

# USING AN INVESTMENT FUND SIMULATION INTEGRATED WITH A BUSINESS GAME

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## ABSTRACT

*This paper presents an exercise involving a manufacturing simulation providing data to run an investment fund simulation. Both simulations were administrated simultaneously in a management simulation capstone course. The paper will be focused on the second simulation. Its model and dynamics are explained. Results of the investment fund simulation are analyzed in three perspectives: (1) comparative performance of the investment funds, (2) students' perceptions about the vivid experience, and (3) acquired knowledge. Comparative performance is analyzed using data provided by the simulator. Student's perceptions and acquired knowledge are analyzed using data gathered by a semi-structured questionnaire administrated at the end of the exercise. Overall, students pleased with the experience. According to them, it brought knowledge in a simple and fast way.*

*Key-words: simulation, investment fund, financial market, business game, management simulation*

## INTRODUCTION

Stock market simulations and gaming are widespread as tools for beginners start negotiating stocks without taking the risk of losing real money. They are usually used as pedagogical instruments to learn about the financial markets. Their first reference in the business game literature coincides with the first edition of the Association for Business Simulation and Experiential Learning (ABSEL) conference in 1974. In that year, Gitman (1974) described a game designed to trade securities. Players of the game were required to develop and implement investment strategies. Instructor could also require players to submit a statement of their investment strategies. These statements could be used by the instructor to evaluate the player's ability to implement the stated strategies. Robana and Biggs (1979) discussed the shortcomings of the Gitman's game and suggested some improvements to turn it more realist. According to the authors, the major limitation of the game was its bull market bias. Consequently, all players had large gains regardless of their adopted investment strategies. The model was modified by adjusting the bull-bear market according to a real (historical) probability of occurrence. As a result, participants became more interested in the simulation. They realized the importance of the risk management by starting to think in terms of risk-return trade off.

Nowadays, there are numerous stock market simulations. A search for 'stock', 'market' and 'simulation'

in Google engine returned the following eight games in its first page (accessed on October 31, 2012): [www.investopedia.com/simulator](http://www.investopedia.com/simulator), [www.nationalsms.com](http://www.nationalsms.com), [www.smartstocks.com](http://www.smartstocks.com), [www.smgww.org](http://www.smgww.org), [www.howthemarketworks.com](http://www.howthemarketworks.com), [www.wisconsinsms.com](http://www.wisconsinsms.com), [www.stocktrak.com](http://www.stocktrak.com). Most of these simulations are based on real life stocks prices from major stock market indexes. Thus, they have a strong external validity in terms of realism. By contrast, business games have specific algorithms to define stock prices (Wolfe and Gold, 2004). Consequently, their representational external validity is questionable. Put differently, do the simulated share price fluctuations represent the financial market reality?

Considering that on line stock market simulations have a higher external validity and they can usually be played for free, why should professors use simulations based on modeled financial markets? Timing and educational purposes can be the answers. On line stock market games use real shares prices; consequently they simulate the actual scenarios. In other words, the instructors do not have control over the simulated scenarios. They have to adjust their educational purposes according to the current financial market scenario. For example, if the real world is facing a bull market, a bear market cannot be simulated. By contrast, simulations based on modeled financial markets usually permit the introduction of events that could not be simulated by on line stock market simulations in a given moment. For example, a business merger process, or macroeconomic events such as a soaring inflation or an abrupt interest rate change. Thus, depending on the instructor's purpose, the representation external validity or the educational validity will be prioritized (Feinstein and Cannon, 2002).

Present exercise uses a stock market simulation not only for educational but also for operational purposes. This author administrates business games in a capstone course. The classes usually have 40 students. They are grouped in eight five-member teams (software limitation is 8 companies by simulation). As long as the simulation runs some activities are performed to create uncertainty to the business environment. It is permitted one merger of two companies. In another activity, one company is forced to go to bankruptcy (the company with the poorest performance). Thus, the competition is not restricted to the leadership, but also to avoid the last position. Both activities have as side-effect students without work. A natural solution is the student reallocation to the remaining companies, resulting teams with up to 7 participants. However, it has been observed that teams with too many members can be unproductive and causing demotivation (Wilson, 1974; Gentry and Burns, 1980; Faria, 2000; Bernard, 2012).

