

LESSONS DRAWN FROM A STOCK MARKET GAME

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ABSTRACT

A new approach in educational science promotes student involvement to replace frontal lectures. The objective is to create a *cooperative environment* in class applying the new educational techniques. *Gamification* is one effective solution to the problem. I used the stock market game described here to introduce my students to the world of trading systems and the basic rules of financial behaviour in a playful but challenging environment.

After the introduction and a description of the literature used, this paper describes how the game is played. I have been playing the game in the same order for years, which has had a dual advantage. On the one hand, based on practical experience, introducing new skills and knowledge is best done in an established order both for the fluency of the game and the effective processing of the new knowledge. On the other hand, the identical order of playing the games is important for subsequent statistical analysis and drawing the conclusions.

The analysis in the paper has been made using a simple statistical descriptive methodology. By their multiplicity, the 136 teams in the sample would have been sufficient to use deductive methodology, however, the participating students belonged to different groups (undergraduate and post-graduate, reading economics, reading other subjects), so the number of the individual teams has become lower. Also, if you look at the number of individual games, i.e. the 34-component sample, deductive statistics will produce more limited results.

It has become clear from the results so far that post-graduate students, particularly those reading non-economics subjects, were more prone to making emotional rather than rational decisions during the course of the game. Psychological elements had a more emphatic impact on their decisions compared to their peers who had a profound knowledge of economics.

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1 INTRODUCTION

I developed a *stock market game* for my students in the 1990s. The idea came from a paper by *Alexandra Szatmári* (Szatmári, 1996), in which the author analysed auctioning techniques. I supplemented the different auctioning techniques with different types of share subscription as well as that of secondary trading, such as stock exchange and OTC trading to create a game of stock trading of many rounds. We usually played it in the last class of a course or in classes discussing the methods of stocks analysis or speaking about the stock exchange. Gaming was not only useful to actively synthesise what students had learnt during the course but also helped them become aware of the diversity of market information and its utility in general.

During the games, the teams could only apply technical trading, in other words, fundamental information or economic analyses were not available to them, so they could only draw conclusions monitoring market movements or supply and demand (i.e. the behaviour of the other participating teams). The teams recorded their decisions on uniform gaming forms; they had to record there their decisions, the actions planned, the final secured deals, but also their closing asset position at the end of each round of the game. The forms provided me with sufficient data for a statistical analysis of *how underinformed players make decisions on the market*. Analysing the players' behaviour, accordingly, can contribute to the literature of financial behaviour. One key point in my stock market game is whether market mood can influence the decisions of different teams, whether and how their strategy changes thanks to new information and as the general atmosphere of the market changes.

2 LITERATURE ON GAMIFICATION

The games represent *decision making situations*. It is an uncertain multi-outcome environment. However, once a decision is made, a player will identify with it and will try to (self)explain subsequently why the decision was dominant compared to other options. That insistence is a kind of mental anchor (anchoring, Tversky – Kahneman, 1974), and holding onto it will trigger a strong psychological impact mechanism. Should the validity of the decision become questionable, a situation of *cognitive dissonance would arise*, which strengthens the long-term life of the information intended to be transferred.

Insistence on the decisions made as well as giving them up from time to time, regret theory, fear of making a decision in uncertain situations (Loomes–Sugden, 1982), the bandwagon effect, i.e., identifying with the majority decision (Kiss–Si-

monovits, 2014)), in other words, decisions made in an underinformed environment can all be analysed well using the statistics of players' strategies.

Davis (2011) provided a detailed analysis of the advantages of creative teaching methods emphasising the importance of games and simulations in teaching economics to reduce the gap between theory and actual life.

The literature describes several games to model different decision-making or economic decision-making situations.

A core work in the literature is *Games and Simulations* by Lewis et al. (1974), which includes a detailed list of and introduction to economic games and simulations that had been developed by then.

Fraas (1980) built a whole course in tertiary education in the 1970s using simulation games, and according to his results, the players' knowledge significantly surpassed that of the reference group.

