TSX Factors and Analysis

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Introduction

Background

The Toronto Stock Exchange (TSX) facilitates the transactions of shares of different types of securities. It functions to provide investors with liquidity and issuers with access to raise capital. There are approximately 1600 listings on the TSX, with the vast majority of which being Canadian issuers (TSX, 2020). The combined market capitalization of these 1600 listings is $3 trillion.

Issuers from a variety of sectors are present, including consumer products, technology, metals and financial services. Furthermore, these securities may be a corporation equity or an exchange traded product (ETP), such as exchange traded funds (ETFs) or real estate investment trusts (REITs). ETPs comprise of almost half (45.86%) of the listings on the TSX (TSX, 2020).

Any given security's price is influenced by a myriad of factors. Some factors include the security's fundamental data, industry strength, investor sentiment, float, inflation, liquidity, supply & demand and the overall economy. This project seeks to aggregate and analyze data relevant to the pricing of TSX securities.

Thesis

The pricing of securities on the TSX is influenced by underlying metrics, including economical and fundamental data. By performing an analysis and understanding these factors, investors may estimate future trends.

Methodology

Data Aggregation

Data is aggregated to provide a holistic view of the factors and state of the stock market. Indices with real time, automatically updated, data is viewable in excel where statistical analysis and charting is completed. Furthermore, a similar analysis is done on economic indicators (i.e. GDP, unemployment rate, etc.), as well as specific values of index constituents. Data is aggregated through web queries in Excel and Python.

Charting

Excel charts that update based on the data may be viewed. The user may modify the charts; however, by default there are charts that display data in line graph and scatter plot format. Charting helps analyze the effect factors have on a security's current and historical pricing. Furthermore, charts exist for 10 economic indicators including GDP, unemployment rate and inflation.

Statistical Analysis

Statistical analysis provides valuable insight into the trends of the data. The analysis conducted includes five number summary, box plot values, box plot graphs, percentile and standard deviation. The scatter plots feature a line of best fit, linear regression equation and co-efficient of determination value.

Python Scripting

In order to expedite the data aggregation of index constituents, a python script is used to access the web. The script searches for and generates the data of 7 indices, so that the data may be analyzed in Excel ("Index Constituents Analysis" file).

Controlled Variables

The data used is updatable through Excel's built in query refresh function. Having the most recent data creates a consistent snapshot in time for the data, so that they may be compared with each other. Furthermore, securities from the same stock exchange (TSX) is used and all currency figures are in $CAD.

Fluctuating Variables

Due to the nature of securities, they have several variables that greatly fluctuate and differ from one another. Furthermore, these values may fluctuate up to as often as on a minute to minute basis.

These variables include:

- Close Price
- Market Capitalization
- P/E
- Volume
- Dividend Yield

To address this, updating the data set is an important consideration. The automatic updating that has been implemented allows for an understanding of these fluctuating variables. The data may be updated using Excel's built in queries & connections function in the 'Data' panel.

Dataset Organization

The dataset has been organized into 4 excel files based on a grouping of the analysis made. The following is a description of the data variables used:

CPI: Consumer price index. It is a measure of inflation reported on a trailing twelve months basis.

Dividend Yield: The dividend per share, divided by the price per share, expressed as a percentage.

EPS: Earnings per share. The net profit per share.

GDP: Gross domestic product. The value of all goods and services produced within Canada.

House Price Index: A measure of the prices of new homes in Canada, including both land and property.

HQ Location: The location of the company's headquarters.

Interlisted: The exchange that the security is also listed on, besides the TSX, if applicable.

Market Capitalization: The market value of the entire company. Calculated as price per share multiplied by number of shares outstanding.

Number of Trades YTD: The number of trades, year to date, that have occurred.

P/E: Price to earnings ratio. Calculated as price per share divided by earnings per share.

Price: The closing price for a share, at the end of the trading day specified.

Sector: The sector/field that a security is grouped in.

Subsector: As a subset of sector, the subsector is a more specific sector.

Trade Balance: The difference between the value of Canada's exports and imports.

Unemployment: The national unemployment rate of Canada, expressed as a percentage.

Volume: The total number of shares traded on one side of a transaction (TMX Group, 2020).

Data

Data Overview

Four data sets are aggregated for the purposes of this research. The data is overviewed in the following table:

Data Set	Description	Excel File	Source
TSX	Data for all 1595 TSX listings was aggregated, including volume, number of trades, market cap and sector.	TSX & Sector Averages.xlsx	https://tsx.com/listings/current-market-statistics
Index Constituents	Using a python script created, data was aggregated into the excel file for analysis. This was done via the web for 7 indices.	Index Constituents & Analysis.xlsx	https://finance.yahoo.com
Index	Close price and date were aggregated for various indices for the past 100 days. This is done for 6 indices.	Index Data & Analysis.xlsx	https://finance.yahoo.com
Economic	The value and date data for 10 economic indicators is imported from Stats Canada.	Economic Data & Analysis.xlsx	https://statcan.gc.ca

Table 1: An overview of the data that was aggregated, as well as the corresponding sources and excel files.

