ANALYZING & PREDICTING THE IMPACT OF NEWS ON THE ASI RETURN OF COLOMBO STOCK EXCHANGE THROUGH BLACK-LITTERMAN MODEL

P.R.S.G. Perera
(178119C)

Thesis submitted in partial fulfillment of the requirements for the degree Master of Science

Department of Mathematics

University of Moratuwa
Sri Lanka

January 2022

"I declare that this is my own work and this thesis does not incorporate without acknowledgment any material previously submitted for a Degree or Diploma in any University or other institute of higher learning and to the best of my knowledge and belief it does not contain any material previously published or written by another person except where the acknowledgment is made in the text"

Signature: UOM Verified Signature Date: 03 Jan 2022

“I have supervised and accepted this thesis for the submission of the degree”

Signature of the supervisor: *UOM Verified Signature* Date: 03 Jan 2022

I dedicate my thesis work to my family.

I wish to thank the lecture panel and other administrators attached to MSc Financial Mathematics (UoM) who were more than generous with their expertise and precious time.

A special thanks to Dr. Lakmal Ranasinghe, the thesis supervisor for countless hours of reflecting, reading, encouraging, and mostly the commendable patience throughout the entire process.

Finally, I would like to acknowledge and thank Dr. Miuran Dencil and Senior Lecturer Rohana Dissanayake for coordinating the MSc and the support given to complete this thesis.

Abstract

Considering the historical data, we can conclude that news on attacks, international political problems, natural disasters, and protests have a negative impact on the stock market return while changes in Government Acts and Election period have a positive impact on stock market return. Further, Monetary & Fiscal policy changes and news on major investments have a neutral impact on the return.

The significance of the news has been tested using the t-distribution method. It concludes that Monetary & Fiscal policy changes and news on major investments don't have a significant impact on index returns while other selected events have a significant impact on the index returns.

By applying the Black-Litterman model together with hypothetical views, one can develop a P matrix to derive/ predict the return of the index movement. Therefore, an investor/analyst can consider the significance level of the news items (t-distribution results) and the type of impact (negative/positive) when assigning numbers and views for the P matrix.

Table of Contents

List of Figures

List of Tables

Introduction

Colombo Stock Exchange (CSE) plays a vital role in the economy. The average market capitalization is ~20% of the total GDP. CSE generated an average daily turnover of LKR 1.8bn in 2020.

Index return is one of the key features that investors are looking at when they are investing in the equity market. There are so many influencers that affect the performance of the equity market indices. Some are quantitative while some are qualitative.

Quantitative influencers can be measurable and reflect directly mostly in real-time on the equity market indices. Selling or buying pressures from both foreigners and locals can be given as an example for the quantitative index influencer. When there is huge selling pressure either from foreigners or locals, we will be able to witness a drop in the index during the trading hours.

On the other hand, qualitative influencers are mostly reflected on the index with the lapse of time. Political news, economical news (e.g. Policy rate cuts) are few examples of qualitative influencers. In reality, even the news is going to take place or officially announced today, the public might have got to know the news (felt the smell of the news) some days ago. At that time, the index tends to react to the news when the smell of the news is felt by the public. Sometimes, the index reacts to the news, some days after the event occurrence date. This is all depended on the type of news.

The basis of this analysis is to build up a model to track news and its impact upon stock market performances. Almost all of the stock market-related analyses are based on quantitative data. Interest rate, GDP rate, and inflation rate are a few of the inputs which are used in quantitative analysis. Most analysts build the relationship between those rates and stock market return. The behavior of those inputs and stock market return is analyzed to derive the relationship between them.

In this thesis, we do not analyze rate/ratios in numerical terms, but the announcement of the news of those ratios. As an example, when the news of interest rate cut is announced or when the smell of the news felt by people, we try to prove a model can be used to track index return reaction for that selected news. Usually, it is said that Sri Lanka has a market-led situation (generally, market/CSE is a leading indicator). That

is, most of the time, the market reacts before the actual event occurs. In this analysis, we try to test the accuracy of that statement via this model.

The link between qualitative news and the equity market index return will be analyzed based on the Black-Litterman model. For that, we have generated the p-matrix to check on to what extent qualitative news can influence equity index returns.

In order to allocate numbers in p-matrix, an investor needs to know the level of significance of the news. That is, he/she wants to know whether there is a significant difference between actual return and the return if the event doesn't occur. For that, the significance of the news items on the index return is checked using t-distribution. It analyzed the extent of the significance of the particular news on the index return. For that, we developed null and alternative hypothesis as described under "Methodology" chapter.

Literature Review

There are various research reports on the stock market. Most of them are to analyze quantitative data while there is a lesser number of researches have been done on qualitative data.

In a research paper published by Rathnayaka, R M K, Seneviratna K, it is revealed that highly volatile fluctuations with instability patterns are a common phenomenon in the Colombo Stock Exchange (CSE). Multivariate statistical methods and economic data forecasting techniques were applied to recognize the behavior of trade volume rates and market prices in CSE from 2006 to 2012.

The research paper on *Equity Risk Premium Puzzle: Evidence from Indonesia and Sri Lanka*, investigates the equity risk premium puzzle in the Sri Lankan and Indonesian stock markets to identify the connection between the volatility of the equity risk premium and excess returns. By using the exponential GARCH-M model, they have resolved that investors have not been compensated for the conditional volatility of the excess returns in these two markets, while Sri Lankan investors are reimbursed for the risk of negative shocks.

Gunasekara, A.L., and Jayasinghe, J.A.D.K. have discovered that weather factors are related to the share prices in the long run and further revealed that temperature has an outperforming involvement to the share price variation. That study has used the Johansen Cointegration Test with VAR - Vector Error Correction Estimates and Variance Decomposition.

P. S. Morawakage and P. D. Nimal focused on examining the volatility behavior of the Colombo Stock Exchange with advanced econometric models. GARCH, EGARCH, and TGARCH models have been used to identify the complex volatility features. It is witnessed that leverage effect and volatility clustering exist in CSE. Further, negative shocks create more volatility compared to positive shocks generated in the market. Moreover, according to the Akaike and Schwarz information criteria, the TGARCH model assuming student-t probability distribution function is more suitable to enlighten the volatility in Colombo Stock Exchange among the other models used.

Accordingly, all most all of the research reports have been published on quantitative data. In this analysis, we examine the extent of the impact of qualitative news on the return of the Colombo Stock Exchange using the Back-Litterman Model.

The Black-Litterman Model was initially published by Fischer Black and Robert Litterman in 1990. Since the first publication, many authors have referred this model as Black-Litterman in their research articles. Even though they may be very different from the original model, this has led to a variety of models being named as Black-Litterman. The Black-Litterman model delivers a clear way to specify investors' views on returns and to combine the investors' views with prior information. The Black-Litterman model delivers a quantitative framework for specifying the investor's views, and a clear way to blend those investor's views with an intuitive prior to arrive at a new combined distribution. The model enables investors to match their views regarding the performance of various assets with the market equilibrium.

Bevan and Winkelmann (1998) explained how they have used Black-Litterman as part of their broader Asset Allocation process at Goldman Sachs, including some corrections of the model which they perform.

Satchell and Scowcroft (2000) attempted to deeply interpret the original Black-Litterman model but instead presented a new non-Bayesian expression of the model. Their model does not include any information on the precision of the estimate because they have used point estimates instead of distributions. This allows them to acclaim setting $\tau = 1$. They also introduce a stochastic τ, but because they use point estimates this becomes a model with a stochastic covariance of returns.

Fusai and Meucci (2003) introduced yet another non-Bayesian variant of the model which removed the parameter τ altogether. Meucci (2005) trailed this paper and invented the phrase, “Beyond Black-Litterman”. Since the mid-2000's we have seen a mixture of the canonical and “Beyond Black-Litterman” model used in the literature. Since Fuasi and Meucci (2003) there has been little use of the hybrid reference model until Michaud, et al (2013) discredited it.

Herold (2003) interprets another view of the problem where he examined optimizing alpha generation for active portfolio management, fundamentally specifying that the sample distribution has zero mean. He has used the alternative reference model with point estimates and tracking error to determine how much shrinkage to allow. The two significant contributions of his paper are; the application of the model to active portfolio management and some additional measures that can be used to validate that the views are reasonable.

Koch (2004) includes derivations of the 'master formula' and the alternative form under 100% certainty. He does not mention posterior variance or shows the alternative form of the 'master formula' under uncertainty (general case).

Idzorek (2005) introduced a technique for specifying Ω such that the impact of the shrinkage was specified in terms of percentage of change in the weights between 0 and the change caused by 100% confidence. In his paper, he has used the Alternative Reference Model, but as it is sensitive to the value of τ specified by the investor, his technique can be applied to the Canonical Black-Litterman model.

Krishnan and Mains (2005) have extended the Black-Litterman model with an additional factor that is uncorrelated with the market. They have named this as the Two-Factor Black-Litterman model. They further demonstrate an example of extending Black-Litterman with a recession factor. They show how it intuitively influences the expected returns generated from the model.

Mankert (2006) has provided a detailed walk-through of the model and provides a thorough transformation between the two specifications of the Black-Litterman 'master formula' for the estimated asset returns. She has approached the problem from the point of view of sampling theory and provided some new intuition about the value τ in the context of the alternative reference model.

Meucci (2006) delivered a method to use non-normal views in the original model. Further, Meucci (2008) extended this method to any model parameter, and allow for analysis of the full distribution. In addition, he has used this model in scenario analysis.

Beach and Orlov (2006) used GARCH models to generate the views. They have tested a model of international equity across twenty countries. They expressed how the results change as the investor uses different values for τ. They do not state exact details on the uncertainty of the views. However, they are appeared to be using an alternative reference model even though their techniques can be applied to the canonical reference model.

The Black-Litterman model creates stable, mean-variance efficient portfolios, based on an investor's unique insights, which overcome the problem of input sensitivity. Lee (2000) suggests that the Black-Litterman model also "largely mitigates" the problem of estimation error-maximization by spreading the errors throughout the vector of expected returns.

The BL model distinguishes itself from other asset allocation models by the fact that it allows investors to express their own beliefs or views in the asset allocation process.

These views are then combined with the information derivable from the CAPM to obtain the updated expected excess returns vector. The combination of the two sources of information is achieved by using Bayes' formula.

Methodology

As the initial step, we are going to calculate the average return of ASI under each news category. For that, daily ASI index data were obtained from 2015 to 2019. Then, date ranges were categorized according to the news. The starting point of a date range is the date the smell of news was felt by the community and the ending point was the date when the market was back into normalization. The return was the percentage difference between the ending point and starting point. Finally, the average return was calculated based on the obtained returns under each news category (refer to page no.24).

Mean values of index returns will be tested under t distribution to identify the significance of the event. Due to our small sample size & two independent samples, we have considered using t distribution for this purpose. Also, since the indexes can be either negative or positive, a two-tailed test is used for the analysis.

We took actual μ gain/loss (group n) against the assumed μ gain/loss if the event doesn't occur (group m). It was calculated by taking 5-day average return prior to starting point of the reaction period. Then dragged it over till the end of the same reaction period to calculate the assumed gain/loss. Like earlier, we got the assumed return under each data point and derived the average return under each **sub topics** of the news. The hypothesis is:

$H_0 = \mu_n = \mu_m$, *and there is no significant impact of the event on index returns*

$H_1 = \mu_n \neq \mu_m$, *and there is a significant impact of the event on index returns*

Under the hypothesis H_0,

$$t_{n+m-2} = \frac{\bar{x} - \bar{y}}{\sqrt{\frac{S_P^2}{n} + \frac{S_P^2}{m}}}$$

S_P^2 is pooled standard deviation. It's a measure that collects (pools) the standard deviation of the whole system. It is calculated by:

$$S_P^2 = \frac{[(n-1) * S_n^2] + [(m-1) * S_m^2]}{(n+m-2)}$$

Therefor, S_P^2 is an overall one figure for both groups while S_n^2 & S_m^2 are standard deviations under group **n** (actual scenario) and group **m** (assumed scenario) respectively. And those figures are two different values. As mentioned in the

"Introduction" chapter, one can consider the significance level of the news item when allocating numbers in *P* matrix under BL model.

The Black-Litterman (BL) Model is an analytical tool used by portfolio managers to optimize asset allocation within an investor's risk tolerance and market views. Global investors, such as pension funds and insurance companies, need to decide how to allocate their investments across different asset classes and countries.

The Black-Litterman model for portfolio construction is based on modern portfolio theory (MPT). Modern portfolio theory posits that an investment's risk and return characteristics should not be viewed alone, but should be evaluated by how the investment affects the overall portfolio's risk and return. MPT shows that an investor can construct a portfolio of multiple assets that will maximize returns for a given level of risk.

Likewise, given the desired level of expected return, an investor can construct a portfolio with the lowest possible risk. Based on statistical measures such as variance and correlation, an individual investment's performance is less important than how it impacts the entire portfolio.

