

Modeling the Dynamics of the Egyptian Stock Market

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Abstract

The Egyptian stock market has been experiencing a set of fluctuations over the past two years. This was caused by several factors that include the behavior of the Egyptian Economy, as well as the performance of the other Middle Eastern stock markets. In this paper we use System Dynamics as a tool for mapping the performance of the CASE 30, Egyptian Stock market index, to identify the various interacting feedback loops that triggered such performance. These loops are then incorporated in a system dynamics model that is used to understand the causes of such performance as well as developing several scenarios for managing the various factors affecting the Egyptian stock market.

Introduction

The Egyptian stock market is among the oldest stock in the world dating back to 1883. It consists of both the Alexandria stock exchange, founded in 1883 and the Cairo stock exchange, founded in 1940's. However, during the 1950's Egypt adopted a socialist regime that resulted in a wave of nationalization which in turn deemed all the outstanding stocks of previously traded companies obsolete, as these companies turned state owned.

Throughout the 1990's, the Egyptian government carried out economic reform programs that included privatization of state owned companies; liberalization of the financial market; and adoption of market based economy. This resulted in the re-activation of the Egyptian Stock Market, (Capital Market Law 95/1992). Further, the Presidential Decree No. 51 for year 1997 redefined the legal structure of the Exchanges and accordingly the Cairo and Alexandria Stock Exchanges have been merged into one entity (The Cairo and Alexandria Stock Exchange or CASE) with one Chairman and one Board of Directors, and two locations: Cairo and Alexandria.

Today, the Egyptian Stock market is an active market that has market capitalization of \$27,847.48, CASE Annual report 2006.

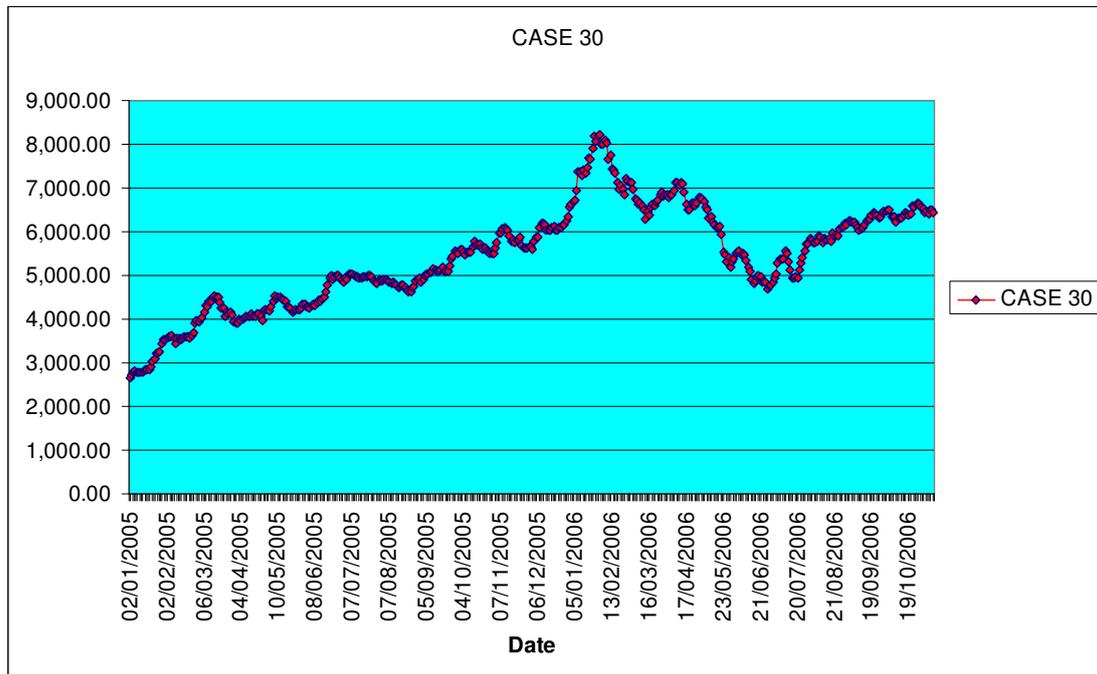


Figure 1 Performance of the Egyptian Stock Market in the Year 2005

As the Egyptian Stock market grew, it started attracting investors from inside and outside Egypt, all investing in the Stock Market with the aim of maximizing the value of their investments as well as growing their portfolios. The current growth of the Egyptian Stock market started by the year 2003 and reached its peak in 2005. However, after reaching its peak in 2005, the Egyptian stock market started to experience some severe fluctuations that resulted in an awakening of the policy makers as they tried to understand this phenomena and tried to develop policies that will guard against such severe fluctuations in the future, figure 1.

This paper attempts to explore the factors affecting the recent fluctuations in the Egyptian Stock market. In doing so, we selected System Dynamics as a tool for mapping the various forces that shaped the recent performance of the Egyptian Stock market. Such approach resulted in the development of a System Dynamics model that is used first, to understand the forces shaping the Egyptian Stock market performance, and second, to examine various policies that can dampen the effect of such severe fluctuations.

The theoretical framework section of this paper presents the theoretical background used to develop the model. Following this presentation, the model section presents the formulation of the System Dynamics model used to explore the forces that affect the behavior of the Egyptian Stock market. Further, the results section outlines the testing of various policies and scenarios that are developed to understand the behavior of the model. Finally, concluding remarks and recommendations are presented to provide analysis of the research as well as providing recommendations for future research.