Kalmi and Silvonen (2022) analysed the possible options of economic games and their potential in education using examples from the international literature.

Guest (2015) presented his own positive teaching experience of ten years regarding both online and in-class economic games.

Wyk (2011) analysed the effectiveness of a Team-Games-Tournament (TGT), i.e., regular weekly team games. Again, the exam results of the students participating in the TGT course surpassed that of their peers who had received traditional training.

Nkonyane and Wyk (2015) assessed the effectiveness of economic games in post-graduate courses for teachers. Based on the results of seven games, the students made significant progress both academically and in understanding everyday practice.

Zapalska and Brozik (2008) listed the steps of developing a game or simulation to be used in teaching beginning from the discovery of the problem through teaching aims and incentives to creating the actual rules of the game.

Brauer and Delemeer (2001) produced a catalogue of non-computerised games developed in teaching economics categorising them according to different options of usage.

Wyk (2013) played seven different economic games with his students. He found with the help of subsequent in-depth interviews that the games had not only improved the participants' academic knowledge, but they had become better in managing their human relationships and had had a better understanding of practical economic operations.

Davis (2019) evaluated the impact of three consecutive economic games among his first-year students. Using both quantitative and qualitative analysis on his

120-component sample, he stated the advantages of using the game to help participants understand economic correlations.

Holt and Capra (2000) analysed the decision-making game called 'A Prisoners's Dilemma' and presented analogous decision-making situations, for instance, bankruptcy negotiations.

Azriel et al. (2005) played Jeopardy, a popular TV game in the US with their students to ensure more effective transfer of management methods and terminology.

Gremmen and Potters (1997) assessed their students' success using the computer game SIER. The students using the game achieved significantly better results at exams of international economic relations than their peers taught traditionally.

Pena-Miguel and Sedano (2014) analysed the advantages of using different computer and board games among Basque schoolchildren.

In Fryer's et al. game (2005), the students had to take on roles of representatives of different trades. The main objective of the game was to generate a debate on discrimination.

Meister (1999) wrote about his experience with the production game 'Oligopoly'. His players gained better understanding of the importance of production strategies and the operation of oligopol type markets.

Wentworthes and Lewis (1975) described a different experience. According to their results, the players of 'Marketplace' did not surpass the results of the control group either in their economic attitudes or learning achievement.

Hinoyosa et al (2010) analysed the utilisation of a stock market game in teaching. The game had been developed by the USA-based Securities Industry and Financial Markets Association (SIFMA) Foundation for Investor Education. According to the learning results of 11.5 million high-school students, the game had significantly improved both their mathematical and reading comprehension capabilities.

Wood et al (1992) also analysed the use of the Stock Market Game. They found a ten-week portfolio decision-making game to be useful, but they complained it had cost USD 10 for each team.

3 CONCEPT OF MY STOCK MARKET GAME

The stock market game is a *team game* developed for a group of 8 – 30 participants. The students were divided into four teams at the beginning of the class. Each team received an opening capital of HUF 2,000 while the game-master had two hundred shares as public shares of an unknown public limited company. I announced 7 - 12 rounds of the game subject to the time available for playing. Seven rounds could be played in 90 minutes, while 11 or 12 rounds took 135 or

180 minutes. The teams could trade with each other in some rounds, but in most rounds, they had to compete against each other to trade with me, i.e., to buy from me so as from the issuer. The teams' goal was to have their closing stock wealth as high as possible at the end of the game including not only the unused cash but also the capitalisation of the closing amount of the shares they held.

To motivate the students, I promised extra scores subject to ranking but in such a way that every player should receive at least one. The scores available that way represented maximum 5% of the exam scores at the end of term, so the scores were not too significant, but the idea still contributed to the players' activity during the game as well as to their risk taking (or risk avoidance).

During the game, the students could gain an understanding of the different forms of trading *in a light-hearted way* (the different varieties of auctions, subscriptions, and secondary market trading). Also, participants may have become aware that a perfect market cannot be beaten in the long run, while gathering even a little information may provide a competitive advantage and consequently more profit.