Step by step BL model construction has been explained below.

Throughout this article, K is used to represent the number of views and N is used to express the number of assets in the formula. The formula for the new Combined Return Vector ($E[R]$) is

$$E[R] = [(\tau\Sigma)^{-1} + \mathrm{P}'\Omega^{-1}\mathrm{P}]^{-1}[(\tau\Sigma)^{-1}\Pi + \mathrm{P}'\Omega^{-1}\mathrm{Q}]$$

Where,

- $E[R]$ is the new (posterior) Combined Return Vector (N x 1 column vector)
- τ is a scalar
- Σ is the covariance matrix of excess returns (N x N matrix)

- P is a matrix that identifies the assets involved in the views (K x N matrix or 1 x N row vector in the special case of 1 view)
- Ω is a diagonal covariance matrix of error terms from the expressed view representing the uncertainty in each view (K x K matrix)
- Π is the Implied Equilibrium Return Vector (N x 1 column vector)
- Q is the View Vector (K x 1 column vector)

In our analysis, we considered 8 qualitative factors and 2 hypothetical views. Applying to our data set, first we derive the view vector. The uncertainty of the views results in a random, unknown, independent, normally distributed Error Term Vector (ε) with a mean of 0 and covariance matrix Ω. Thus, a view has the form Q +ε.

$$Q + \varepsilon = \begin{pmatrix} Q_1 \\ \vdots \\ Q_k \end{pmatrix} + \begin{pmatrix} \varepsilon_1 \\ \vdots \\ \varepsilon_k \end{pmatrix}$$

The variance of each error term (ω), which is the absolute difference from the error term's (ε) expected value of 0, does enter the formula. The variances of the error terms (ω) form Ω**,** where Ω is a diagonal covariance matrix with 0's in all of the off-diagonal positions. The off-diagonal elements of Ω are 0's because the model assumes that the views are independent of one another. The variances of the error terms (ω) represent the uncertainty of the views. The larger the variance of the error term (ω), the greater the uncertainty of the view.

$$\Omega = \begin{bmatrix} \omega_1 & 0 & 0 \\ 0 & \ddots & 0 \\ 0 & 0 & \omega_k \end{bmatrix}$$

The expressed views in column vector Q are matched to specific assets by Matrix P. Each expressed view results in a $1 \; x \; N$ row vector. Thus, K views result in a $K \; x \; N$ matrix.

$$P = \begin{bmatrix} p_{1,1} & \cdots & p_{1,n} \\ \vdots & \ddots & \vdots \\ p_{k,1} & \cdots & p_{n,n} \end{bmatrix}$$

Data & Analysis

We have considered the ASI index return of the Colombo Stock Exchange. Colombo Stock Exchange (CSE) is the only stock market in Sri Lanka. According to the MSCI index, CSE is a frontier market. The Colombo Stock Exchange (CSE) has 283 companies representing 11 GICS industry groups as of 30th April 2021, with a Market Capitalization of around LKR 3tn.

CSE has two indices. All Share Price Index (ASI) and S&P SL20. The All Share Price Index (ASPI) is the broad market index of the CSE and is designed to measure the movements of the overall market. The index is calculated in real-time as a market capitalization-weighted index, which constitutes all voting and non-voting ordinary shares listed on the CSE. The S&P Sri Lanka 20 is designed to measure the performance of 20 of the largest and most liquid companies in the Sri Lankan equity market. Index constituents must be listed on the CSE and are screened for size, liquidity, and financial viability. For this analysis, we have considered the closing value of the ASI index at the end of each day (2015-2019) to calculate the return/ loss of the identified news items.

CSE follows GICS guidelines for sector classification. Accordingly, there are 11 sectors. The Global Industry Classification Standard (GICS) was developed by Morgan Stanley Capital International (MSCI), a premier independent provider of global indices and benchmark-related products and services, and Standard & Poor's (S&P), an independent international financial data and investment services company and a leading provider of global equity indices. The GICS classifications aim to enhance the investment research and asset management process for financial professionals worldwide. The 289 companies listed in the CSE, are classified into these 11 categories. There is sector-specific news or company-specific news. Examples are an appointment of a director, change in auditor, share transactions by directors, etc. In this analysis, we have not considered those company or sector-specific news. Followings are the sectors:

- Energy
- Materials
- Industrials
- Consumer Discretionary
- Consumer Staples
- Healthcare
- Financials
- Information Technology
- Communication Services
- Utilities
- Real Estate