Dataset 1: TSX

Dataset 1 comprises of data for all 1595 TSX listings. This allowed for the generation of several insights. For example, the company with the largest market capitalization on the TSX is RBC, with a market capitalization of $147B, while the smallest market capitalization was $785K.

The data collected for each TSX listing was as follows:

- Name
- Ticker
- Market Value
- Outstanding Shares
- Sector
- Subsector
- Listing Type
- HQ Location
- Interlisted
- Former CPC
- Fund Family
- Security Product Type
- Volume YTD

- Number of Trades YTD

Through this data, it was possible to filter through securities based on their sector. It was found that ETPs are the most common security type on the TSX, followed by mining. SPAC was the least common security type, followed by Utilities and Pipelines.

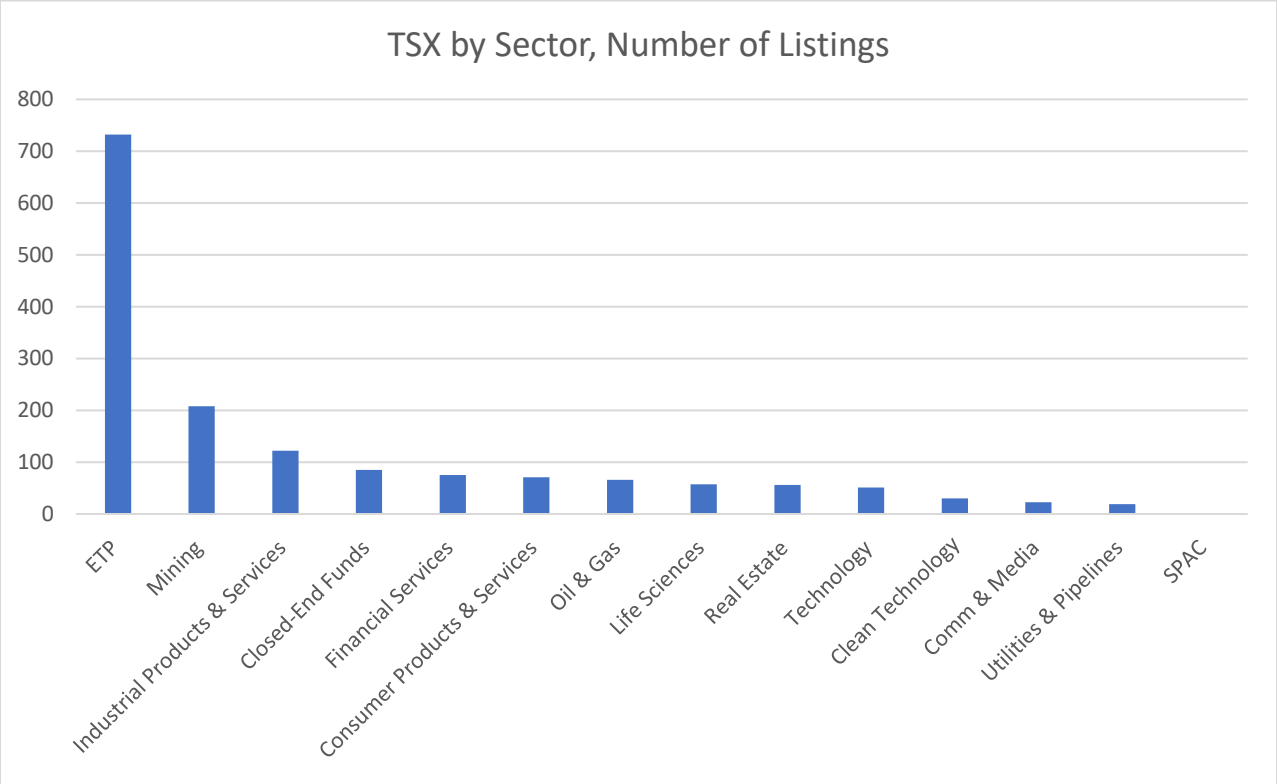

Figure 1: Number of listings on the TSX, grouped by sector.

When viewing the market capitalization by sector as a percentage of the total TSX market capitalization, it was found that financial services comprised the largest percentage. Financial service was followed by industrial products & services. Among the lowest market capitalization proportions were the sectors of clean technology, life sciences, close-ended funds and SPAC, in descending order.