Theoretical Framework

The quest for understanding the behavior of the stock market has been examined extensively throughout the literature. This resulted in the development of theories and models that examine the various factors affecting the stock market performance. Cutler et al. (1989) examined the behavior of stock markets in developed countries and have found many forces that shape its behavior. Out of these forces are the reaction of the stock market to the announcement of various events, Ball and Brown (1968) ; Fama(1969) examined the reaction of the stock price to stock splits; McConnell and Muscarella(1985) studied the impact of capital expenditures; Klein(1986) examined the impact of divestitures; Jensen and Ruback (1983) studied the effect of takeovers on stock pricing; Chan (2002) examined the speed of Stock price adjustment to information.

While most of these studies examined the performance of stocks in developed markets, little studies have been conducted to examine the performance of the stock markets in developing countries. Among the few studies that examine the performance of stock markets in developing countries is the study conducted by Ignatius (1998) who examined the performance of the Bombay Stock exchange in India.

The study of stock market behavior in developing countries requires first to understand the factors that govern the behavior in of stock markets in developing countries. Hess (1998) highlighted such factors as:

- Gross domestic product per capita substantially below the average for developed economies.
- Greater government regulation limiting or banning foreign ownership in domestic companies.
- A lax and/ or corrupt regulatory environment.
- Inefficient back office operations including clearing and settlement capabilities.
- Restrictions on repatriation of initial capital, dividends, interest and capital gains.
- Greater perceived investment risk than in developed markets and a general perception by the investment community that the country should be considered emerging.
- Massive privatization schemes
- Lack of investors confidence due to inadequate disclosure of companies information
- Lack of training for financial market participants (investors, local intermediaries, brokers)

Further, Papaioannou and Duke(1993) outlined four evolutionary stages in the development of Stock Markets. These stages are:

1. Equity markets tend to develop only after a country has achieved a degree of economic and political stability and begun implementing growth- oriented policies. In this phase, equity prices tend to rise encouraging the confidence of domestic investors. The market be

comes more widely accepted as an investment alternative to traditional bank deposits and government securities.

2. In the second phase, because the equity market now has some degree of credibility, pressure abroad for greater accessibility and at home for cheaper capital funding leads to a loosening of regulations in the domestic capital markets. As investment barriers decline and as market liquidity and risk-adjusted returns increase, international investors begin to realize the diversification benefits of investing in such markets.
3. In the third stage, the market offers the prospect of higher, less volatile returns, and investors easily absorb new issues of stocks and bonds. The volume of new issues increases as firms strive to pay down debt and private or newly privatized companies make their initial public offerings. Trading volume increases, producing greater market efficiency, while the growing need for a risk transfer mechanism spurs the development of equity and currency-hedging instruments such as derivatives.
4. In the final phase, equity risk premiums fall to internationally competitive levels relative to short-term money market rates. The equity markets begin to achieve the stable growth that marks a mature or developed country.

Based on these two studies, it can be argued that the Egyptian Stock market is as a developing stock market which is currently in the second phase of development as outlined by Papaionnou (1993) and is in the process of developing into the third stage.

Moreover, when comparing between developing and developed stock markets, it is obvious that stock pricing in developed markets is based on market efficiency, while developing stock markets are characterized to have weak market efficiencies, Dockery(2000). Such weakness in market efficiencies calls for the intervention of governments directly by imposing price limits or indirectly through securities laws and regulations, Dockery(2000) and Phylaktis (1999).

Model Development

After presenting the theoretical framework that regulates the stock prices, we now move to present the system dynamics model we developed to model the behavior of the Egyptian Stock Market. The model is developed for a typical stock that is registered in the CASE30 index. In doing so, we have developed the following assumptions:

1. The price of the share is determined by the supply and demand for stocks. The supply is represented by the amount of shares available for sale; sell orders. On the other hand, demand is represented by the number of buy orders placed to buy the shares.

2. Investors in the Egyptian Stock market are grouped into four basic categories, namely; Local Small investors, Local Large investors, Foreign investors(Arabs and others), and finally Government. The definition of each class is provided as follows:

Local Small Investors: This class represents the small Egyptian investors, individuals who invest in the stock market. This group is divided into two sub-classes: Local Small Direct Investor, LSDI; and Local Small Indirect Investor. The direct local small investors represent the local investors trading directly in the stock market, and the Indirect class represents those who invest in the stock market indirectly through financial vehicles such as mutual funds.

Local Large Investors, LLI: This class of investors represents large investors (individuals and corporations) who invest in the stock market directly, but because of the volume of their investments, they seek the help of qualified financial advisors and rely on availability of information and sophisticated technical analysis.

Foreign Investors: This class of investors represents those other than Egyptians or Egyptian Companies investing in the Egyptian stock market. This class is broken further into two subclasses; Arab Investors, AI, and Other Investor, OI. The Arab investors represent those from Arabian countries, mainly Gulf countries, investing in the Egyptian stock market. The others class represents all other non-Egyptian nationals investing in the Egyptian stock market.

Government: This fourth class represents the different branches of the Egyptian Government investing in the Egyptian Stock market.

The breakdown of each class of investor, their motives, investment strategies and the factors that affect their investment decisions are presented in table (1).