Breakdown of each sector is as follow

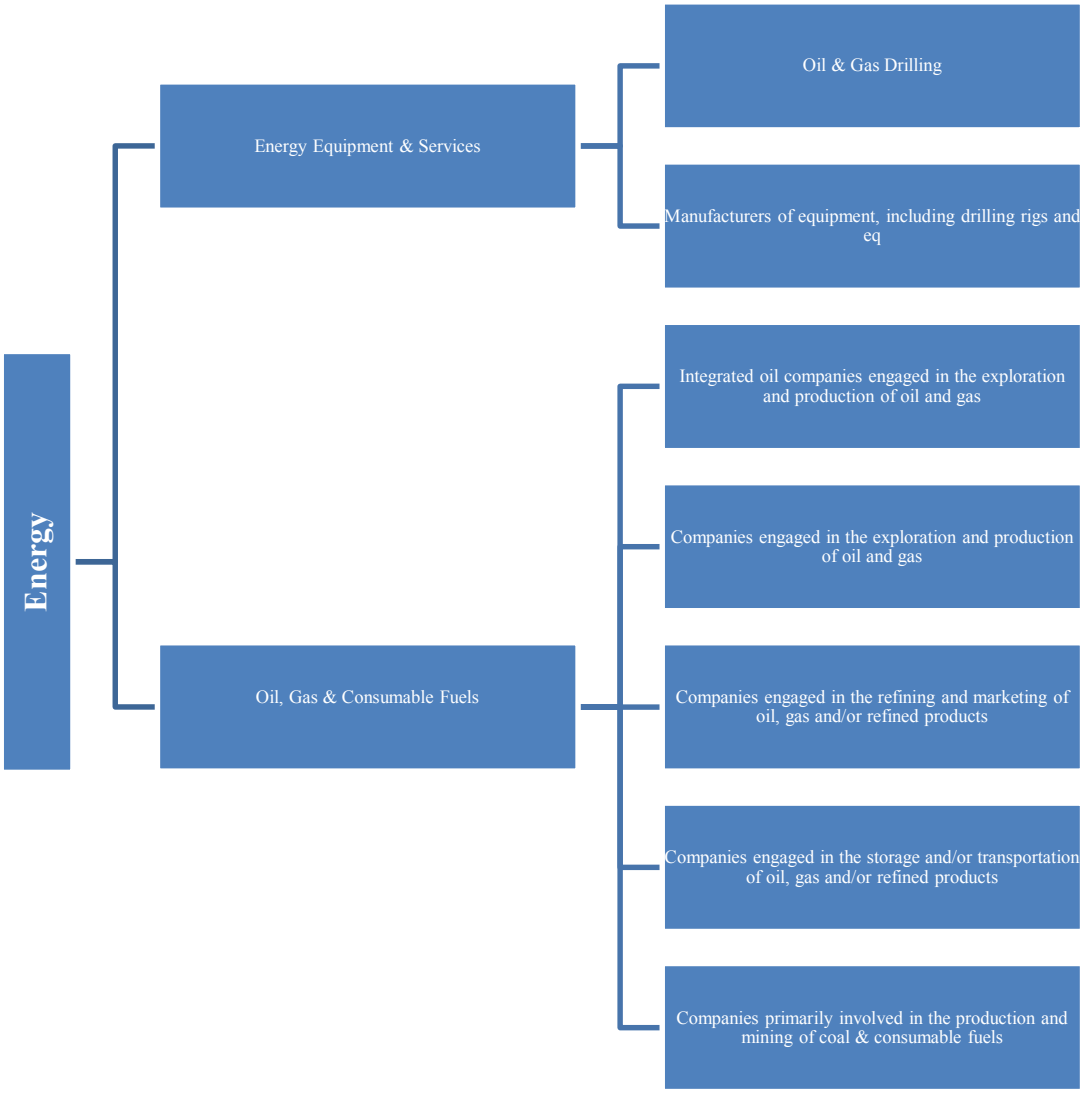


Figure 1: GICS Classification - Energy sector

Source: MSCI; S&P Global

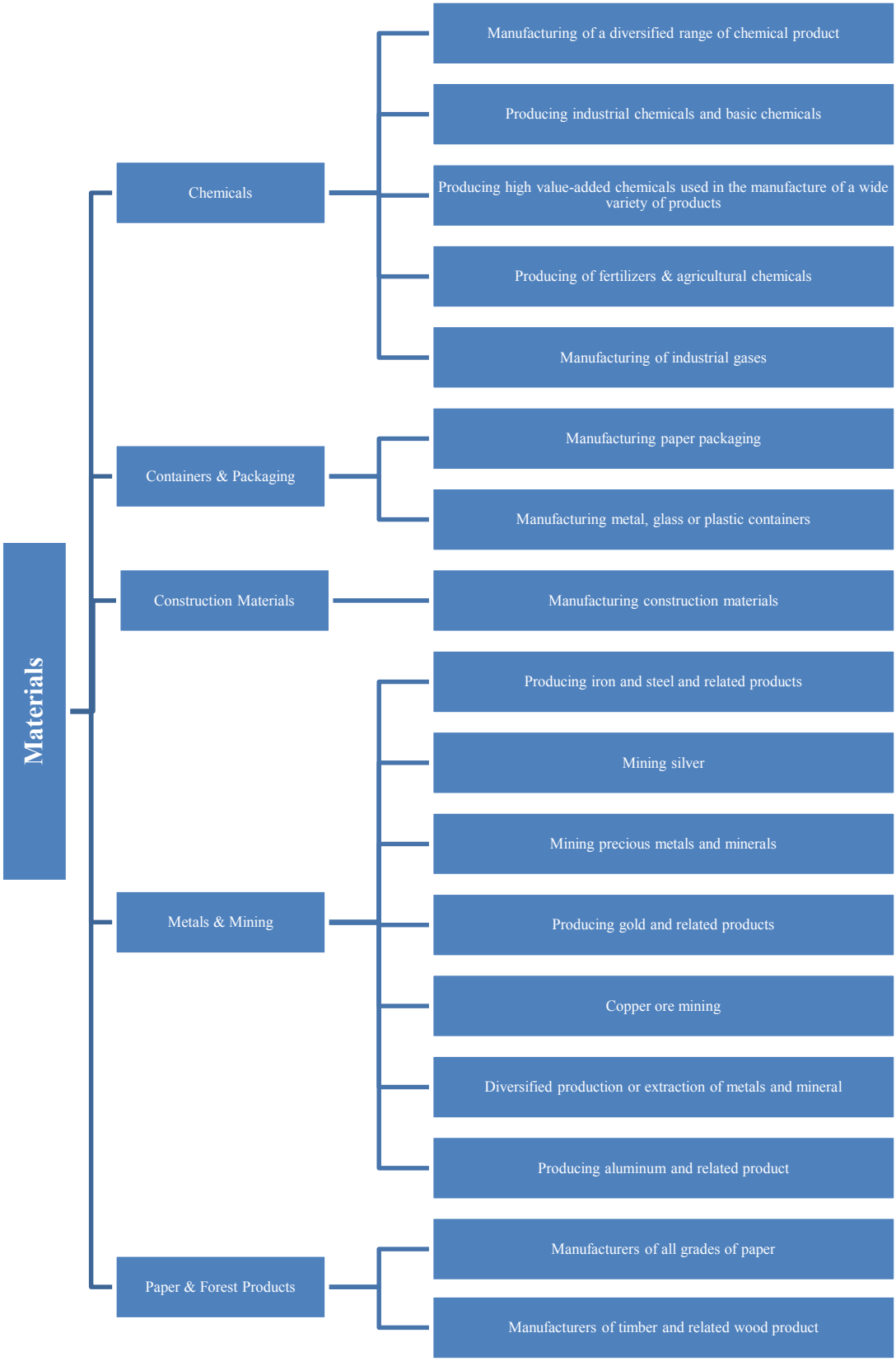


Figure 2: GICS Classification - Materials sector

Source: MSCI; S&P Global

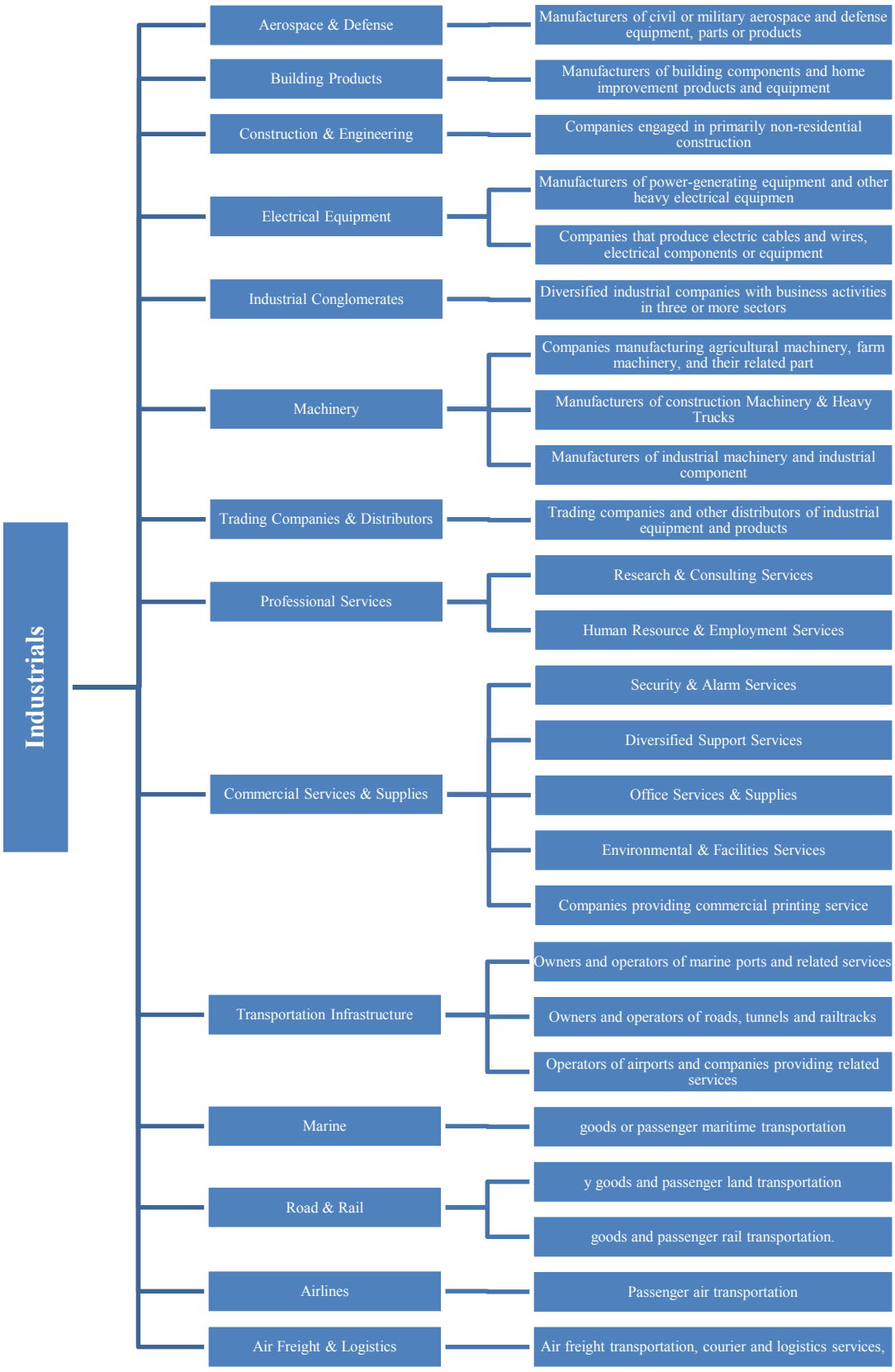


Figure 3: GICS Classification - Industrials sector

Source: MSCI; S&P Global

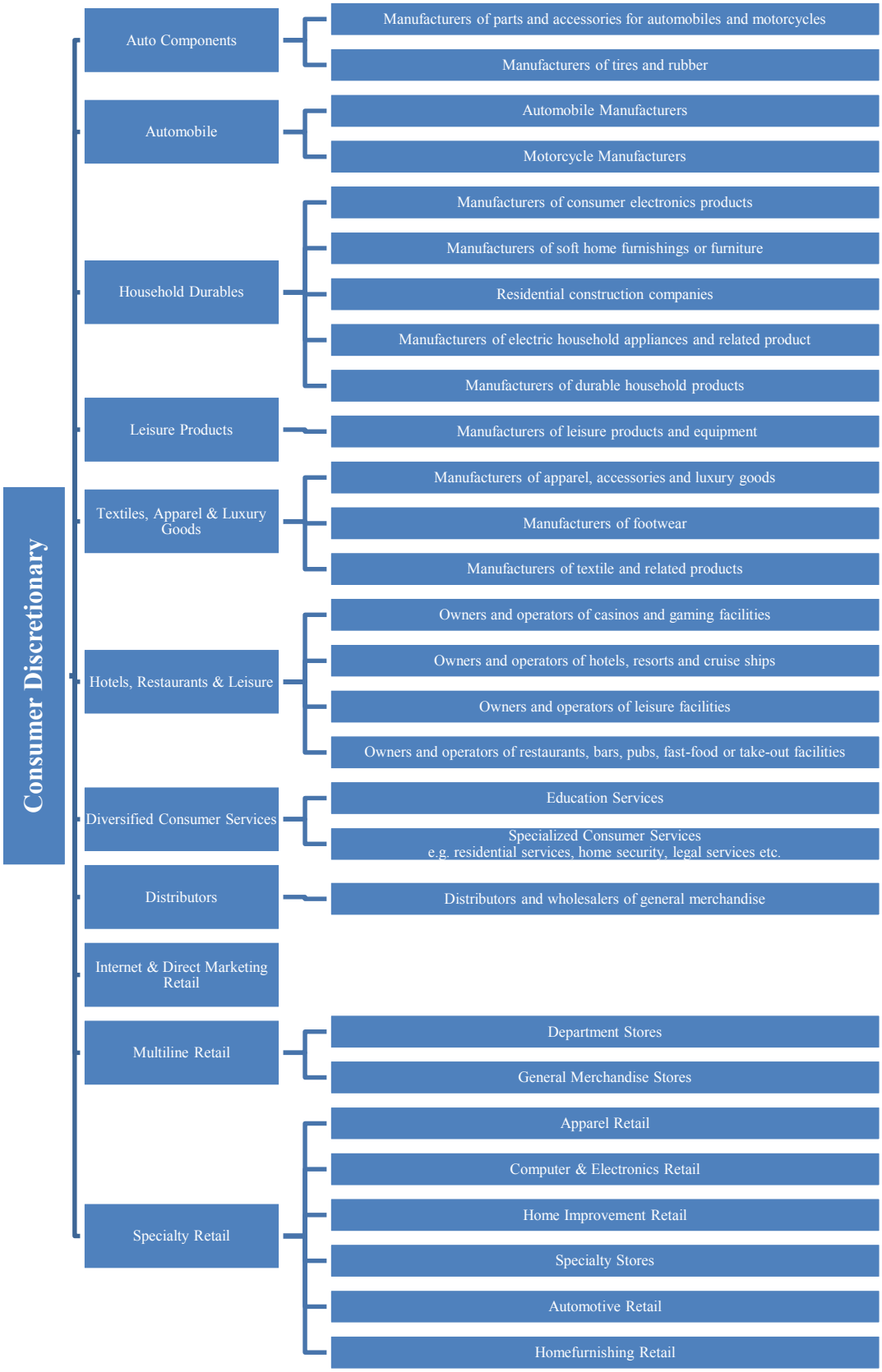


Figure 4: GICS Classification - Consumer Discretionary sector

Source: MSCI; S&P Global

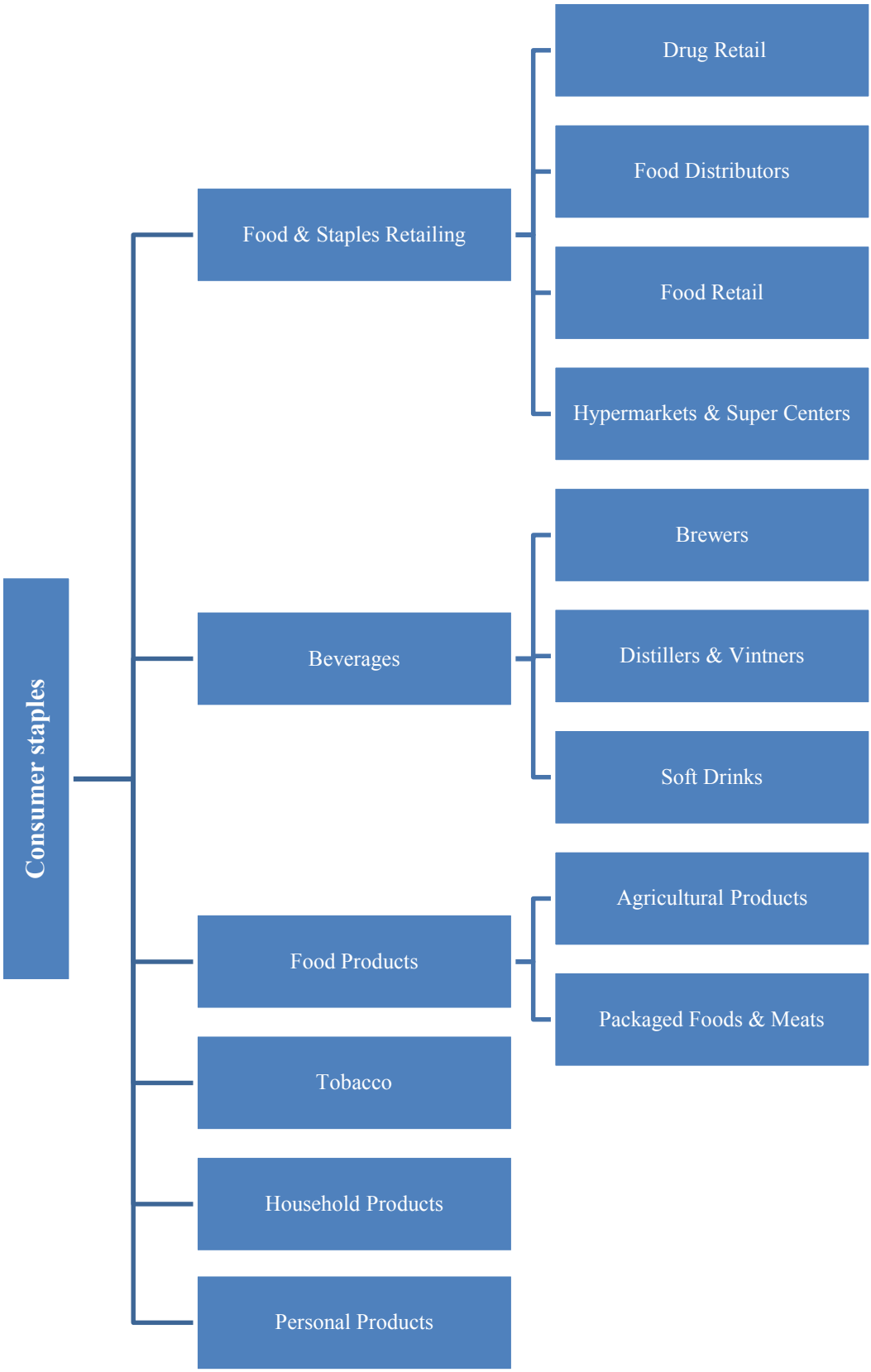