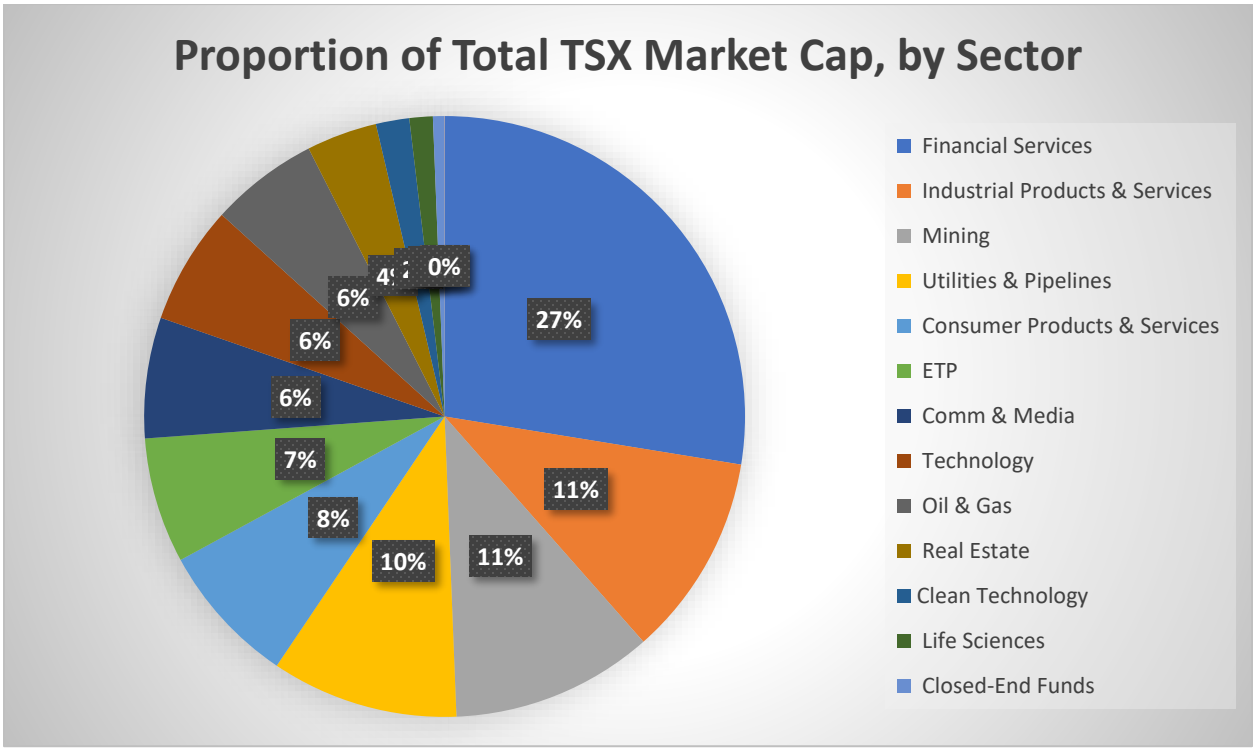

Figure 2: The proportion of TSX market capitalizations, grouped by sector.

For the values of market capitalization, outstanding shares, volume YTD and number of trades YTD, the values were grouped by sector and the averages were found. On average, securities in the Utilities and Pipelines sector have the largest market capitalization, while closed-end funds have the lowest average market capitalization. Furthermore, the utilities and pipelines sector has been the most active this year, with the highest average number of trades YTD and the highest average volume YTD.

Sector	Criteria	Mean
Clean Technology	Market Cap	$1,823,088,274.22
	Volume YTD	11,429,094.23
	Number of Trades YTD	46,234.97
Closed-End Funds	Market Cap	$218,448,343.16
	Volume YTD	946,253.59
	Number of Trades YTD	1,917.27

Sector	Criteria	Mean
Comm. & Media	Market Cap	$8,591,510,878.12
	Volume YTD	15,857,225.96
	Number of Trades YTD	64,638.87
Consumer Products	Market Cap	$3,273,937,417.82
	Volume YTD	8,280,995.76
	Number of Trades YTD	41,570.94
ETP	Market Cap	$280,756,519.10
	Volume YTD	1,659,917.15
	Number of Trades YTD	2,202.39
Financial Services	Market Cap	$11,180,156,354.40
	Volume YTD	19,410,546.68
	Number of Trades YTD	69,632.52
Industrial Products	Market Cap	$2,725,281,560.96
	Volume YTD	13,252,018.58
	Number of Trades YTD	35,061.52
Life Sciences	Market Cap	$669,806,705.13
	Volume YTD	26,198,458.56
	Number of Trades YTD	46,592.07
Mining	Market Cap	$1,591,375,275.23
	Volume YTD	16,815,772.53
	Number of Trades YTD	38,479.06
Oil & Gas	Market Cap	$2,681,959,840.22
	Volume YTD	38,556,015.62
	Number of Trades YTD	79,436.44
Real Estate	Market Cap	$2,063,587,826.38
	Volume YTD	9,382,281.79
	Number of Trades YTD	37,949.57
Technology	Market Cap	$3,806,843,475.73
	Volume YTD	7,185,341.16
	Number of Trades YTD	31,103.49

Utilities & Pipelines	Market Cap	$16,114,399,455.80
	Volume YTD	42,118,718.32
	Number of Trades YTD	150,324.89

Table 2: Average market capitalization, volume and number of trades, by sector on the TSX.