Table 1: Classification of the various investor types investing in the Egyptian Stock Market

Investor Type	Local Small Direct Investor	Local Small Indirect Investor	Local Large Investor	Arab Investor	Other Investor	Government
Reason for Investment	Short term profit	Long-term profit	Long-term profit	Portfolio diversification and investment of surpluses from oil revenues	Portfolio diversification	Stabilize the market
Reliance on Technical Analysis	No	Yes	Yes	Yes	Yes	Yes
Ability to sustain loss	Low	High	High	High	High	High

Following the presentation of the assumptions, we now move to introduce the system dynamics model used for mapping the Egyptian Stock market. The model is developed in four sections: Supply-Demand and Share Price section, Buy and Sell

Transactions section, Financial Section, and Share Ownership section. The details of how each of these sections is formulated as follows:

Supply-Demand Share Price

The first section presents the mapping of the supply-demand and their interaction with the stock price, figure (2). The upper section of the model represents the mechanism by which share prices change. This is achieved by mapping the share price as a stock that is changed through the stock price change rate. This rate is expressed as a function of the current stock price, the demand/supply ratio, share price elasticity and the price limit. The demand supply ratio is formulated as the ratio of Demand to Supply for the stock. The price elasticity represents how sensitive the share price is to changes in the Demand/Supply ratio. As for the price limit, this represents the maximum percentage imposed by the Stock Market officials for allowed stock price changes.

The demand for shares is modeled as the total of the buy orders placed by each type of investor investing in the Egyptian Stock market. Similarly, on the supply side, the total supply consists of the total placed sell orders placed by the various investors investing in the Egyptian Stock market represents the supply as well as the rate of new share offerings placed in the Egyptian stock market. The fulfillment rate represents the minimum of the supplied and demanded shares.

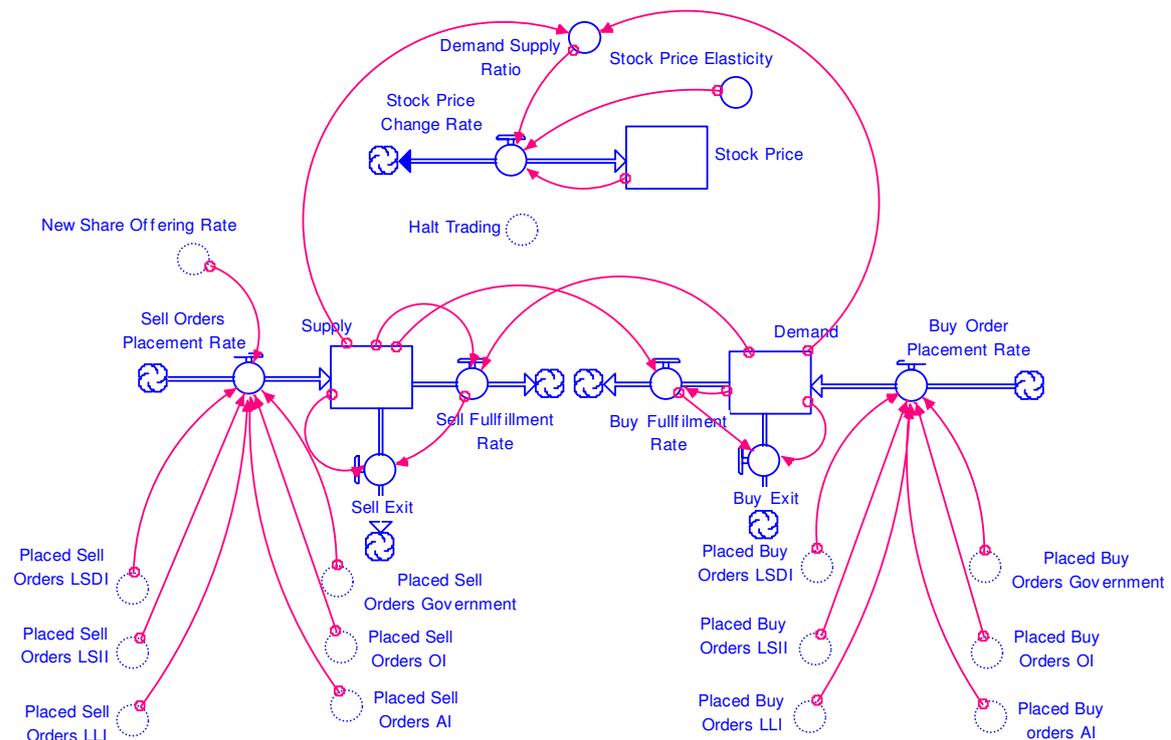


Figure 2 Mapping the Supply-Demand Interaction and Stock Price

Buy/Sell Decisions

The buy/sell decision varies from one type of investor to the other. Figure (3 a-f) present the factors used in formulating the buy/sell decisions for each investor type,

and how they are incorporated in the model. In the case of the Local Small Direct Investor, LSDI, investment decision is initiated by the pure profit motives and depends on:

1. Perception about the direction of the price of the stock
2. Stock price appreciation
3. and the inability of the small investor to sustain loss

The mapping of the investment decisions environment of the LSDI is modeled as presented in figure (3-a) for both the buy and sell decisions.

In the case of the Local Large Investor, LLI, investment decisions are based on the long-term view of the market. Further, as presented earlier, this type of investor relies mainly on sound technical analysis and long-term growth forecasts. The strategies employed by this type of investors are:

1. Buy low sell High strategy
2. Consider the long –term stock performance
3. Have the ability to sustain short-term losses in return to long-term gains

The technical analysis of the stock is used to determine the real value of the share price; the maximum and minimum ranges for the price to move, as well as the long term-forecast for the share price. This in turn has resulted in developing the mapping of the investment decisions environment of the LLI is modeled presented in figure (3-c). Further, a similar environment is used for mapping investment decisions made by the Local Small Indirect Investor (professionally managed investment funds), figure (3-b) .