3.1 Participants

The game was played at my university classes. Due to the higher number of post-graduate courses, a significant part of the participants were older (25 to 40 years of age). Another part of the participants were full-time university students of 20-22 years of age.

Full-time university students mainly came from Budapest Corvinus University, i.e., they had *some knowledge of economics*. Another group consisted of second-year full-time students at the Hungarian University of Sports Science. *Post-graduate students of economics* included economists, law students, physicians, pharmacists, engineers and teachers. In effect, all players either had a university degree or were studying for one. Their different educational levels explained the difference in their behaviour and strategy.

Table 1
Educational level of participant teams

Teams	Full-time	Post-graduate	Total
Economist	40	40	80
Other degree	12	44	56
Total	44	72	136

Source: own design

3.2 The game

The lesson plan of the gaming lesson had been simplified in the course of time and had been well arranged (*Table 2*).

Table 2
Lesson plan for a stock market game for 90 minutes (180 minutes in brackets)

To dos	Team activity	Time limit (minutes)	Cumulated time (min)
Rules of the game, forming teams	Forming teams, team name, edit team form	15	15
Securities' trading in finance	Presentation	2 (20)	17 (35)
Subscription and elements of guarantee	Presentation	8 (15)	25 (60)
First two rounds: subscription	Two rounds	5 (7)	30 (67)
Varieties of stock market trading *	Presentation	8 (15)	38 (82)
Stock market round*	Third round	5 (7)	43 (89)
Features of technical and fundamental trading*	Presentation	4 (15)	47 (104)
Variants of auctions**	Presentation	8 (10)	55 (114)
Phase of increasing prices	Two (3) further funds	5 (8)	60 (122)
The 'winner's curse' phenomenon	Discussion	3	62 (125)
Phase of falling prices	Three (five) further rounds	12 (22)	74 (147)
Closing round	Submit offers for closing round	5	79 (152)
Edit register	Teacher's presentation	4 (8)	83 (160)
Identify closing price	Teacher's presentation	4 (6)	87 (166)
The 'blind monkey' effect	Presentation	2 (5)	89 (171)
Announcement of results	Count scores	1 (3)	90 (174)

Note: *In the 11-12-round version, the auction round marked ** and the related information could take place earlier.

Source: own design

During the game, I tried to offset more boring, content-type information with more exciting active gaming time.

As I *introduced the game*, I emphasised the bonus targets. Ranking was not the only thing to matter. As the issue of risk taking also arises in a competitive situa-

tion, players could get extra scores if their team closed with a profit on the starting HUF 2,000. This was used to encourage players to be active, so that they would not simply sit on their purses, because in that case they would have given up part of the gains.

At the start, each team was aware of the following:

- Each team had HUF 2,000 to do business with, i.e., the demand side in the room was a total of HUF 8,000;
- The supply was the 200 shares of the same series held by the game-master all of which would be offered in the rounds of the game;
- The background figures of the shares were unknown, the players would not get any fundamental information,
- They could buy and sell during the three secondary rounds (at one-third, two-thirds and at the end of the game, i.e., for nine rounds, at round 3, 6 and 9) both to/from the game-master and other teams. They could make more than one offer during those rounds;
- During the other rounds, the teams could buy only, and one offer alone could be made, i.e., both quantity and unit price had to be fixed in advance.

I gave the students funny tasks to get involved in the games and to boost their activity. They had to produce witty team names – so they were immediately involved in the game. Next, they had to choose three officers: a liaison to the game-master, a head of accounts and a head of the team. This allowed the tasks to be shared. *Table 3* is the front page of a typical team form.

Table 3
Team form – a team name often selected

Team name: FailBUX*						
Round	Offers		Accepted		Closing stock	
	pc	HUF/pc	pc	HUF/pc	HUF	Pc shares
0.					2,000	0
1.	12	40	5	40	1,800	5
2	15	43	8	43	1,456	13
3.	4	45	4	45	1,276	17
4.						

Note: *In Hungarian the BUX – Budapest Stock Exchange Index – is pronounced the same way, as failing an exam.