Figure 5: GICS Classification - Consumer Staples sector

Source: MSCI; S&P Global

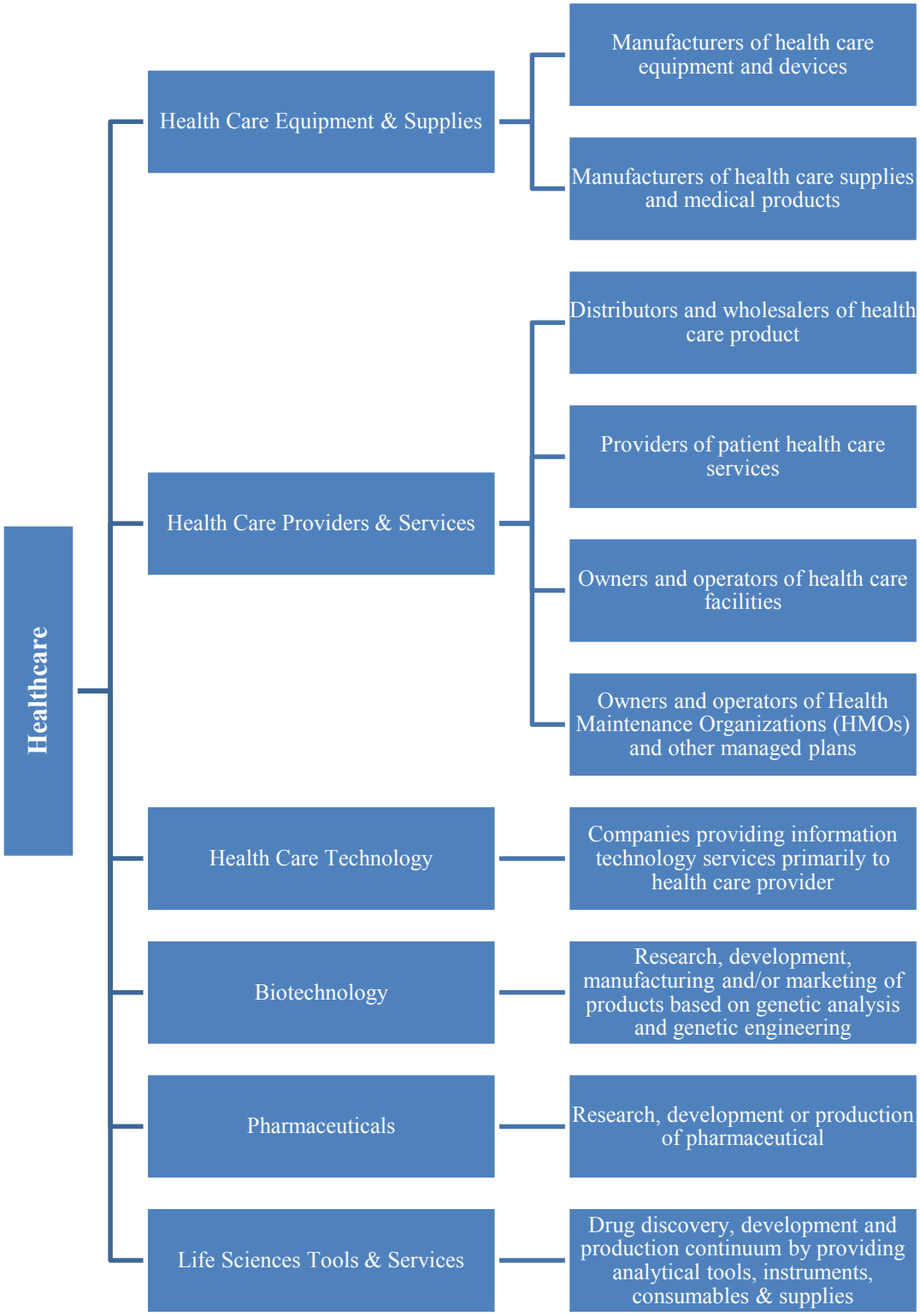


Figure 6: GICS Classification - Healthcare sector

Source: MSCI; S&P Global

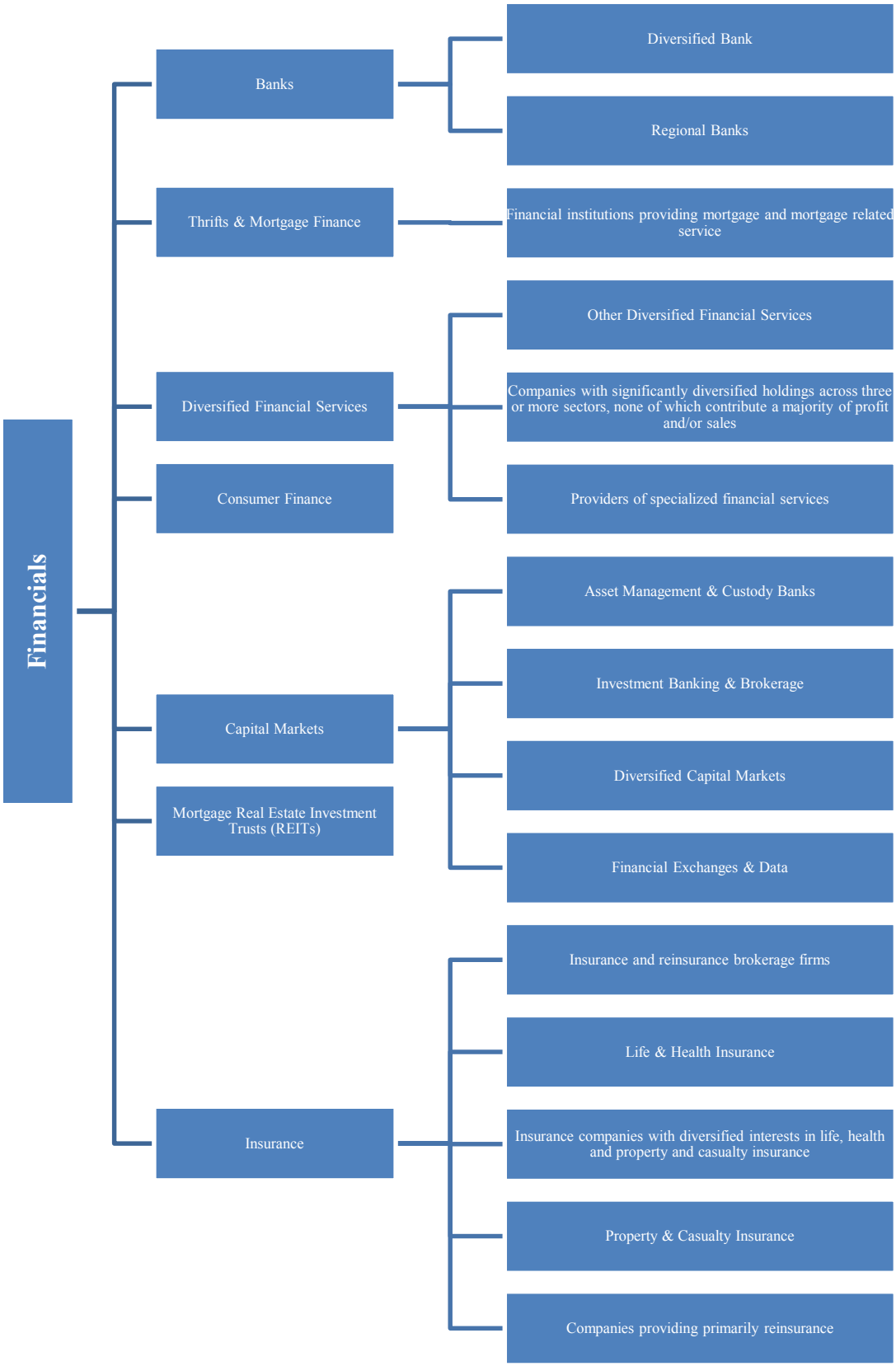


Figure 7: GICS Classification - Financials sector

Source: MSCI; S&P Global

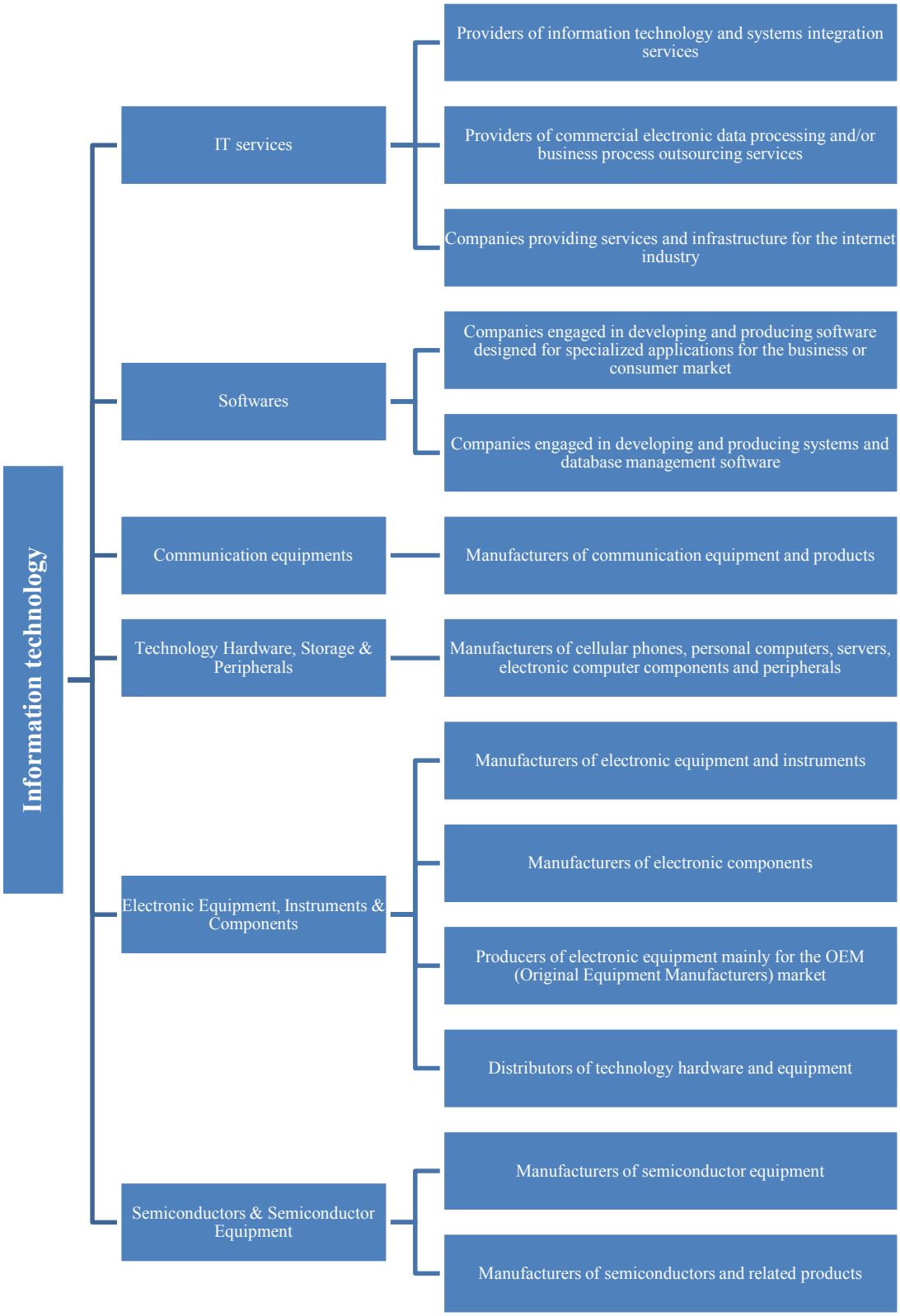


Figure 8: GICS Classification - Information Technology sector

Source: MSCI; S&P Global

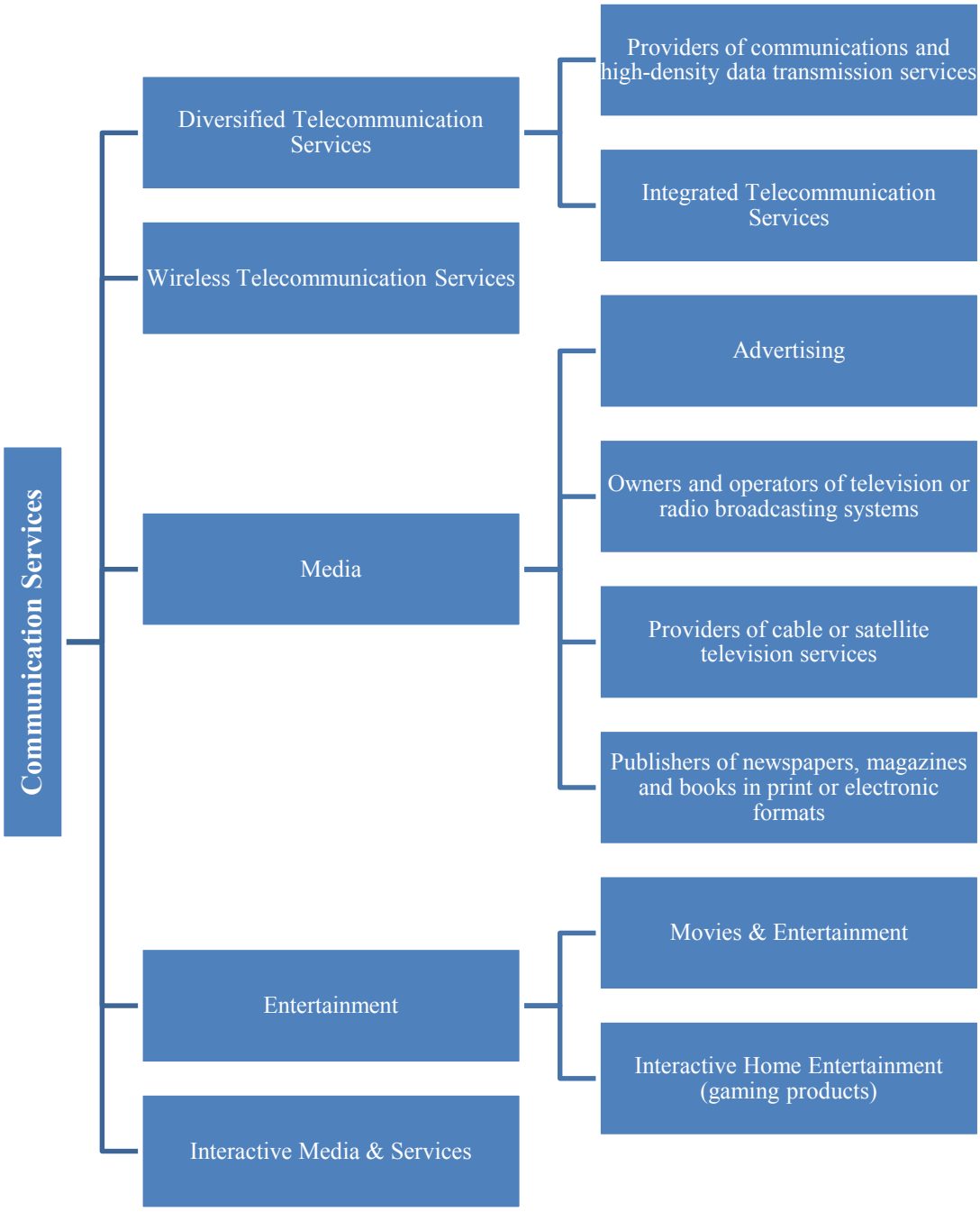


Figure 9: GICS Classification – Communication Services sector