The case of the Arab is presented in figure (3-d). Added to the current stock price, the technical assessment of the stock price, the long term-forecast, another factor is considered, the Arab Investment Funds allocated for investment in the Egyptian Stock Market. Given all these factors combined, the mapping of the investment decisions of the Arab investors is presented in figure (3-d).

Moving to the Other Foreign Investors, case e, investment decisions are modeled in a similar fashion as the case of Arab investors, with one difference that is these decisions are constrained by the funds made available for investment in the Egyptian Stock market by the Other Foreign Investors. The mapping of such decisions is presented in figure d.

The modeling of the last type of investor, Government Investor is presented in case e. The Egyptian Government invests in the Stock market for two main reasons:

1. Stabilize the Market in the case of the market falling below its fair value
2. Use the stock market to invest social security funds. However this type of investment is considered as part of the Local Large Investor.

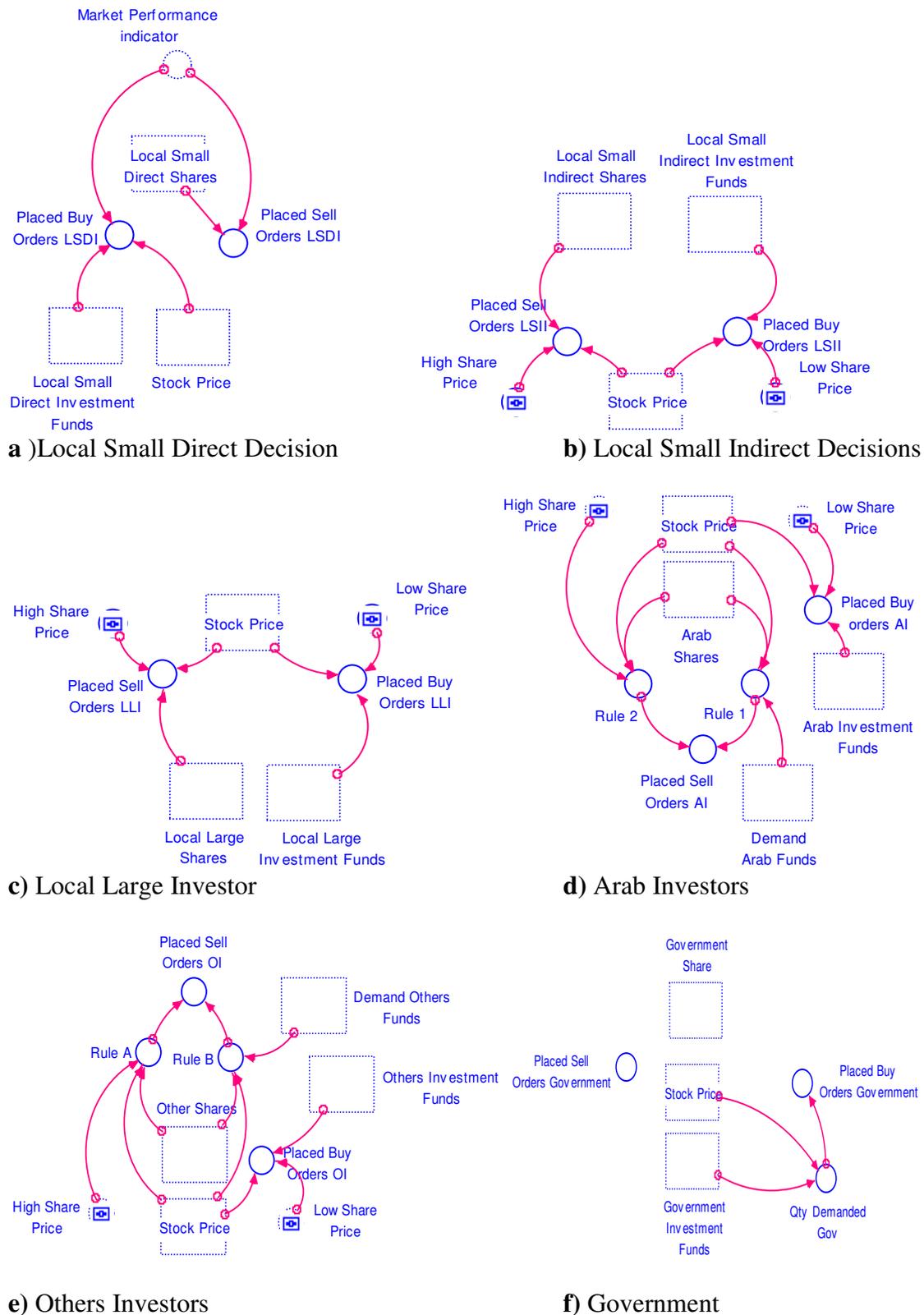


Figure 3 Mapping of Buy and Sell Decisions for each type of Investor

By incorporating these two factors, the investment decision of the Egyptian Government is presented in figure (3-f). The buy and sell decisions are affected by the market price, funds set aside by the Egyptian government for investment in the stock market, and the technical analysis of the performance in terms of the price fluctuation range, and the long-term price forecast.

Mapping the Financial Section

The final section of the model deals with the mapping and formulation of the funds made available for investment in the Egyptian Stock market. As the buy/sell decisions, these funds differ from one type of investor to another. The detail of how the fund of each type of investor was formulated is presented as follows:

Local Small Investor

The funds available for investment by the Local Small Investor are divided by their decision whether to invest directly in the stock market, or to investment indirectly through professionally managed investment funds.