Source: own design

You *knew nothing about the shares or the issuer*. I illustrated that using non-existent company names, for instance, NoWay Ltd or Bankruptcy Ltd.

Academic knowledge was transferred on eight occasions. Here is the typical run of a 9-round game class:

- At the beginning of the class: the part played by financing channels, securities, and share -issue in financing.
- After introducing the game but before the first round: subscription as an inflexible way of issue. The essence of point-fixed and book-building subscription procedures. Issuer's options in case of under or oversubscription.
- Prior to round three: secondary market trading – ‘stock market trading’ on concentrated/ standardised and OTC markets, physical and online markets
- After round three: characteristic features and differences of technical and fundamental analyses.
- Prior to round four: types of auctions – open or closed auctions, one or more than one winner, secondary-price auctions.
- At half time: the ‘winner’s curse’ – psychological difficulties of first-price auctions. Prices had usually been rising until this round.
- As the data of the last round are recorded: the structure of the share quotation, the method to decide the equilibrium price for phased trading.
- Closing remarks: the ‘blind monkey’ effect (Malkiel, 2017). There, I discussed some lessons of a (generally but not always) perfect market in money markets.

4 PHASES OF THE GAME

4.1 Mental anchor

At the start of the game, the teams had no idea how much a share you know nothing about was worth. In such a situation, anything you can hold onto will help. This is termed *mental anchor*.

So, to start the game, I had to identify an *initial price level*. I set it at HUF 40 – the quotient of the total assets of HUF 8,000 and the two hundred pieces of shares. A fixed price was needed for the start, and an inflexible form of subscription matched the fixed price level. In that way, the players received something to hold onto, a mental anchor. They had something to start out of, so they could relate to that HUF 40 in subsequent rounds.

4.2 Prices start to rise

During the game, I made efforts to produce a ‘*price bubble*’. Interesting conclusions could be drawn about the players’ behaviour as a rising price spiral was triggered in the first rounds and when the price bubble was burst. If there was over-subscription in the first two rounds of subscription, the dynamics of the game was ensured.

The *price* usually significantly surpassed the initial HUF 40 by the fourth or fifth round (Table 4).

Table 4
Average (and highest in brackets) maximal price

Teams	Full time	Postgraduate	Total
Economist	46.6 (52)	48.1 (61)	50.0 (61)
Other qualification	51.67 (60)	52.2 (70)	52.0 (70)
Total	47.77 (60)	50.2 (70)	50.8 (70)

Source: own calculation

You can see in the Table 4 that prices had become higher with players of other qualifications.

4.3 The turning point

At half time, there were usually two auctions with the price race becoming quite fierce so that the price balloon had reached a critical size.

At that point, I usually describe the phenomenon called ‘*the winner’s curse*’ (Thaler, 1988). It is a psychological problem: the person offering the highest price cannot be certain whether their successful bid has been a wise or a stupid step. Such psychological tension may limit the bids, which will reduce the potential revenues of the issuer (Szatmári, 1996). It has been proved that secondary-price auctions or equal-price auctions may increase the issuer’s total revenue on well-operating markets. The typical feature of those types is that the winner or winners must pay a lower price than the bid price.

In case of a *secondary-price auction* the only winner must pay the second-highest price after his price. In case of an *equal-price auction* there might be more than one winner. All will pay the lowest winning price.

With those two auction types, buyers may be willing to bid higher prices as a tendency, as they may think they will not actually have to pay them, but only the

lower threshold price. But, since everybody on the market is calculating in the same way, everybody may bid a higher price, which will push the threshold price higher too.

Because of the lessons drawn from the ‘winner’s curse,’ prices started to fall in the following rounds of the game.

4.4 Falling prices

Prices typically fall in the second half of the game. I actually amplified that by using issuer techniques that triggered a panic. For instance, the issuer had no reserve price, i.e., prices could (in theory) fall to HUF 1. The price slide or Dutch auction also contributed to a bear mood.