The business simulation package used by the author has recently integrated an investment fund simulation. This new featuring solved the problem of what to do with the unemployed students: they become investment fund managers. The integration is simple because the software's interfaces are the same and the managers continue to analyze the same industry to decide their investment options. However, some questions arise from a student's perspective: How do they react to the reallocation? How much learning does the investment fund simulation bring to the participants? If permitted, would the students like to repeat the experience?

## METHODOLOGY

The subjects were 30 out of 68 undergraduate students enrolled in two classes of a required management simulation capstone course. A single professor was responsible to both classes during the second semester of 2012. The students received the guidelines, as follows: Initially all students will participate of one manufacturing simulation (SIND, 2012). After round 5, an investment fund simulation will be introduced and some students will be transferred to it based on three activities: (1) The manufacturing simulated company with the lowest equity value will go to bankruptcy; (2) A merger will be performed resulting in one closed company (see Bernard, 2012, to get more information about the merger process in business games); (3) Each CEO of the remaining manufacturing companies must dismiss one director. Thus, all students without employment after such activities will be hired to manage simulated investment funds. Each fund will be formed by two people from different manufacturing companies.

The manufacturing simulation started with seven four-member teams in class 1 and eight five-member teams in class 2. After round 5 the investment fund simulation initiated encompassing fifteen teams, six in class 1 (simulation A) and nine in class 2 (simulation B). Three rounds were conducted, followed by a debriefing session. As preparation to this session, participants had one week to answer a five-question semi-structured questionnaire. The students were asked about their strategies to manage their funds and the lessons learnt. Open-ended questions were analyzed using the Miles and Huberman's approach (1994).

Students were previously informed how they would be evaluated. Two criteria were used: fund performance and questionnaire answers. Actually, the questionnaire was asked to be written in a management report format. Grade was attributed based on the quality of the provided information. Personal opinions and management failures were not reasons to reduce grade.

## INVESTMENT FUND SIMULATION

The investment fund simulation provides knowledge in financial market by developing and implementing strategies to invest in securities. Participants invest in variable income securities (stocks) and fixed income securities (bonds). The investment fund simulation

is web-based and requires data from a simulation (manufacturing, retailing, service or banking) included in the same simulation package. Such data are share prices, dividends and interest rate. Before making decision about stock market transactions (to buy and sell stocks), participants must analyze all available simulated reports (financial, market, newspapers, etc.). General instructions of the investment fund simulation are given below (SINVEST, 2012):

Assumptions: (1) All transactions will occur in moment zero of the round X based on the shares prices of the round X-1; (2) The volume of transactions in a given round is not sufficient to change the shares prices. In other words, the price of a given share will remain constant even though all funds spend their available resources buying that share (or selling all shares of their portfolios); (3) Share price fluctuation will be based on financial, economic and market share indicators.

Operations: Each fund will receive \$ 2 million for starting operating. They must execute at least 4 operations by round, including buying stocks, selling stocks (the stock market had 5 and 6 companies respectively for simulations A and B) and investing in one fixed income security (bond). The limit to invest in bonds is 20% of the fund resources.

Reports: Managers will have different reports for controlling the fund performance. These reports provide the following information: executed operations; selling operations describing each result (gain or loss); portfolio (stocks and bond); cash flow; income statement; and a comparative report encompassing stock market index (points and percentage), interest rate, fund performances (money and percentage), average investment fund performance (percentage), portfolio of each fund (money and percentage variation).

Results: Funds will make money by (1) selling stock by a price higher than it was bought; (2) receiving dividends of the stocks in the portfolio; and (3) investing in bonds. Bond issuers pay the basic interest rate plus 1%. Income tax is 15%, both to stock and bond operations. Income tax of the stock transactions will be calculated considering the net income of the round, that is, gross income (selling price – buying price) reduced by losses (buying price higher than selling price) and by brokerage commissions (0.5% of the negotiated value). Three operating expenses will also be considered to calculate the net income. First expenditure is the fund management fee. It corresponds to \$ 30,000 (1.5% of the initial fund resources) per round. The other two expenses are penalty when the fund does not follow the rules. One penalty is charge when the managers do not respect the mandatory limit of 20% to invest in bonds. The other is charged when the managers spend more than the available resources (an emergency loan will be provided). Both penalties are charged at 10% of the exceeding expenditures.