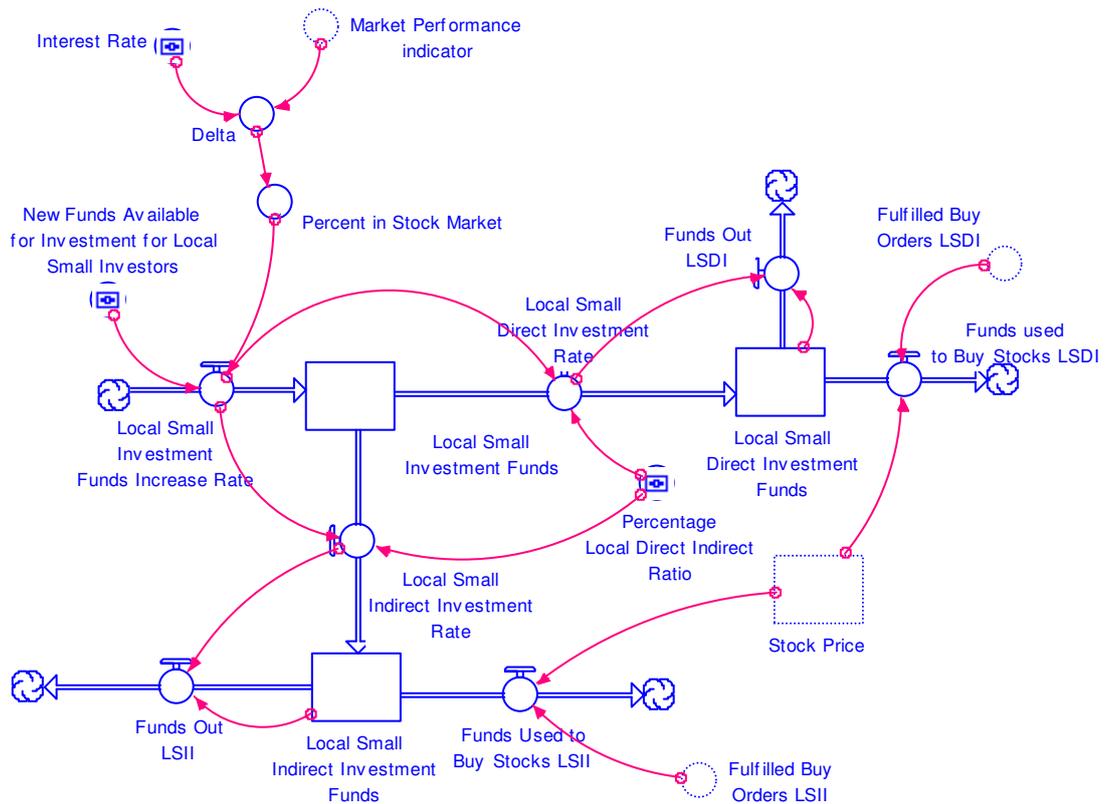


Figure 4 Mapping of funds for the Local Small Investor

The percentage of direct to indirect decisions is set to a slider as changes in this percentage represent various policy scenarios that are investigated later. The total funds available for investment in the stock market is calculated based

on the new funds available to the local small investors, the current bank interest rate and the market performance indicator. The mapping of local investors' funds is presented in figure.

Local Large Investors

The modeling of the funds invested by the Local Large Investors is presented in figure . These funds are dependent on the funds allocated for investment by the large investors, and the market performance rate.

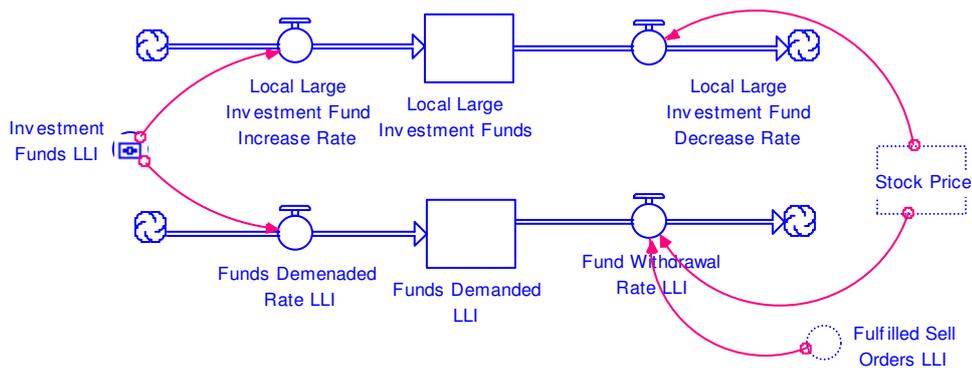


Figure 5 Mapping of funds for the Local Large Investor

Arab Investors

The mapping of the Arab Investment funds allocated to the Egyptian Stock market is presented in figure. The flow of Arab Investment funds is governed by the oil revenue surpluses that have been enjoyed over the past years as well as the Egyptian Market performance indicator. Withdrawal of these funds on the other hand is controlled by commitments Arab Investors have to fulfill in their home markets; primarily due to cover losses that result from fluctuations in their stock markets.