Source: MSCI; S&P Global

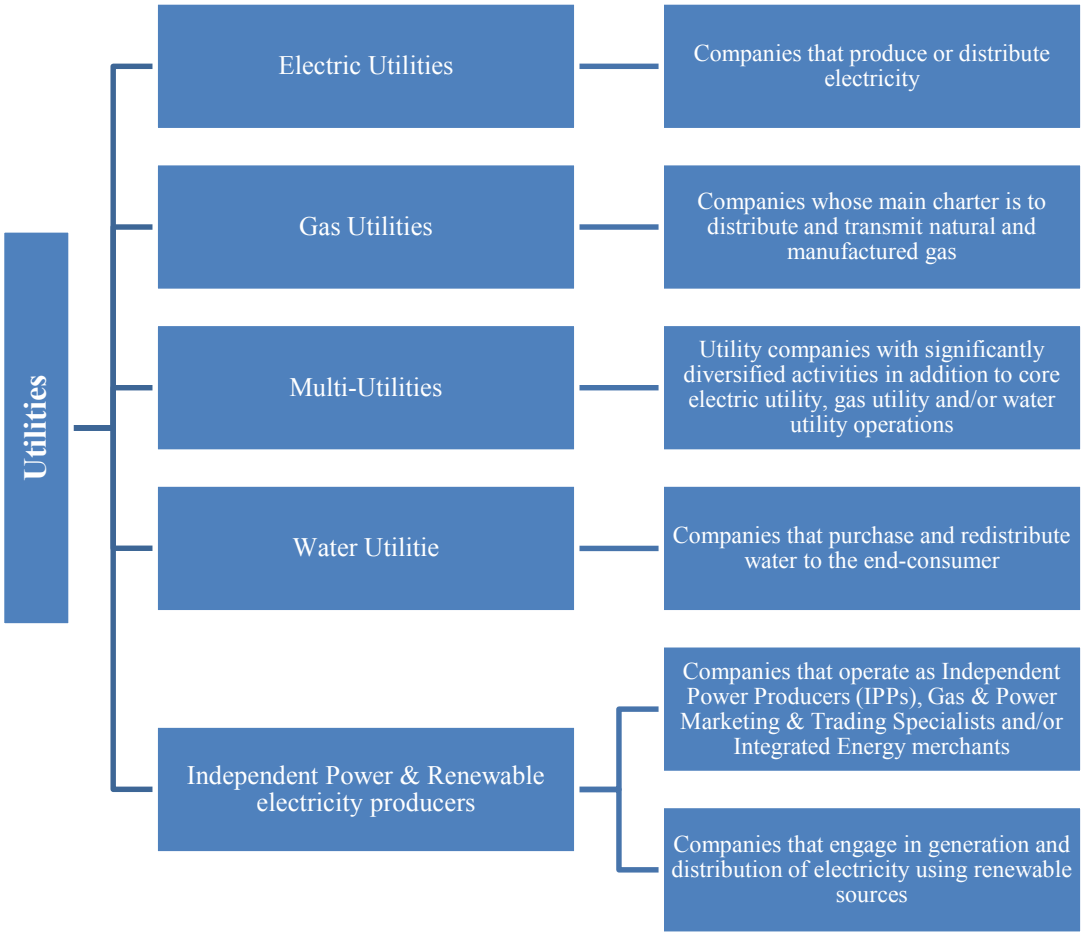


Figure 10: GICS Classification - Utility sector

Source: MSCI; S&P Global

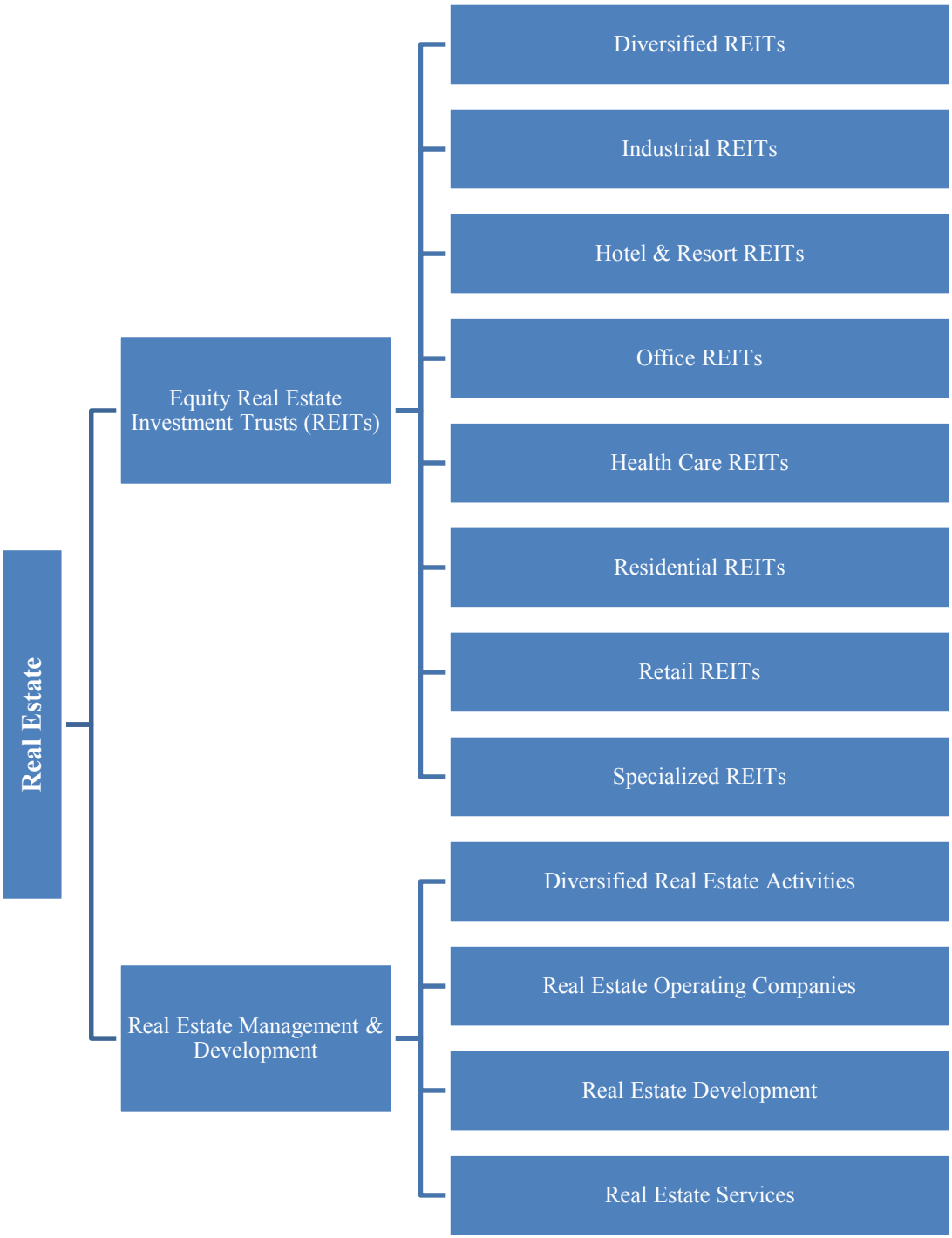


Figure 11: GICS Classification - Real Estate sector

Source: MSCI; S&P Global

Identified data points/ news items over the period:

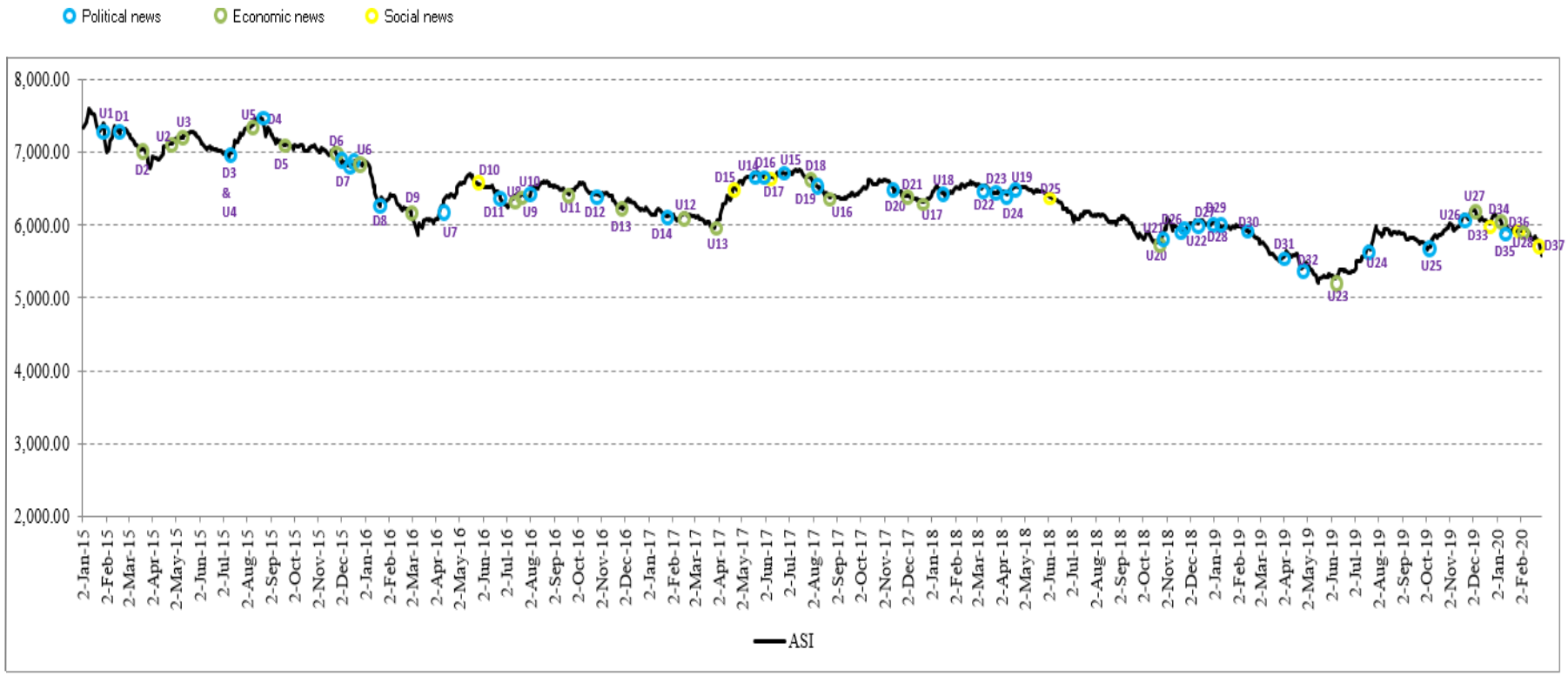


Figure 12: ASI index movement

Source: Colombo Stock Exchange

Data points have been described in **appendix 1.** "U" points are upsides and "D" points are downsides.