## RESULTS

Three kinds of results were analyzed: funds' performance, students' perceptions about the experience and students' perceived acquired knowledge. Funds'

performance was analyzed by using the reports from the simulator. Students' perceptions were analyzed by using data gathered from the semi-structured questionnaire.

Manufacturing simulations (class 1 and class 2) were administrated by the same professor, using the same simulator and with equal scenarios. Thus, different companies' performance between manufacturing simulations is expected to be related with adopted strategies to compete in their respective markets. Overall, the manufacturing companies faced a difficult scenario in both simulations. Domestic market grew between 1.8 to 2.0% by quarter, but supply growth was significantly higher. Moreover, the companies started with a problematic capital structure; that is, the indebtedness was too high. As a result, the stock market index was negative in the three last rounds for both simulations. The stock market index was -22.4% in simulation A and -16.4% for simulation B. In the last round, the index declined in 1.3% for simulation A and 7.1% for simulation B, as it can be seen in Figures 1 and 2. Given these macroeconomic analyses, in the next paragraphs the investment fund simulations will be discussed.

Fund industry was composed by six funds in simulation A and nine funds in simulation B. Funds were named by the first name of each manager. After three rounds, average fund return of simulation A was negative, but better than stock market index (-15.6% against -22.4%). However, in last round it was positive and significantly better than stock market index (8.7% against -1.3%). Such data suggest that fund managers learned about the stock market industry by selecting better stocks to operate. In simulation B the average fund return was worse than stock market index (-19.7% against -16.4%). In last round the average fund return was also negative, but this time it outperformed the stock market index (-5.1% against -7.1%).

Results show that funds of simulation A outperformed not only the stock market index, but also funds of simulation B. A question arises: Why have funds of simulation A outperformed their counterparts? The higher number of funds in simulation B cannot be alleged as one possible answer because competition among funds was not incentivized (the comparative fund report was only available by the end of the simulations). Two possible hypotheses are: (1) manufacturing companies of simulation

A outperformed their counterpart in simulation B, and (2) funds' managers of simulation A were more skilled than simulation B.

Table 1 presents data for hypothesis 1. Comparing the stock market indexes, it can be observed that simulation A index was worse than simulation B index (-22.4% against -16.4%) and both are quite similar in round 8 (47.61 against 48.84). In a first glance, it can be inferred that funds' managers of simulation B should outperform managers from simulation A. However, index is an average, that is, it is a measure of central tendency. Thus, if the range is considered, it is possible to observe that variation in simulation A is much higher in round 8 (\$ 80.2 against \$ 71.4). Main reason of this variation was Etc & Tal Company. It lost more than 80% of its value in only 3 rounds. In simulation B, by contrast, Top Prime, the merged company, increased its stock market value in 58.8% in the same period. It had outperformed all other companies. Contradictory data refute hypothesis 1, and reinforce the hypothesis 2; that is, fund's performance is manager related (in depth analysis about this issue will be provided later).

Analyzing the funds of simulation A (Figure 1), it is possible to observe that only Heraldo&Marco Fund had a positive return (12.0%). Two funds (Mariane&Marco, Taise&Vinicios) had negative returns, but their performances were superior to the stock market index. The remaining three funds had worse performance than the stock market index. Additionally, it can be observed that all funds had positive returns in the last round. The fund with the best performance in the last round was not the winner one, but the second in the rank (Mariane&Marco with return of 12.6%). Thus, data indicate that the dispute for the leadership could intensify whether more rounds were simulated.

Differently from the simulation A, all funds of simulation B (Figure 2) had negative returns. Four out nine funds outperformed the stock market index. A surprise happened in the last round: contrary to simulation A, all funds had negative performance. Additionally, in this round the winner fund (André&Diandra) only got the fourth place, indicating that, as to simulation A, the dispute could also intensify in the next rounds.