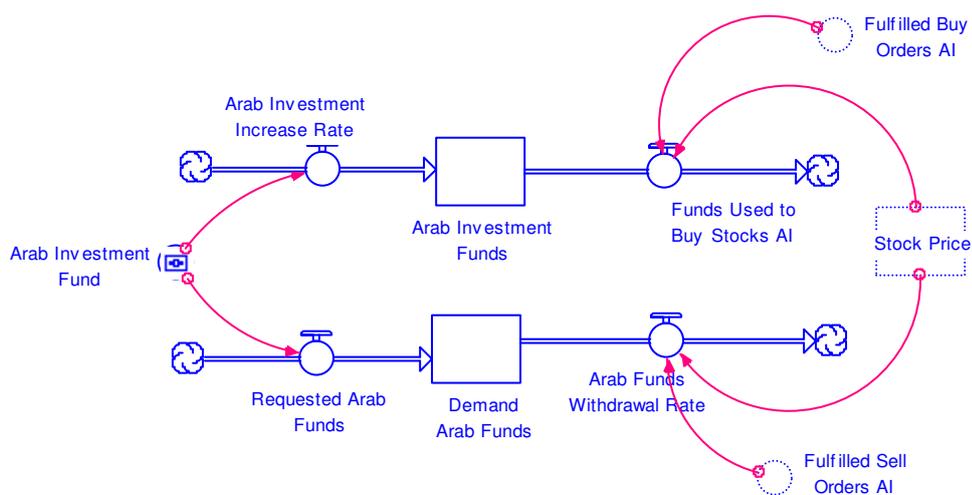


Figure 6 Mapping of funds for the Arab Investor

Other Investors

The mapping of the Other Investors Funds is presented in figure. The increase rate of these funds is affected by the Egyptian Stock Market Performance Indicator, the Country Stability Index, and New funds made available for Investment in the Egyptian market. The decrease rate on the other hand is affected by the market performance indicator and the country stability index.

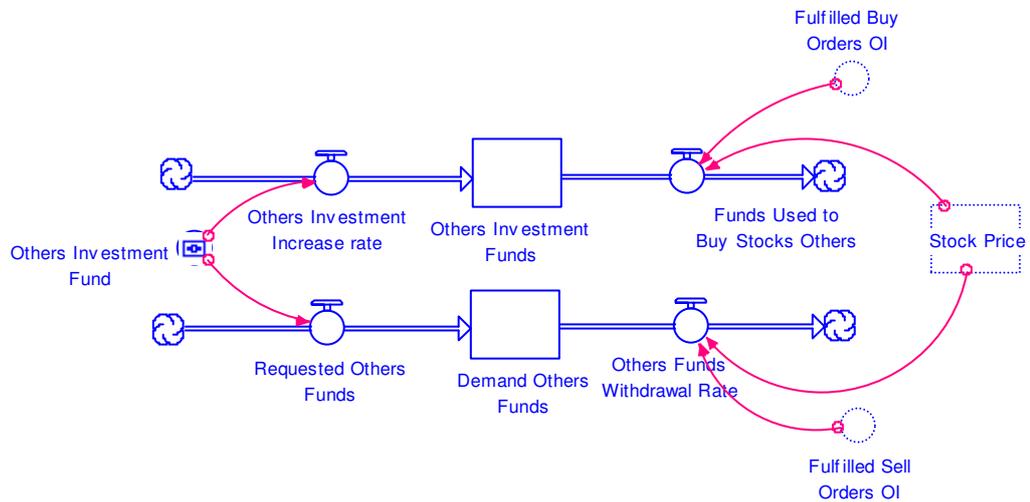


Figure 7 Mapping of funds for the Others Investor

Government

The funds made available by the Egyptian Government for investment in the stock market is modeled as presented in figure. The market performance indicator plays as a trigger for the Government decisions. As the market performance goes down, the Egyptian Government steps into the market in order to stabilize prices. Further, the Egyptian Government uses the Stock Market to invest social security funds in order to enable the future payments as they are required.

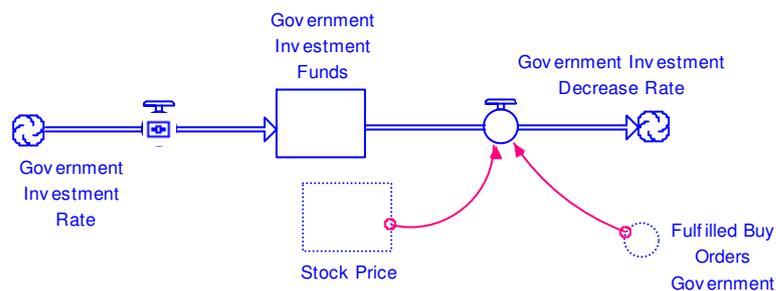


Figure 8 Mapping of funds for the Government

Share Ownership

The final part of the model deals with share ownership. Six similar stocks and flow sub-models were developed to map the share ownership, figure (a-c). As presented in figures a-c, the stock that maps the shares held by each type of investor increases from the buy orders placed by the investor multiplied by the buy fulfillment percentage.

Similarly, the stock of shares is decreased via the fulfilled sell orders flow that is calculated as the product of the placed sell orders and the sell fulfillment rate.