Example: data point U7- Constitutional changes on parliament in Sri Lanka

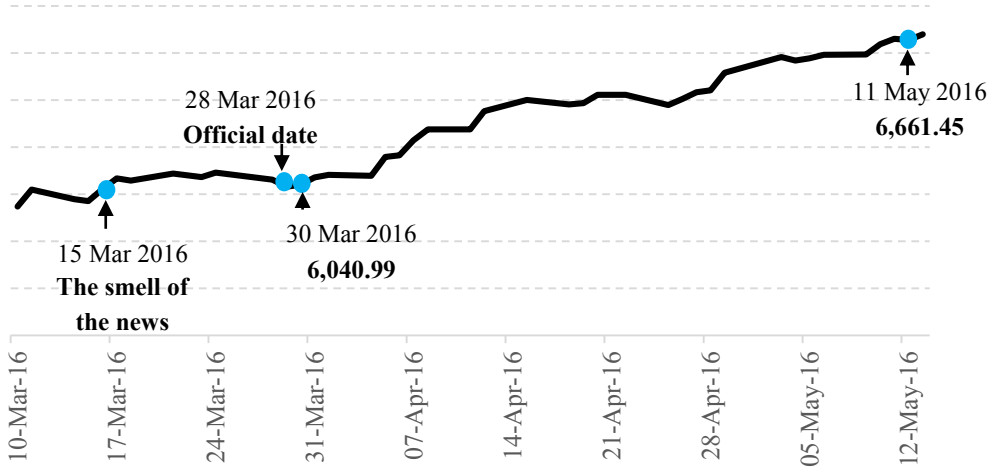


Figure 13: Data point U7

The smell of the news: the date that the public got aware of the news informally (as a rumor/ un-official way)

Official date: the date that the public got aware of the news formally

30 Mar 2016: the date that the market started to respond to the news

11 May 2016: the date that the market ended the upward movement towards the news

The return of the ASI towards the news: 10%

The stock market is usually a leading indicator. Therefore, there is always a lagging weakness in stock market return analysis. Most of the time, the market/ investor gets to know the news some days before the official announcement. Thereby sometimes, the market started to react to the news before the official date of the announcement; vice versa.

As mentioned in the previous chapter, we considered 8 qualitative factors and 2 hypothetical relative views. Using the returns calculated under each data point, we have calculated following average returns under each qualitative sub news category.

Main category	**Qualitative factor**	**Average return/loss**
Political	Attacks (terrorists)	-2%
Political	Changes in Government Acts	2%
Political	Election time/ political issues	1%
Political	International political problems	-4%
Economic	Monetary & Fiscal policy changes	0%
Social	Natural disasters	-1%
Economic	News on major investments	0%
Political	Protests	-1%

Table 1: Average returns of selected news items

Results indicates that Attacks, International political problems, Natural disasters and Protests have negative impact over the CSE index return while Changes in Government acts and Election time have positive impact over the CSE index return. It further summarizes that Monetary & Fiscal policy changes and News on major investments have a neutral impact over the index return.

The above generated type of impact and significance of the news item would be considered when allocating numbers for the p-matrix under BL model. The significance level would be measured through two tailed- t-test. It shows us whether there is a significant difference between actual mean return and assumed mean return (if the event doesn't occur) under each news item. Based on that, we can conclude the extent of the significance level in each news category.

Two tailed, t-test results:	Actual (X)			If the event doesn't occur (Y)							Two-tailed:
	n	$\bar{x}$	Standard deviation	m	$\bar{y}$	Standard deviation	S_P^2	n+m-2	t(n+m-2)	t(n+m-2),0.90	Significance
Social											
Natural disasters (e.g. Flood)	4	-0.82%	0.29%	4	3.65%	3.97%	0.00079397	6	(2.247)	1.440	H0 is rejected
Economic											
Monetary & Fiscal policy changes	17	-0.40%	2.98%	17	-0.55%	1.16%	0.00051173	32	0.196	1.310	H0 is accepted
News on major investments	8	0.02%	1.53%	8	-0.48%	0.82%	0.00015112	14	0.808	1.345	H0 is accepted
Politics											
Changes in Government Acts	6	1.78%	4.24%	6	-1.42%	2.56%	0.00122619	10	1.582	1.372	H0 is rejected
Protests	5	-1.46%	0.99%	5	0.24%	1.05%	0.00010462	8	(2.624)	1.397	H0 is rejected
Terrorist attacks	6	-2.30%	1.84%	6	0.45%	3.93%	0.00094095	10	(1.555)	1.372	H0 is rejected
Elections incl. nomination times	16	0.68%	2.50%	16	-0.66%	1.58%	0.00043721	30	1.811	1.310	H0 is rejected
International political problems	2	-3.54%	0.09%	2	0.68%	2.10%	0.00022073	2	(2.837)	1.886	H0 is rejected

Table 2: Two tailed, t-test results

Attacks (terrorists):

If Sinhala-Muslim riots were not taken place from 26 Feb 2018 to 21 Mar 2018, ASI would have moved up to 6,448.29 with a daily average return of 0.04% (5-day average return). However, it ended up at 6,445.97 which derives a loss of around 2%.

Applying two-tailed t-test for scenarios; the actual gain/loss when this event took place and the assumed gain/loss if this event didn't take place:

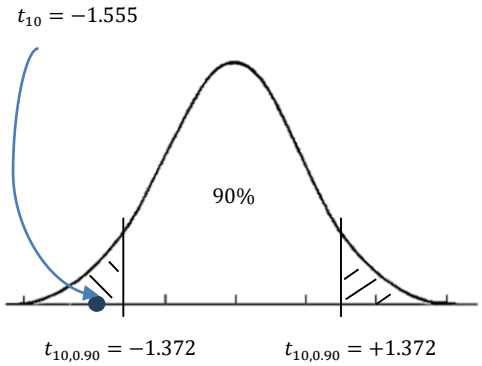
$H_0 = \mu_n = \mu_m$, *and there is no significant impact of the event on index returns*

$H_1 = \mu_n \neq \mu_m$, *and there is a significant impact of the event on index returns*

Under the hypothesis H_0,

$$t_{n+m-2} = \frac{\bar{x} - \bar{y}}{\sqrt{\frac{S_P^2}{n} + \frac{S_P^2}{m}}}$$

$$t_{10} = -1.555$$



Since estimated $t_{10} = -1.555 <$ table $t_{10,0.90} = \pm 1.372$, H_0 is rejected. Therefore, there is a significant impact of the event on index returns. It concludes that attacks (terrorists) generate a significant impact on the return of the index. It changes index return significantly. In other terms, there is a significant different between actual result and the assumed result where we presumed the event doesn't take place. Therefore, one should consider news on attacks significantly when allocating their investments on stocks and when building the *P* matrix. That is, one can decide on their views to build

the matrix, based on these significance level. Here, an investor can decide a view such as: Political News (since attacks fall to political news category) will underperform social news.

Changes in Government Acts:

Before the public got aware of the 19th amendment the 5-day average loss was 0.26%. Based on that ASI could have been dropped to 7,183.53 by 06 May 2015 but from the day (around 16 Feb 2015) the smell of the news got through the public, ASI has improved to 7,192.29 (~2%).

Applying two-tailed t-test for scenarios; the actual gain/loss when this event took place and the assumed gain/loss if this event didn't take place:

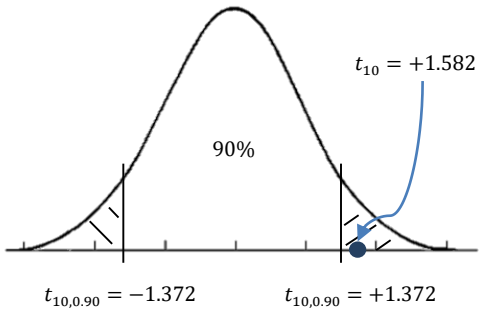
$H_0 = \mu_n = \mu_m$, *and there is no significant impact of the event on index returns*

$H_1 = \mu_n \neq \mu_m$, *and there is a significant impact of the event on index returns*

Under the hypothesis H_0,

$$t_{n+m-2} = \frac{\bar{x} - \bar{y}}{\sqrt{\frac{S_P^2}{n} + \frac{S_P^2}{m}}}$$

$$t_{10} = +1.582$$



Since estimated $t_{10} = +1.582 >$ table $t_{10,0.90} = \pm 1.372$, H_0 is rejected. Therefore, there is a significant impact of the event on index returns. It concludes that changes in

Government acts generate a significant impact on the return of the index. It changes index return significantly. Therefore, result can be significantly changed when there's a news on changes in Government Acts. An investor should consider these type of news when arranging their portfolios & *P* matrix. Under *P* matrix, one can choose a view such as: Political news (Changes in Government Acts) will over-perform economic news.

Election time/ political issues:

Election & political issues are key drivers for Colombo Stock Market. The impact of them prevails for a long time; the impact begins way before nominations and ends after results are out. In the short term, elections draw a notable impact while in the long term the overall impact is average at 1%. During the 2020 Presidential Election, in the short run, from Nominations to Election results, the market has derived 14% of return. However, if the market maintained an average daily return of 0.06%, it could have derived an 8% of return at the end of the results. Nevertheless, if we account for the return from the day when the public got the smell of the presidential election to the date where all the Presidential election chaos ended, the average return is a mere 1%.

Applying two-tailed t-test for scenarios; the actual gain/loss when this event took place and the assumed gain/loss if this event didn't take place:

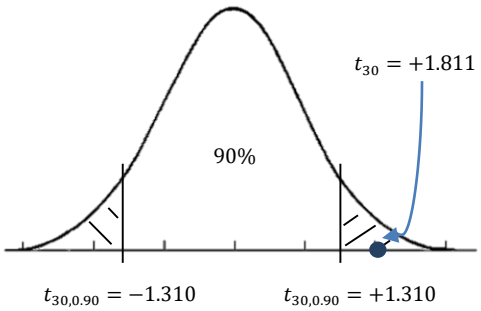
$H_0 = \mu_n = \mu_m$, *and there is no significant impact of the event on index returns*

$H_1 = \mu_n \neq \mu_m$, *and there is a significant impact of the event on index returns*

Under the hypothesis H_0,

$$t_{n+m-2} = \frac{\bar{x} - \bar{y}}{\sqrt{\frac{S_P^2}{n} + \frac{S_P^2}{m}}}$$

$$t_{30} = +1.811$$



Since estimated $t_{30} = +1.811$ > table $t_{30,0.90} = \pm 1.310$, H_0 is rejected. Therefore, there is a significant impact of the event on index returns. It concludes that election times/ political issues generate a significant impact on the return of the index. It changes index return significantly. The two results: the actual and the assumed (if the event doesn't occur) would significantly be changed when there's a news on election time/ political party issue. Therefore, an investor should consider this news especially when allocating fund or building the *P* matrix.

International Political Problems:

During the US – Iran political turmoil in Jan 2020, the market went down to record a loss of ~3%-4%. However, if the market maintains the average latest 5-day return, it would have generated ~0.2% return.

Applying two-tailed t-test for scenarios; the actual gain/loss when this event took place and the assumed gain/loss if this event didn't take place:

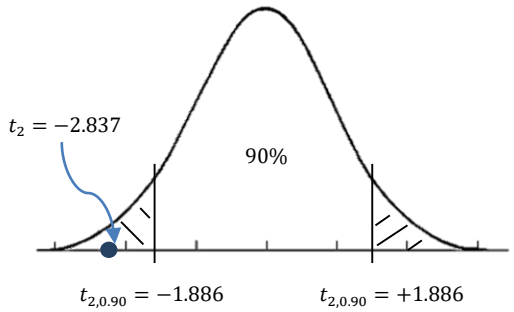
$H_0 = \mu_n = \mu_m$, *and there is no significant impact of the event on index returns*

$H_1 = \mu_n \neq \mu_m$, *and there is a significant impact of the event on index returns*

Under the hypothesis H_0,

$$t_{n+m-2} = \frac{\bar{x} - \bar{y}}{\sqrt{\frac{S_P^2}{n} + \frac{S_P^2}{m}}}$$

$t_2 = -2.837$



Since estimated $t_2 = -2.837$ < table $t_{2,0.90} = \pm 1.886$, H_0 is rejected. Therefore, there is a significant impact of the event on index returns. It concludes that changes in international political issues generate a significant impact on the return of the index. It changes index return significantly. In other terms, there is a significant different between actual result and the assumed result where we presumed the event doesn't take place. Therefore, one should consider news on international political problems significantly when allocating their investments on stocks and when building the *P* matrix. That is, one can decide on their views to build the matrix, based on these significance level.

Monetary & Fiscal Policy changes:

Overall, the market is indifferent towards Monetary & Fiscal Policy changes. The interest rate cuts will improve the market turnover but the overall long-term impact on the indices is neutral.