Financial figures were previously discussed. Next step is to identify how students perceived the experience and

**Table 1**  
**Stock prices by company in rounds 5 and 8**

<b>Simulation A</b>	<b>Etc &amp; Tal</b>	<b>Inovarte</b>	<b>Lifetech *1</b>	<b>Ultratech *3</b>	<b>Eletró Home</b>	<b>Future Now*2</b>	<b>Magic Way</b>	<b>-</b>	<b>Index</b>	<b>Range</b>
Prices in round 5 (\$)	34,51	83,55	63,05	64,52	59,23	62,67	62,35	-	61,41	49,04
Prices in round 8 (\$)	6,70	86,97	0	75,79	43,48	0	25,12	-	47,61	80,27
<b>Gap (%)</b>	-80,59%	4,09%	-	17,47%	-26,59%	-	59,71%	-	22,47%	63,68%
<b>Simulation B</b>	<b>Gigabox</b>	<b>Apollo *1</b>	<b>Top Prime *3</b>	<b>Gigaware</b>	<b>Optimus *2</b>	<b>E Agora Zé</b>	<b>Stark Ind.</b>	<b>Long Life</b>	<b>Index</b>	<b>Range</b>
Prices in round 5 (\$)	56,80	28,40	54,18	78,60	61,19	65,82	75,67	47,13	58,47	50,20
Prices in round 8 (\$)	18,22	0	86,07	68,66	0	37,04	68,44	14,58	48,84	71,49
<b>Gap (%)</b>	-67,92%	-	58,86%	-12,65%	-	-43,73%	-9,55%	69,06%	16,47%	42,41%

how much learning they achieved about the financial market. To do so, a qualitative approach was performed by using a semi-structured questionnaire. Two open-ended questions were asked to the participants stress their management styles: (1) strategies used to manage the fund; and (2) the best and the worst stock transactions, specifying the involved companies. A four-item Likert-Scale question was formulated to measure the use of sources of information (data are shown in Tables 2 and 3). Last two open-ended questions were asked to measure the learning achieved by the participants: (1) lessons learned with the simulated experience; and (2) open question for students stress their feelings about the experience. The questionnaires had 100% response rate; that is, six from simulation A and nine from simulation B.

Data from question 1 were reduced showing three patterns. Participants defined their strategies focusing on: (a) types of used information, (b) what securities to invest, and (c) how to invest. Two main sources of information emerged as strategic: contact with companies' managers and financial report analyses. Some participants gave special attention to the operational information because they could be used to predict companies' outcomes. Examples of such information are production capacity, inventory, market share, and R&D investment. Strategic securities were bonds (especially when participants observed a bear market tendency), stock of companies with the best performance, and managers' concern about portfolio diversification. Finally, some participants based their transactions on the well-known stock market orientation: buying when the share price is low and selling when it is high. An alternative declared strategy was selling the share with loss to prevent higher losses.

In the second question participants stressed their most successful, and unsuccessful, operations. As in both simulations a bear market was established, successful operations were rare. Most demonstrations were focused on less loss rather than earnings. By contrast, big losses were described by almost all participants. The biggest lost was 81% by Stephane&Tchiara Fund (simulation A) and the smallest one was 19% by Cristiny&Valter Fund (simulation B). Five out six funds of simulation A stressed worst operation with a single company (Etc. & Tal). In simulation B the biggest lost were distributed along 3 companies (E Agora Zé, Gigaware and Long Life).

Fund simulations were administrated to achieve a specific learning objective: Initiate students in the stock market. However, no explicit orientation was given about the kinds of learning were supposed to be achieved. It would be up to the students to define. Considering this flexibility, the question about lessons learnt becomes a very important aspect to be analyzed. Five patterns were identified:

- Importance of the information – Eight answers did reference about the importance of the information and the decision making process.
- General knowledge – Understanding about the rules and dynamics of the stock market and its complexity.
- Specific knowledge – Some participants described topics such as taxes, brokerage commission and dividends payments.
- Learning from examples – Some learning was achieved toward specific examples appeared in the simulated stock market. According to the students'

