aggregate asset value increased by 75% after playing four rounds of the game. Some students suffered losses in their portfolio strategies. The grading of the assignments, however, was not based solely on the final outcome of their investments. The students’ learning outcomes, as discussed in their reports, were also considered.

Limitations of the Game

We obtained much feedback and many suggestions from students on how to improve and make the game scenario more accurately reflect real market environments. One student suggested that “real time” transactions be used in stock selections. Some also felt that the game was too short, and suggested extending future games over a longer period of time. They also gave suggestions on the investment rules for real estate and stocks.

In addition, some students felt that the game’s restrictions on the number and types of real estate that can be bought and sold were unrealistic. For example, properties in different submarket could be included. However, investors were still limited to buying only one HDB unit. Some students also suggested that we impose the 5-year time bar on the sale of HDB units. Another concern raised was the lack of transparency of real estate price information, as prices were randomly determined. One solution would be to include some simulated historical real estate price trends, which serve the same function as the private residential property indices published by the Urban Redevelopment Authority (URA) of Singapore, which prospective buyers commonly refer to.

Students also gave feedback about the supply of new real estate, with some feeling strongly that we should restrict the supply and stocks of real estate that could be transacted in each period. In this way, players could purchase the units either directly in the open market, or they could negotiate the price in private with other players during the game.

The main criticism students had of the stock investment was the restriction on intra-day trading in the game. Some students could perform arbitrage using trading prices prior to the game’s ending period and make abnormal profits from their stock selection. The dividend policies of listed firms could influence the payouts, but the implementation of differential dividend rates could be difficult in the game. Students who were more financial savvy argued that they should be allowed to use warrants and other derivatives in the game to hedge against the price risks of underlying stocks. We should have also imposed transaction costs in the real estate and stock transactions.
**Future Extensions**

Simulation games, if properly designed, can be an effective pedagogical tool to improve our students’ learning experiences and also help them grasp difficult and abstract theoretical concepts. For researchers who are interested to learn the rational behaviour of investors, the simulation game is a useful experiment to study how individuals’ aversion towards risks in different asset classes influences their portfolio decisions. Are all investors risk averse in a volatile market? Do investors follow some forms of herd-mentality behaviour? There are many interesting issues which can be examined, as long as game rules and scenarios are set up properly.

This simulation portfolio investment game could be further extended in many ways to support teaching and research in topics relating to real estate risks. We could extend the game to incorporate new asset classes and new investment rules. We could also use the game structure to simulate the risk-aversion behaviours of investors in different controlled scenarios, for example, by imposing different income constraints on players. We could also test the effects of information efficiency on the players’ risk-aversion behaviours. This game could be modified to study the impact of government policies on the market, for example, how investors will react to the government’s measures to curb speculation, like lowering the loan-to-value ratio to 80%, imposing stamp duty on sellers who sell houses within one year from the last purchase date, and others.

If the game could be repeated over time on a different student cohort or extended to players in different age groups, we could also learn more about the inter- and intra-generational risk aversion behaviours in portfolio investments.

**Conclusion**

Learning about real estate risks and portfolio diversification need not be a chore, if students were given the opportunity to “get their hands dirty” in the game without having to pay monetary penalties. The game’s interactive element could also help students cultivate friendships and trust in other players, such that they could share information and exchange knowledge freely. Some of these aspects of learning which students gain from playing the game could never be taught through sophisticated optimisation formula and modelling. One student reflected on the game in her report:

- “Casting aside the fundamentals and the technicality, sometimes, really, it all boils down to what lenses you are looking through that would create extraordinary results.”

Simulation games allow us to experiment and use innovative pedagogical approaches to supplement traditional classroom teaching. It takes time and effort to set up a game, but the value of the payoffs educators reap in creating new and effective learning experiences for students is immeasurable. As Johann Wolfgang Von Goethe put it, 

“[k]nowing is not enough; we must apply. Willing is not enough; we must do.”