

## SRO Summary

**Student Name:** Andrew Hu, Class of 2016

**Title of project and professor(s) worked with:** “Psychological Aspects of Financial Decision-Making” with Professor Nicholas Barberis

**Brief description of research project, including findings:** The goal of the research detailed in this summary is to empirically attempt to measure what everyday individuals react to on charts when deciding between two possible investments. A survey was conducted to ask participants to select between two stocks based off of charts alone. This generated ~ 2000 data entries. Then, various chart attributes were computed and used as predictors to decide whether or not a chart was chosen.

To this point, it has been found that

- the Cumulative Prospect Theory value has significant predictive power in the logistic regression. That is, a chart with a high CPT value attracts investors
- An upward trend and lower volatility attracts investors

The above two corroborated our pre-regression hypothesis but it was also found that high skewness turned away investors, contrary to predictions.

To see a more detailed report, see the attached pages.

**Activities student was responsible for:** Creating, distributing, and evaluating the results of a survey aimed to determine how charts influence individuals in choosing stocks; applying a narrow framing model to the asset allocation puzzle (future)

**What student learned:** Dealing with the finer points of experimental finance, fundamental concepts of behavioral finance and the empirical evidence behind it

**Opinion of SRO experience:** I enjoyed it a lot. I felt like I learned a lot about behavioral finance and economics research in general.

## **SRO Summary Report**

**Purpose:** The goal of the research detailed in this summary is to empirically attempt to measure what everyday individuals react to on charts when deciding between two possible investments.

**Data Collection:** A list of all stock tickers available on Yahoo Finance was obtained and 30 stocks were randomly selected from this list. The 5-year stock price chart of these 30 stocks stretching from June 13, 2009 to June 13, 2014 was downloaded from Yahoo Finance.<sup>1</sup> These charts were then stripped of their y-axis (i.e. survey taker would not be aware of the actual price of the stocks) and of their names (i.e. survey takers would not be aware of which stocks they were choosing).

A proxy survey was set up on Amazon's Mechanical Turk that linked to a Yale Qualtrics survey. Amazon's Mechanical Turk is a tool that crowd sources human intelligence tasks, motivating "Workers" by providing payment for a task and a possible bonus. This particular survey paid \$1 with a possible bonus of \$0.25. The Qualtrics survey was set up with 11 questions. Each survey taker received 10 random questions that randomly selected 2 stocks (without replacement) and displayed them side-by-side, inquiring the survey taker to decide which stock to invest in. The 11<sup>th</sup> question (in Question #4, which was randomly selected), was a fixed question displaying stocks NBRXF and WF in order to facilitate the bonus. This choice was blind to the participants.

Survey takers were informed ex ante that a random question on the survey would be selected and the survey taker would be bonused if the stock they selected on that question outperformed the other stock. They were informed of the time period which the charts spanned and basic information regarding the purpose of the survey.

Each survey question had a minimum time of 60 seconds, requiring the survey taker to wait at least that long before advancing, and a maximum time of 90 seconds, forcing the survey taker to advance after that time.

Then, the daily and monthly stock price for each of the 30 stocks was downloaded from Yahoo Finance.

### **Methods of Analysis:**

There are several possible avenues of analysis. Some of these are still under exploration so below will only detail these avenues of analysis and preliminary results along them.

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<sup>1</sup> When the randomly selected ticker did not have 5-year price data available, it was replaced by another randomly selected stock.

The methods of analysis are probably best stratified by regression models:

$$z_i = \alpha \cdot \mathbf{x}_i + \beta \cdot \mathbf{y}_i + \epsilon_i$$

where  $\mathbf{x}$  is a vector of measurements corresponding to the left graph in the survey display,  $\mathbf{y}$  is a vector of measurements corresponding to the right graph in the survey display, and alpha and beta are vectors of coefficients for their respective predictors. The variable  $z$  is 1 if the left graph was chosen by the survey taker and 0 otherwise. The possibilities for  $\mathbf{x}$  and  $\mathbf{y}$  include the trend (average change), volatility (variance of change), skewness, or kurtosis on the daily/monthly prices levels or price changes. Another possible option is to consider the Cumulative Prospect Theory Value as set forth in "First Impressions..." paper. This method of analysis seems to be the strongest and has been, to this point, explored most.

Another possible regression model is:

$$z_i = \alpha \cdot \mathbf{x}_i + \epsilon_i$$

where  $z$  is the proportion of times stock  $i$  was selected when it was an option and  $\mathbf{x}$  is a vector of measurements corresponding to stock  $i$ . Possibilities for components of  $\mathbf{x}$  are similar to those in the previous regression model. This regression is a weak choice because the sample size is effectively 30 (one for each stock).

Recall that survey takers were not aware of the actual levels of the stocks so it is prudent to scale the price data of stocks by some method. Possible methods include *normalizing* the data by way of  $(x - \min)/\text{range}$  OR standardizing the data by way of  $(x - \text{mean})/\text{sd}$ .

It may also benefit to recognize that individuals should respond more intensely to recent data vs data from 5 years ago. Thus, possible analysis also includes dividing the predictors into various cuts by time period.

#### **Analysis:**

All analysis done to this point has been done by *normalizing* the data and with no consideration for recent vs past data.

The first regression analyzed was a logistic regression that regressed whether or not the left graph was chosen on the left and right graph CPT values (computed from price levels). We expect the coefficient on the left CPT value to be positive and that on the right to be negative and that is indeed the case. Furthermore, both regressors are significant and furthermore a cursory overview of the correlation table indicates no strong possible biases.

It could be argued that because the CPT values were computed from price levels (and therefore could not benefit from the gains/loss vs. absolute value of Prospect Theory), that the above model is weak. It is impossible to do this with price levels as we cannot choose a specific price as the point from which to consider gains/losses. Therefore, a regression was run as above except with CPT value computed from price changes from consecutive periods, thus embedding gains/loss inversion in the source data. This

model provided similar results to above but with an even stronger regression. The above indicates that there is indeed a tendency for individuals to gravitate towards stocks with higher CPT values portrayed in their charts as conjectured in "First Impressions..."

Next, an attempt was made to explore the fundamental characteristics of graphs. Here, we expect that upward trends and skewness increase the attractiveness of a graph and volatility to decrease the attractiveness of the graph. Trend is measured in average price change, skewness is the skewness of price changes and volatility is the standard deviation of price changes. The model corroborated two of these predictions, i.e. upward trends and lower volatility increased the attractiveness of a graph but found that skewness decreased attractiveness. All variables were once again significant in this regression.

**Further Work:**

Further work can be explored along lines proposed in the methods of analysis. Recent vs past information can be considered. Other fundamental attributes of charts (of which there are many) can be considered. Altering the parameters and methods of calculating the CPT value could also be explored.

After this, a possible line of exploration is to see if these biases are reflected in actual purchases and holding of small-cap stocks, as initially proposed.