**Figure 1**  
**Report about funds' performance – Simulation A**

Fundo	Heraldo&Marco	Mariane&Marco	Taise&Vinicius	Edson&Rafael	André&Paola	Stephane&Tchiara
Posição no Ranking	1º	2º	3º	4º	5º	6º
Valor atual da carteira de ações	2.140.856,00	1.666.869,00	1.264.376,00	1.565.410,00	1.251.896,00	1.366.488,00
(+) Aplicação renda fixa	0,00	0,00	320.000,00	0,00	200.000,00	50.000,00
(+) Saldo final de caixa	99.320,27	82.612,54	57.554,67	-38.042,19	53.098,69	42.715,43
(-) Total de recursos do fundo	2.240.176,27	1.749.481,54	1.641.930,67	1.527.367,81	1.504.994,69	1.459.203,43
Rentabilidade do fundo (%)	12,01	-12,52	-17,90	-23,63	-24,75	-27,04
Rentabilidade do fundo no período (%)	10,28	12,66	10,72	3,41	9,82	5,59
Variação da carteira de ações (\$)	178.500,00	297.771,00	-158.097,00	-100.433,00	114.016,00	-241.648,00
Variação da carteira de ações (%)	9,10	21,75	-11,11	-6,03	10,02	-15,03

words ‘... a share price is not too low that it cannot continue to fall down’, ‘... a big merger can change drastically the established share prices’. A common sense rule was also described by a neophyte student ‘... when a company has financial losses, investors reduces their buys and the share price falls’.

- **Theory in practice** – Albert Einstein once said that ‘learning is experience. Everything else is just information’. Simulation is based on this quotation; that is, learning is achieved by participating in a simulated experience. In investment fund simulation the students did experienced theoretic concepts in practice. Two declared learning exemplify such statement. First, it is the agency theory concept, used in different disciplines such as accounting, economics, finance, market, political science, organizational behavioral and sociology (Eisenhardt, 1989). In stock market the agency theory can be discussed in terms of information asymmetry between managers and investors. Four participants, acting as investors, stressed the limited information in relation to companies’ managers. They felt that managers had much more information than them. Thus, the limited information prevented, according to them, to make better decisions. Secondly, the concept of portfolio diversification. It was cited as a good strategy to protect the investment. However, participants regretted they have discovered such strategy too late.

In the final question students were asked to write comments about the experience. They were categorized in three groups:

- **Differences between real and simulated worlds** – No relationship between volume of transactions and share prices and lack of behavioral finance in the simulated world.
- **Suggestions** – Five out fifteen respondents cited the short duration of the simulation. According to them, three rounds are not sufficient to fully understanding the stock market. Two teams suggested starting the investment fund simulation before the merger process. Thus they could invest in the involved companies.
- **Personal evaluations** – Four teams spontaneously declared their satisfaction with the experience. According to them, it was a fruitful experience because it brought knowledge in a simple and fast way.

Tables 2 and 3 compile the sources of information used by the funds’ managers. Main sources of information were financial and market reports. The majority of respondents declared to have used them in all rounds. Results were not surprise because such reports were essentials to the decision making process. Financial reports provided the earnings and the dividends figures. Market reports contained the shares prices to be used in the transactions. But macroeconomic reports were barely used. In both simulations ‘Seldom’ was the most cited answer. These reports were expected to be more explored, because they provided compiled information of the simulated scenario. Information of the macroeconomic reports could also be accessed in a graphic format. But, they were not used as well as they could have been.

Relationships among managers were expected to occur intensively, especially between funds’ managers and