Applying two-tailed t-test for scenarios; the actual gain/loss when this event took place and the assumed gain/loss if this event didn't take place:

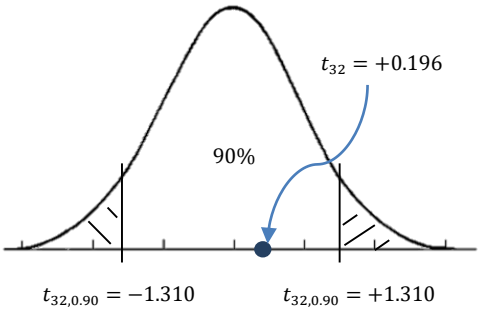
$H_0 = \mu_n = \mu_m$, *and there is no significant impact of the event on index returns*

$H_1 = \mu_n \neq \mu_m$, *and there is a significant impact of the event on index returns*

Under the hypothesis H_0,

$$t_{n+m-2} = \frac{\bar{x} - \bar{y}}{\sqrt{\frac{S_P^2}{n} + \frac{S_P^2}{m}}}$$

$t_{32} = +0.196$



Since estimated $t_{32} = +0.196$ < table $t_{32,0.90} = \pm 0.196$, H_0 is accepted. Therefore, there is no significant impact of the event on index returns. It concludes that Monetary & Fiscal policy changes don't generate a significant impact on the return of the index. It doesn't change index return significantly. In other terms, the t-test results indicate that there will not be significant difference between actual result and the assumed result (is the event doesn't occur). Therefore, an investor can give minor priority for news on Monetary & Fiscal Policy changes when allocating funds for stock investments. Else, they don't need to give significant attention for these news when taking decisions on stock buy/sell.

Natural Disasters:

During May 2018 flood season, the market recorded a loss of around 1%. If the market continues the latest 5-day average, it could have derived only -0.2% of the loss.

Applying two-tailed t-test for scenarios; the actual gain/loss when this event took place and the assumed gain/loss if this event didn't take place:

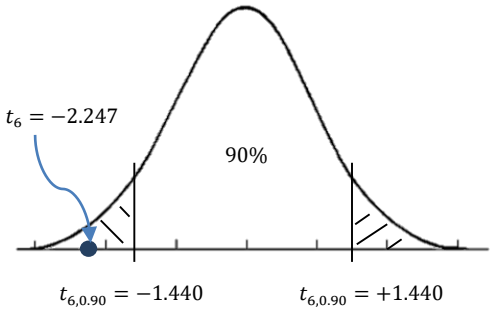
$H_0 = \mu_n = \mu_m$, *and there is no significant impact of the event on index returns*

$H_1 = \mu_n \neq \mu_m$, *and there is a significant impact of the event on index returns*

Under the hypothesis H_0,

$$t_{n+m-2} = \frac{\bar{x} - \bar{y}}{\sqrt{\frac{S_P^2}{n} + \frac{S_P^2}{m}}}$$

$$t_6 = -2.247$$



Since estimated $t_6 = -2.247$ < table $t_6 = \pm 1.440$, H_0 is rejected. Therefore, there is a significant impact of the event on index returns. It concludes that natural disasters generate a significant impact on the return of the index. It changes index return significantly. The two results: the actual and the assumed (if the event doesn't occur) would significantly be changed when there's a news on natural disaster. Therefore, an investor should consider this news especially when allocating fund or building the *P* matrix.

News on major investments:

Like in Policy changes, major investments derive a neutral impact on the equity market indices overall.

Applying two-tailed t-test for scenarios; the actual gain/loss when this event took place and the assumed gain/loss if this event didn't take place:

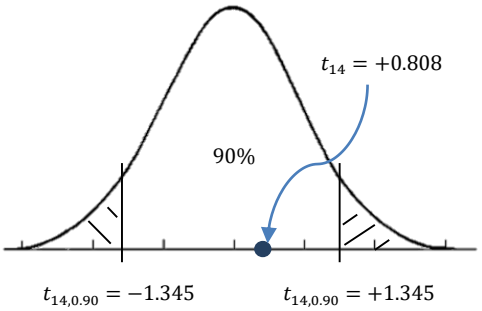
$H_0 = \mu_n = \mu_m$, *and there is no significant impact of the event on index returns*

$H_1 = \mu_n \neq \mu_m$, *and there is a significant impact of the event on index returns*

Under the hypothesis H_0,

$$t_{n+m-2} = \frac{\bar{x} - \bar{y}}{\sqrt{\frac{S_P^2}{n} + \frac{S_P^2}{m}}}$$

$$t_{14} = +0.808$$



Since estimated $t_{14} = +0.808$< table $t_{14,0.90} = \pm 1.345$, H_0 is accepted. Therefore, there is no significant impact of the event on index returns. It concludes that news on major investments does not generate a significant impact on the return of the index. It doesn't change index return significantly. This indicates that both results under two scenarios are almost same. T-test hasn't found a significant difference between two results. Therefore, an investor doesn't need to prioritize these type of news when taking stock investment decisions or building the *P* matrix.

Protests:

There was a protest over the Port City in Jan 2017. The market reported a 1% of loss during that period. However, if the market maintains the 5-day average return, it could have reported a gain of 2% at the end of the protest period.

Applying two-tailed t-test for scenarios; the actual gain/loss when this event took place and the assumed gain/loss if this event didn't take place:

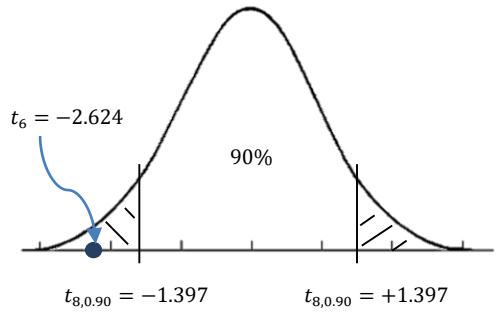
$H_0 = \mu_n = \mu_m$, *and there is no significant impact of the event on index returns*

$H_1 = \mu_n \neq \mu_m$, *and there is a significant impact of the event on index returns*

Under the hypothesis H_0,

$$t_{n+m-2} = \frac{\bar{x} - \bar{y}}{\sqrt{\frac{S_P^2}{n} + \frac{S_P^2}{m}}}$$

$$t_8 = -2.624$$



Since estimated $t_8 = -2.624$ < table $t_8 = \pm 1.397$, H_0 is rejected. Therefore, there is a significant impact of the event on index returns. It concludes that protests generate a significant impact on the return of the index. It changes index return significantly. Therefore, result can be significantly changed when there's a news on changes in Protests. An investor should consider this news when arranging their portfolios & *P* matrix. Under *P* matrix, one can choose a view such as: Political news (protest) will under-perform economic news.

Under *P* matrix, as the initial step, we assumed two views. In our thesis, following hypothetical views were considered.

View 1: Political news will outperform economic news by 2%
View 2: Social news will outperform economic news by 1%

The above views are assumed by us for this analysis. One can assume any other news category along with any other percentage value. Like that, analysts can build the model according to their assumptions/ views to predict the return.

Applying to our data set, the number of views or k is 2; thus, the View Vector (Q) is a 2 x 1 column vector. The uncertainty of the views results in a random, unknown, independent, normally distributed Error Term Vector (ε) with a mean of 0 and covariance matrix Ω. Thus, a view has the form Q +ε.

$$Q + \varepsilon = \begin{pmatrix} 0.02 \\ 0.01 \end{pmatrix}$$

The expressed views in column vector Q are matched to specific assets by Matrix P. Each expressed view results in a 1 x N row vector. Thus, K views result in a K x N matrix. In the two-view data set, in which there are 8 qualitative factors, P is a 2 x 8 matrix.

$$P = \begin{bmatrix} 0.2 & 0.2 & 0.2 & 0.2 & -0.5 & 0 & -0.5 & 0.2 \\ 0 & 0 & 0 & 0 & -0.5 & 1 & -0.5 & 0 \end{bmatrix}$$

View 1 and View 2 are represented by Row 1 and Row 2, respectively. In the case of relative views, each row sums to 0. *P* Matrix eliminates the impact of news happening together. It automatically removes the simultaneous impact of news. Therefore, *P* matrix considers that only the selected news item will be affected to the market at a given point.

In Matrix *P*, the nominally outperforming assets receive positive weightings, while the nominally underperforming assets.

Further, it is assumed that these rows are independent from each other. That is, views are independent from each other.

Conclusion

Considering the above data, we can conclude that attacks, international political problems, natural disasters, and protests have a negative impact on the stock market return while changes in Government Acts and Election time have a positive impact on stock market return. Further, Monetary & Fiscal policy changes and news on major investments have a neutral impact on the return.

The hypothetical testing further proves that Monetary & Fiscal policy changes and news on major investments don't have a significant impact on index returns. It indicates that, results under actual scenario and assumes scenario (if the event doesn't occur) would not be significantly changed. Therefore, an investor can give minor priority for such news items when deciding on stock investments in CSE or when arranging numbers/ views in *P* matrix.

In addition, other selected events have a significant impact on the index returns. It indicates that actual and assumed result can be significantly varied. Therefore, an investor should consider significantly when taking decisions on stock investments in CSE. Also, he/she prioritize such news items when deciding on views and arranging number in *P* matrix.

Therefore, one can consider the significance level of the news items and the type of impact (negative/positive) when assigning numbers and views for the *P* matrix.

In a nut shell, it is proved that a *P* matrix can be derived by applying the Black-Litterman model together with hypothetical views to predict the return of the index movement.

What could go wrong?

- Lag between announcement of the news and reaction of public. It is hard to identify starting point and the ending point of reaction period. Therefore, most of the time, this lagging problem prevailed in stock market analysis. It is also very subjective to identify the starting and ending points.
- The considered ASI index covers all of the shares in the Colombo Stock Exchange. Some companies are weak in liquidity. Their weightage over the index is comparatively low. Therefore, even though ASI covers all of the shares, the weights over the index are different. Thereby, although a particular news

impact on the share price significantly, due to low weightage (weak liquidity) on the index, that impact would not be able to witness in the return.

- Black-Litterman model is largely based on estimations/ assumptions/ hypothesis which could go wrong.
- T-distribution:
    - Type I error is the probability of rejecting a true null hypothesis, that is, making the error of claiming that there is a significant difference between two populations when no such difference exists.
    - A Type II error means not rejecting the null hypothesis when it's actually false. This is not quite the same as "accepting" the null hypothesis, because hypothesis testing can only tell you whether to reject the null hypothesis. Instead, a Type II error means failing to conclude there was an effect when there actually was.
- Sector/ company-specific news: As discussed in the chapter "Data & Analysis", there may be news that is specific only to a certain company or sector. That might change the suggested results of the model.

References

- Bevan, A., & Winkelmann, K. (1998, December). *Using the Black-Litterman Global Asset Allocation Model: Three Years of Practical Experience.* Goldman, Sachs & Company.

- Fusai, G., & Meucci, A. (2003). Assessing Views. *Risk*, 18-21.

- Gunasekara, A., & Jayasinghe, J. (2020). Does Weather Contribute to Stock Price Variation? A Cointegration Analysis. *Kelaniya Journal of Management*, 55-66.

- Herold, U. (2003). Portfolio Construction with Qualitative Forecasts. *Journal of Portfolio Management*, 61-72.

- Idzorek, T. (2002). *A STEP-BY-STEP GUIDE TO THE BLACK-LITTERMAN MODEL.* Zephyr Associates, Inc.

- Lee, W. (2000). Advanced Theory and Methodology of Tactical Asset Allocation. *New York: John Wiley & Sons.*

- Markowitz, H. (1952). Portfolio Selection. *The Journal of Finance*, 77-91.

- Michaud, R. (1989). The Markowitz Optimization Enigma: Is Optimized Optimal? *Financial Analysts Journal*, 31-42.

- Morawakage, P., & Nimal, P. (2015). Equity market volatility behavior in Sri Lankan context. *Kelaniya Journal of Management*, 1-9.

- Morawakage, P., Nimal, P., & Kuruppuarachchi, D. (2019). Equity Risk Premium Puzzle: Evidence from Indonesia and Sri Lanka. *Bulletin of Indonesian Economic Studies*, pp. 239-248.

- MSCI. (n.d.). *Market Intelligence.* Retrieved from S&P Global: https://www.spglobal.com/marketintelligence/en/documents/112727-gics-mapbook_2018_v3_letter_digitalspreads.pdf

- Rathnayaka, R., Seneviratna, D., & Nagahawatta, S. (2014). Empirical Investigation of Stock Market Behaviour in the Colombo Stock Exchange. *Reshaping Management and Economic Thinking through Integrating Eco-Friendly and Ethical Practices Proceedings of the 3rd International Conference on Management and Economics* (pp. 209-216). Faculty of Management and Finance, University of Ruhuna, Sri Lanka.

- Satchell, S., & Scowcroft, A. (2000). A demystification of the Black–Litterman model: Managing quantitative and traditional portfolio construction. *Journal of Asset Management*.

Appendix

1. Tables in the following pages includes breakdown of data points we identified throughout the period of 2015-2020 Jan. The starting point of the reaction period is taken as when people felt the smell of the news. In other terms, when people gets to know that there will be an announcement of the news. Then, we calculated return while comparing it with index at the end of reaction time. Therefore, returns were calculated for each and every data point/ news events we identified.

   "U" points represent upsides and "D" points represent downsides. After calculating returns under each news point, then we derived the averages of returns under each sub topics.