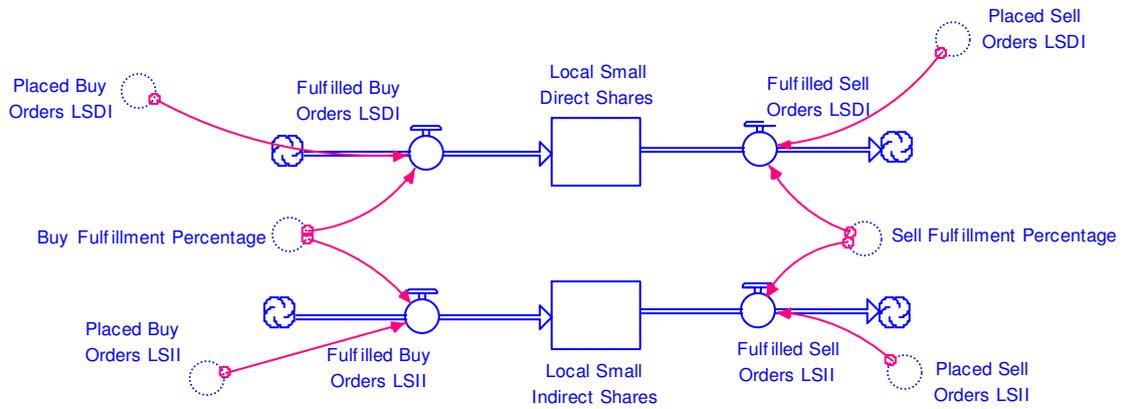


Figure 9 a Mapping of share ownership for Local Small Direct Investors and Local Small Indirect Investors

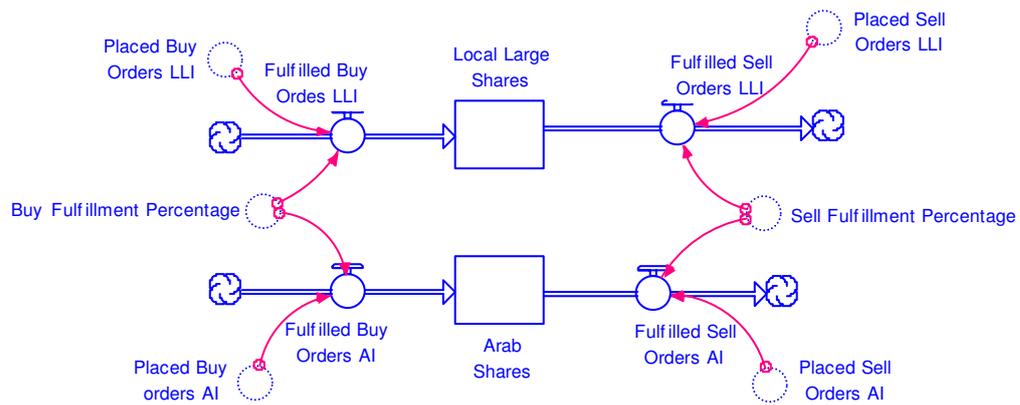


Figure 9 b Mapping of share ownership for Local Large Investors and Arab Investors

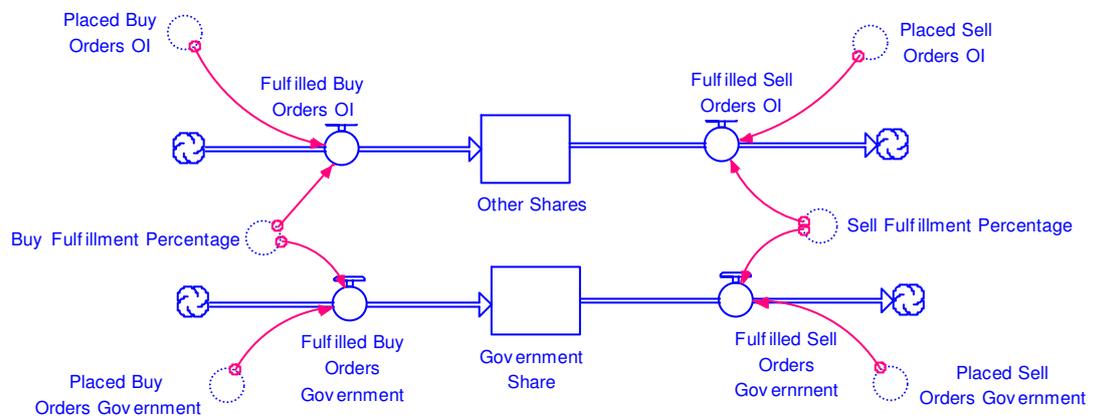


Figure 9 c Mapping of share ownership for Other Investors and Government.

Results

After presenting the model, we now move to present some scenarios that illustrate the model behavior. Three policy scenarios are presented to illustrate the behavior of the model. These scenarios investigate the effects of the following factors; Effect of Local Small Direct Investors, Impact of Fluctuations in the Arab Stock Markets, and Government Intervention.

Scenario 1: Impact of Local Small Direct Investors

This scenario represents the base scenario that explains the current situation in the Egyptian Market. As stock prices move upward, the market attracts Local Small Direct Investors who enter the market seeking fast profit. The increased demand generated by this type of investors' heats up the market, driving share higher than the high prices calculated based on the technical analysis. This in turn triggers the other investors, (Local Large, Arab and other) to sell their stocks to capture the profits. As a result, the supply of shares increases, leading the stock price to take a south turn. As this happens, Local Small Direct Investors start selling their shares as they have limited ability to sustain market loss, resulting in a bigger dive in stock prices to levels that are considered below the low prices estimated by the technical analysis. At this point, the market becomes more attractive to the Large investors who start to buy stocks, hence repeating the cycle, figure 10.