**Figure 2**  
**Report about funds’ performance – Simulation B**

Fundo	André & Diandra	Marcelo & Oberti	Luana & Priscila	Cristiny & Valter	Luiza & Michel	Carla & Rodrigo	Joice & Leticia	Ereni & José	Raphael & Rafael
Posição no Ranking	1º	2º	3º	4º	5º	6º	7º	8º	9º
Valor atual da carteira de ações	1.253.985,00	1.755.658,00	1.400.198,00	1.422.620,00	1.631.207,00	1.448.964,00	1.265.814,00	1.226.567,00	1.165.155,00
(+) Aplicação renda fixa	360.000,00	0,00	100.000,00	315.601,37	0,00	150.000,00	200.000,00	38.882,70	0,00
(+) Saldo final de caixa	220.447,19	46.765,92	295.560,96	30.036,69	35.928,52	-30.597,67	101.867,84	-6.440,17	15.255,02
(-) Total de recursos do fundo	1.834.432,19	1.802.423,92	1.795.758,96	1.768.258,06	1.667.135,52	1.568.366,33	1.567.681,84	1.259.009,53	1.180.410,02
Rentabilidade do fundo (%)	-8,28	-9,88	-10,21	-11,59	-16,64	-21,58	-21,62	-37,05	-40,98
Rentabilidade do fundo no período (%)	-4,28	-6,21	-6,09	-5,47	-3,35	-2,55	-3,55	-10,90	-4,32
Varição da carteira de ações (\$)	-142.811,00	-169.042,00	-177.205,00	-230.454,00	-83.617,00	-69.801,00	-257.322,00	-665.092,00	-8.310,00
Varição da carteira de ações (%)	-10,22	-8,78	-11,23	-13,94	-4,88	-4,60	-16,89	-35,16	-0,71

companies' managers to gather inside information. As expected, contacts between these two types of managers were more intense than contacts among funds' managers to both simulations. Contacts among funds' managers provided only secondary information or they would be based on the managers' perceptions. Such contacts could also be considered as undesired because these managers were competitors.

Sources of information outside the simulated environment were not used by any manager. Such sources could be from related discipline professors, real stock market people (e.g., investors, brokers) and reference materials (e.g., academic papers, specialized magazine articles). At least two reasons can justify the absence of external source of information: (a) the professor has not indicated what kind of information to look for; and (b) the stock market simulation was not based on real share prices.

### CONCLUSION

Results of the investment fund simulation are analyzed in three perspectives: (1) comparative performance of the investment funds, (2) students' perceptions about the vivid experience, and (3) acquired knowledge. Funds' performance was compared with the stock market index and among them. On average, funds of simulation A outperformed funds of simulation B. As a bear market was simulated, all funds had negative returns. Data indicate that performance is skill related and students learned how to develop and implement investment strategies in the financial market.

Students' perceptions about the vivid experience and the acquired knowledge were analyzed using data gathered by a semi-structured questionnaire. They stressed learning about the stock market; its dynamics and particularities. Students perceived the importance of the information to the decision making process. Moreover, they realized the information asymmetry impact upon the stock market, as discussed in the agency theory literature. As novice in the field, students experienced basic theoretical and practical aspects of the stock market. They externalized subjects such as portfolio diversification, share price fluctuation dynamics and the impacts of new events in the stock

market. Overall, students pleased with the experience. According to them, it brought knowledge in a simple and fast way.

This research was conducted to evaluate the results of the investment fund simulation integrated with a manufacturing simulation. As a pilot, this study had some limitations. The lack of time for running more than three rounds was the major one. Another limitation was the reduced number of participants in the investment fund simulations (30 students). Thus, it is suggested to replicate this research by increasing the number of simulated rounds and of students to extend the validity of the study's findings.

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**Table 2**  
**Managers' use of information to decide which stock buy or sell in simulation A**

Item	Never	Seldom	Frequently	Always
Financial reports	0	1	0	5
Market reports	0	1	1	4
Macroeconomic reports	2	3	1	0
Newspaper	0	1	2	3
Companies indicators graphics	1	1	2	2
Macroeconomics graphics	3	2	1	0
Contacts with managers of the simulated companies	1	1	1	3
Contacts with managers of the simulated funds	2	1	2	1
Contacts with other people. Specify: _____	6	0	0	0
Other sources: Specify _____	6	0	0	0

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**Table 3**  
**Managers’ use of information to decide which stock buy or sell in simulation B**

Item	Never	Seldom	Frequently	Always
Financial reports	0	1	1	7
Market reports	1	0	4	4
Macroeconomic reports	1	5	1	2
Newspaper	1	0	4	4
Companies indicators graphics	0	3	1	5
Macroeconomics graphics	2	5	1	1
Contacts with the simulated companies managers	2	4	2	1
Contacts with the simulated funds managers	6	2	1	0
Contacts with other people. Specify: _____	9	0	0	0
Other sources: Specify _____	9	0	0	0