Code	News	The smell of the news	The original date of the incident	Up/down start	ASI value	Up/down end	ASI value	Trading days	Size of jump/dip	Qualitative factor/ sub news category
U1	Presidential election (MS won)	29-Mar-14	08-Jan-15	2-Jan-15	7,348.39	12-Jan-15	7,566.70	5	3%	Election time/ political issues
D1	Political problems over the port city	28-Jan-15	05-Feb-15	28-Jan-15	7,395.29	5-Feb-15	7,047.31	4	-5%	Election time/ political issues
D2	Port city project was suspended	20-Feb-15	05-Mar-15	27-Feb-15	7,301.29	16-Mar-15	7,050.91	10	-3%	News on major investments
U2	spiked in alcohol taxes and vehicle import taxes	10-Apr-15	15-Apr-15	10-Apr-15	6,901.06	17-Apr-15	7,086.41	3	3%	Monetary & Fiscal policy changes
U3	19th amendment was adopted	16-Mar-15	28-Apr-15	21-Apr-15	7,098.60	6-May-15	7,192.29	9	1%	Changes in Government Acts
D3	Parliament is dissolved	09-Apr-15	26-Jun-15	18-May-15	7,255.02	4-Jun-15	7,120.91	12	-2%	Election time/ political issues
U4	Parliament is dissolved	24-Jun-15	26-Jun-15	24-Jun-15	7,053.83	20-Jul-15	7,147.86	12	1%	Election time/ political issues
U5	Thomas Cook buys SL travel firm	25-Jul-15	30-Jul-15	29-Jul-15	7,313.97	30-Jul-15	7,332.05	1	0%	News on major investments
D4	Parliamentary election	18-May-15	17-Aug-15	3-Aug-15	7,336.59	27-Aug-15	7,273.14	18	-1%	Election time/ political issues
D5	Printed money	1-Sep-15	01-Sep-15	1-Sep-15	7,298.75	2-Sep-15	7,240.39	1	-1%	Monetary & Fiscal policy changes

Code	News	The smell of the news	The original date of the incident	Up/down start	ASI value	Up/down end	ASI value	Trading days	Size of jump/dip	Qualitative factor
D6	Port city to be resumed (political issues over that)	04-Jun-15	18-Nov-15	9-Nov-15	7,050.21	16-Nov-15	6,965.98	4	-1%	Election time/ political issues
D7	Budget proposals to increase taxes, restrict gold back loan %	10-Nov-15	15-Nov-15	17-Nov-15	6,977.95	14-Dec-15	6,803.08	18	-3%	Monetary & Fiscal policy changes
U6	re-applying GSP+	30-Nov-15	15-Dec-15	15-Dec-15	6,820.77	21-Dec-15	6,881.75	4	1%	News on major investments
D8	Budget proposals post impact	27-Nov-15	18-Jan-16	4-Jan-16	6,867.62	20-Jan-16	6,261.18	11	-9%	Monetary & Fiscal policy changes
D9	Budget proposals post impact	27-Nov-15	15-Feb-16	9-Feb-16	6,372.71	18-Feb-16	6,208.89	7	-3%	Monetary & Fiscal policy changes
U7	Constitutional changes on parliament in Sri Lanka	15-Mar-16	28-Mar-16	30-Mar-16	6,040.99	11-May-16	6,661.45	26	10%	Changes in Government Acts
D10	Flood and landslides	14-May-16	14-May-16	17-May-16	6,670.79	3-Jun-16	6,519.23	12	-2%	Natural disasters
D11	BREXIT discussions	08-Jun-16	15-Jun-16	14-Jun-16	6,518.08	30-Jun-16	6,283.27	12	-4%	International political problems
U8	New CB Governor	16-Jun-16	02-Jul-16	4-Jul-16	6,254.77	5-Jul-16	6,280.39	1	0%	Monetary & Fiscal policy changes

Code	News	The smell of the news	The original date of the incident	Up/down start	ASI value	Up/down end	ASI value	Trading days	Size of jump/dip	Qualitative factor
U9	Singapore and SL free trade agreement discussions	7-Jul-16	15-Jul-16	7-Jul-16	6,310.69	13-Jul-16	6,402.78	4	1%	News on major investments
U10	Raised policy rates	25-Jul-16	28-Jul-16	28-Jul-16	6,392.15	3-Aug-16	6,511.58	4	2%	Monetary & Fiscal policy changes
U11	SL revises VAT threshold for wholesale and retail sales	08-Sep-16	14-Sep-16	21-Sep-16	6,451.61	4-Oct-16	6,591.41	9	2%	Monetary & Fiscal policy changes
D12	Hartal in North	10-Oct-16	15-Oct-16	10-Oct-16	6,562.50	19-Oct-16	6,444.39	7	-2%	Protests
D13	Budget proposals (increase in VAT)	8-Nov-16	15-Nov-16	8-Nov-16	6,439.06	29-Nov-16	6,231.87	14	-3%	Monetary & Fiscal policy changes
D14	Police clash on Port City	06-Jan-17	15-Jan-17	16-Jan-17	6,201.65	25-Jan-17	6,127.08	7	-1%	Protests
U12	Fitch upgrades Sri Lanka outlook	15-Feb-17	15-Feb-17	15-Feb-17	6,175.50	16-Feb-17	6,173.72	1	0%	News on major investments
U13	CBSL raises policy rates	21-Mar-17	24-Mar-17	23-Mar-17	5,979.85	6-Apr-17	6,250.04	10	5%	Monetary & Fiscal policy changes
D15	Meethotamulla garbage dump	15-Apr-17	15-Apr-17	12-Apr-17	6,402.99	17-Apr-17	6,351.26	1	-1%	Natural disasters

Code	News	The smell of the news	The original date of the incident	Up/down start	ASI value	Up/down end	ASI value	Trading days	Size of jump/dip	Qualitative factor
U14	EU restores GSP+	13-May-17	15-May-17	15-May-17	6,659.87	17-May-17	6,718.34	2	1%	Monetary & Fiscal policy changes
D16	Cabinet was reshuffled	10-May-17	22-May-17	19-May-17	6,729.66	23-May-17	6,689.96	2	-1%	Election time/ political issues
D17	Floods and landslides	25-May-17	25-May-17	25-May-17	6,714.95	30-May-17	6,655.25	3	-1%	Natural disasters
U15	Minimum public rule enforcement announcement	20-Jun-17	29-Jun-17	28-Jun-17	6,697.08	30-Jun-17	6,747.07	2	1%	Changes in Government Acts
D18	increased minimum capital requirements on financial institutes	05-Jul-17	15-Jul-17	14-Jul-17	6,766.14	25-Jul-17	6,662.34	7	-2%	Monetary & Fiscal policy changes
D19	SL signs deal on Hambanthota Port	20-Jul-17	28-Jul-17	27-Jul-17	6,668.86	9-Aug-17	6,506.03	8	-2%	Election time/ political issues
U16	Hayleys acquired Singer SL	11-Sep-17	13-Sep-17	13-Sep-17	6,372.70	20-Sep-17	6,452.91	5	1%	News on major investments
D20	Anti-Muslim riots	8-Nov-17	10-Nov-17	8-Nov-17	6,598.26	15-Nov-17	6,428.83	5	-3%	Attacks
D21	Budget 2018 (slams carbon tax on cars/ alcohol tax)	10-Nov-17	25-Nov-17	17-Nov-17	6,483.55	28-Nov-17	6,405.22	7	-1%	Monetary & Fiscal policy changes

Code	News	The smell of the news	The original date of the incident	Up/down start	ASI value	Up/down end	ASI value	Trading days	Size of jump/dip	Qualitative factor
U17	Officially handed over Hambantota port	12-Dec-17	15-Dec-17	20-Dec-17	6,321.36	22-Dec-17	6,323.74	2	0%	News on major investments
U18-1	Local elections	01-Jan-18	10-Feb-18	23-Jan-18	6,418.05	8-Feb-18	6,542.90	10	2%	Election time/ political issues
U18-2	Local elections	09-Feb-18	10-Feb-18	14-Feb-18	6,532.26	21-Feb-18	6,598.73	5	1%	Election time/ political issues
D22	Anti-Muslim riots	27-Feb-18	27-Feb-18	26-Feb-18	6,560.32	6-Mar-18	6,533.46	5	0%	Attacks
D23	Social media shutdown	05-Mar-18	07-Mar-18	6-Mar-18	6,533.46	7-Mar-18	6,503.86	1	0%	Attacks
D24	state of emergency	10-Mar-18	15-Mar-18	13-Mar-18	6,554.83	21-Mar-18	6,445.97	6	-2%	Attacks
U19	RW survived from no-confidence	30-Mar-18	04-Apr-18	3-Apr-18	6,458.33	5-Apr-18	6,474.70	2	0%	Election time/ political issues
D25	Floods	26-May-18	26-May-18	24-May-18	6,472.21	31-May-18	6,398.44	4	-1%	Natural disasters
U20	SL ranked in Lonely planet list	15-Oct-18	15-Oct-18	16-Oct-18	5,796.02	18-Oct-18	5,778.30	2	0%	News on major investments
U21	MR was appointed as PM	26-Oct-18	26-Oct-18	29-Oct-18	5,944.18	1-Nov-18	6,114.13	3	3%	Election time/ political issues
D26	political crashes	1-Nov-18	05-Nov-18	1-Nov-18	6,114.13	8-Nov-18	5,930.59	4	-3%	Protests

Code	News	The smell of the news	The original date of the incident	Up/down start	ASI value	Up/down end	ASI value	Trading days	Size of jump/dip	Qualitative factor
U22	MS dissolved the Parliament	05-Nov-18	09-Nov-18	8-Nov-18	5,930.59	13-Nov-18	5,993.54	3	1%	Election time/ political issues
D27	political crashes	13-Nov-18	15-Nov-18	13-Nov-18	5,993.54	19-Nov-18	5,947.90	4	-1%	Protests
D28	3 banks were downgraded	19-Nov-18	20-Nov-18	19-Nov-18	5,947.90	23-Nov-18	5,929.98	2	0%	Changes in Government Acts
D29	RW was reinstated	14-Dec-18	16-Dec-18	14-Dec-18	6,062.55	21-Dec-18	6,005.65	5	-1%	Changes in Government Acts
D30	President stressed in parliament that the death sentence would be initiated	30-Jan-19	05-Feb-19	1-Feb-19	5,982.05	6-Feb-19	5,957.41	2	0%	Changes in Government Acts
D31	2019 Sri Lanka electricity crisis started after the Ceylon Electricity Board decided to impose four-hour rolling power cut on a scheduled basis throughout the country	22-Mar-19	25-Mar-19	22-Mar-19	5,540.05	27-Mar-19	5,511.77	3	-1%	Protests

Code	News	The smell of the news	The original date of the incident	Up/down start	ASI value	Up/down end	ASI value	Trading days	Size of jump/dip	Qualitative factor
D32-1	Easter Attack	23-Apr-19	23-Apr-19	18-Apr-19	5,606.35	23-Apr-19	5,402.58	1	-4%	Attacks
D32-2	2019 Kalmunai shootout	29-Apr-19	29-Apr-19	30-Apr-19	5,478.41	15-May-19	5,199.98	10	-5%	Attacks
U23	Policy rates cut	28-May-19	31-May-19	6-Jun-19	5,276.84	11-Jun-19	5,335.29	3	1%	Monetary & Fiscal policy changes
U24	Presidential election heating up (Mahinda named Gotabaya as the candidate on 11th Aug)	31-May-19	29-Jul-19	23-Jul-19	5,683.47	13-Aug-19	5,949.30	14	5%	Election time/ political issues
U25	Presidential election nominations	01-Jun-19	30-Sep-19	3-Oct-19	5,677.50	14-Oct-19	5,870.09	7	3%	Election time/ political issues
U26	Presidential election results	08-Nov-19	18-Nov-19	15-Nov-19	6,023.02	28-Nov-19	6,201.12	9	3%	Election time/ political issues
U27	Tax concessions were announced	25-Nov-19	28-Nov-19	28-Nov-19	6,201.12	3-Dec-19	6,214.99	3	0%	Monetary & Fiscal policy changes
D33	Flood & landslides	19-Dec-19	19-Dec-19	18-Dec-19	6,059.09	23-Dec-19	6,031.81	3	0%	Natural disasters

Code	News	The smell of the news	The original date of the incident	Up/down start	ASI value	Up/down end	ASI value	Trading days	Size of jump/dip	Qualitative factor
D34	SME loan extension	25-Dec-19	27-Dec-19	30-Dec-19	6,156.00	2-Jan-20	6,108.53	2	-1%	Monetary & Fiscal policy changes
D35	US & Iran war	06-Jan-20	06-Jan-20	3-Jan-20	6,111.28	8-Jan-20	5,898.84	3	-3%	International political problems
U28	Tax concessions were announced	20-Jan-20	23-Jan-20	22-Jan-20	5,941.42	24-Jan-20	5,991.29	2	1%	Monetary & Fiscal policy changes

Table 3: Breakdown of news items and the index return