4.5 Identification of the closing price

At the end of the game the value of the remaining shares is included in the teams’ total assets. The closing price of the shares is an important issue, which is decided in the last stock exchange round, in the online trading round. So, it is a stock market round. I ask every team to record more than one offers in their shares register both on the buying and selling sides. By this time, the players usually have many shares but little money while price falls have also had a sobering effect on their buying ambitions, so it is usually me who sets off the buying side to reach the initial price of HUF 40 again. *Table 5* illustrates the final order book

Table 5
Order book and identification of closing price
(data in pc, except for price, in HUF)

Buying side		Price	Deliverable	Unsatisfied	Selling side	
total					total	
0	0	47	0	180	6	180
0	0	45	0	174	54	174
5	5	<u>44</u>	5	115	30	120
12	17	<u>42</u>	12	78	15	90
60	77	40	60	15	75	75
16	93	38	0	93	0	0
12	105	35	0	105	0	0

Source: own design

Buying and selling offers are cumulated on the left and right edges of the order book. Equilibrium price is where the highest number of deals can be made, i.e., where supply and demand meet most. Naturally, this is mostly true for the middle prices, but I usually try to influence the market with my offers so that the didactic requirement of a closing price of HUF 40 (HUF 8,000/200pc) be reached.

4.6 The end of the game

At the end, we sum up closing assets. Since players usually had bid above HUF 40 in the course of the game, most of them close with a loss – except if they could sell to other teams at a higher price. To round up the game, I mention the ‘*blind monkey*’ effect (Malkiel, 2017). According to the story, investment fund managers and chimps brought over from the zoo competed in an actual stock market game. The final result was close, which is explained by the fact that markets are *as a rule* perfect. However, significant gains in some rounds by the professional investors has shown that a competitive advantage, i.e. more information, knowledge, and competence provides additional advantage. In our game, the information is simply monetary: there are assets of HUF 8,000 against two hundred shares in the room, i.e., the equilibrium price must be HUF 40.

5 CONCLUSIONS

Table 6 illustrates the cumulated wins of thirty-four finished games

Table 6
Cumulated result of the games

Study level	Qualification level	No of Teams / Winning teams	Average of price deviation in the game	Average loss by teams	Deviation of closing assets of teams
postgraduate	other	44/7	7.13 HUF	-112.85 HUF	127.82 HUF
postgraduate	economics	40/3	4.12 HUF	-100.16 HUF	102.97 HUF
full-time	other	12/1	2.46 HUF	-61.27 HUF	78.11 HUF
full-time	economics	40/5	2.99 HUF	-61.72 HUF	54.41 HUF

Source: own calculation

As you can see in the summary table, a mere sixteen out of the total of 136 teams (11.76%) closed the game at a profit. The average loss was HUF 89.38 and the teams together closed at a loss without exception in every game (*Table 6*).

The results show that players with some knowledge of economics, i.e., *the teams using a more rational approach to problem solving* performed better. It is interesting to see that postgraduate students performed poorer in every category than full-time students. This suggests that *overconfidence* had an adverse effect on postgraduate students already in jobs, who showed much enthusiasm in the rounds of rising prices, jumped on the bandwagon demanding maximum quantities and tried to surpass their peers. In other words, the older age group decides faster, with more bravado and decisiveness even if they do not have all the necessary information, thus they can be influenced more easily.

The game was an absolute success among students. Even people sitting with a bored face in class, not contributing to general discussion became active and were emotionally involved in the games. My former students had the best memories of the games many years later. They also remembered the lessons learnt, the importance of information or the nature of self-perpetuating market bubbles.

The numerical results suggest postgraduate students already in jobs are more affected psychologically than younger full-time students. Although the ratio of teams closing with profits was similar (10 out of eighty-four postgraduate teams, i.e., 12% and 6 out fifty-two full-time student teams, i.e., also 12%), the result of older students showed more deviation. On average, they lost much more in the games. It seems herd mentality or overconfidence in decision making is more characteristic of them. They are inflexible, they stick to their decisions in a longer run while they make faster and riskier decisions.

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