Figure 10 Basic Scenario

In dealing with this case, we recommend an Investment Policy that encourages small investors to seek the use of professionally managed funds that rely on sound technical analysis and limit their direct trading in the market. The impact of this policy is demonstrated in figure resulting in reduction of the cyclical fluctuations in the market, figure 11.

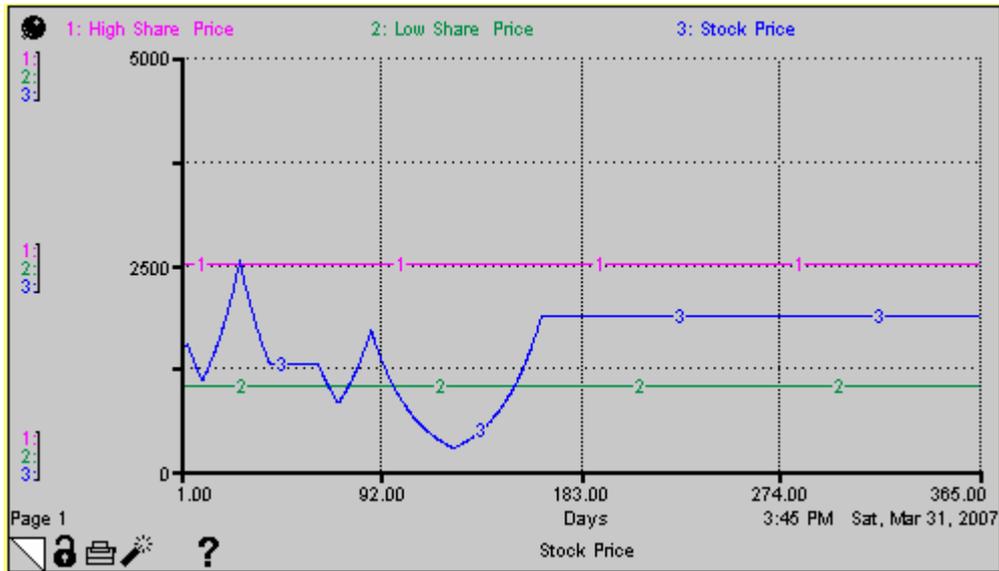


Figure 11 Effect of Eliminating the effect of Local Small Direct Investors

Scenario 2: Impact of Fluctuations in the Arab Market

This scenario investigates the impact of fluctuations in Arab Stock Markets on the Egyptian Stock Markets. As fluctuations take place in Arab markets, Arab investors start a selling frenzy to generate funds needed to cover losses in accrued in their markets. As this takes place, increase in supply of shares is experienced, driving the Egyptian Stock market prices down. This then triggers other investors, especially Local Small Direct Investors, resulting in further decrease in prices, figure 12.



Figure 12 Effect of Demand for Arab Funds on the Stock Market

Scenario 3: Dealing with Market Extremes

This case deals with market stabilization in the downward cycle. As the market prices decline and approach their low end, the policy calls for the government to temporarily intervene in the market by buying stocks. This will have two main effects namely:

- Increase confidence in the market, and stop the further decline of prices.
- Make the Government profits as they will buy at very low prices that will be transformed later to profits as the market recovers.

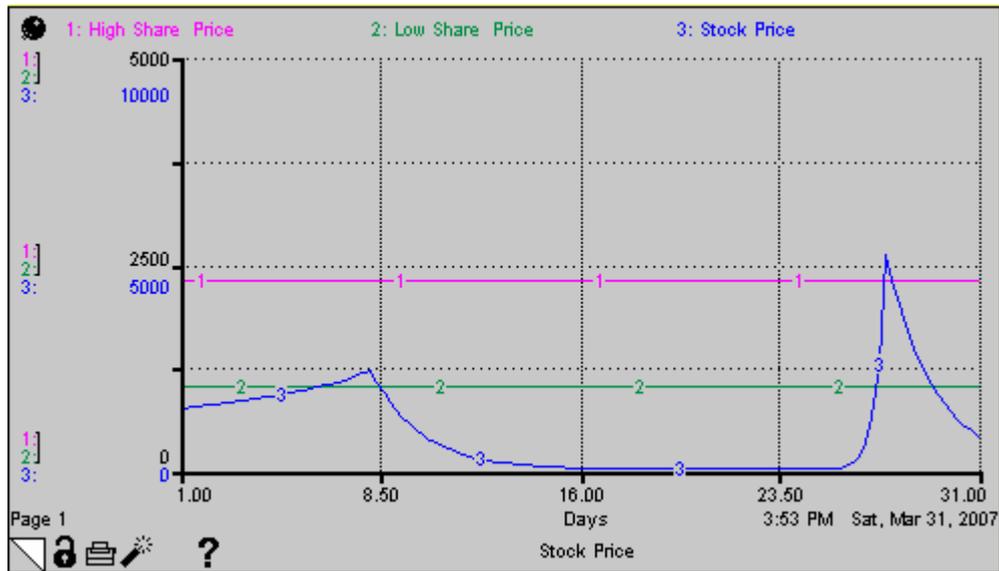


Figure 13 Effect of Government Intervention on the Stock Market

Concluding Remarks

This paper presents an exploratory model for studying the Egyptian Stock Market Dynamics. The model attempts to explain what is currently happening in the Egyptian Stock Market in face of speculative demand for stocks. As a result the policies presented investigate several scenarios that can be utilized in dealing with such fluctuations in the market.

Building on this paper, the model needs to be further expanded to incorporate the issues of risk associated with each type of investor, and the impact they will have on the overall market performance.

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