Data Set 2: Index Constituents

The data values of EPS, P/E, volume, market capitalization, dividend yield and close price were generated through Python for the constituents of 7 ETFs tracking indices. These indices were:

- TSX60
- TSX/S&P
- TSX/S&P Energy
- TSX/S&P Financial
- TSX/S&P Real Estate
- TSX/S&P Technology
- TSX/S&P Consumer Staples

This allowed for the viewing of specific fundamental data for each constituent of an index. Despite belonging to the same index, there are significant fluctuations in the data values collected. For example, the dividend yields of the constituents of the TSX/S&P Financial index yielded a variety of values ranging from 0% to over 20%.

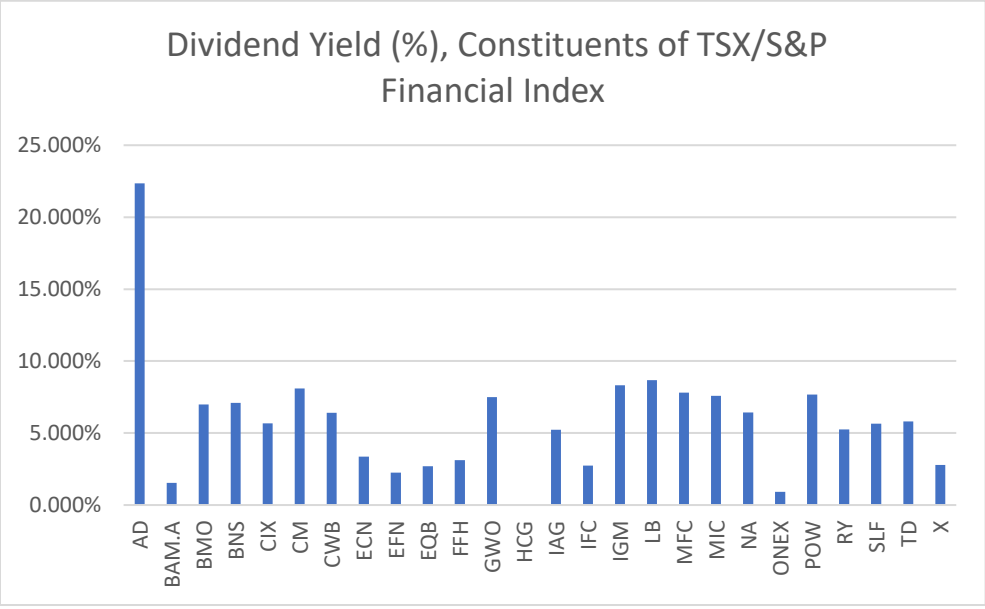

Figure 3: The dividend yield values of the constituents of the TSX/S&P Financial Index

Among the 7 indices, sizes ranged greatly with the smallest index, consumer staples, containing 11 constituents. On the other hand, the TSX/S&P index contained 230 constituents.

The TSX/S&P energy index yielded the greatest average dividend yield among its constituents, while consumer staples yielded the lowest average dividend yield.

Data Set 3: Index

The data values of date and close price was generated for 6 indices for the past 100 days. These indices were:

- TSX60
- TSX/S&P
- TSX/S&P Energy
- TSX/S&P Real Estate
- TSX/S&P Technology
- TSX/S&P Consumer Staples

Following data aggregation, statistical analysis was conducted on each index's data. Five number is among the statistical analysis. First, the minimum, three quartiles, and maximum was determined. Afterwards, quartile differences and the interquartile range was calculated. A box plot was generated based off this data for each index, and the maximum and minimum non-outliers were established.

Index	Recent Value	Minimum Non-Outlier	Maximum Non-Outlier
TSX60	$19.44	$24.09	$27.48
TSX/S&P	$20.12	$25.59	$29.08
TSX/S&P Energy	$3.00	$6.74	$9.97
TSX/S&P Real Estate	$138.30	$179.55	$216.52
TSX/S&P Technology	$25.08	$22.69	$35.69
TSX/S&P Consumer Staples	$56.99	$59.56	$69.29

Table 3: Minimum and maximum non-outlier values based on IQR and five number summary analysis.

Furthermore, for each index, a scatter plot was generated with a linear regression equation. The correlation of determination and standard error of estimate values were then calculated.

Index	Regression Equation	Coefficient of Correlation	Coefficient of Determination
TSX60	y= -0.03042x + 1358.8891	-0.5403	0.2919
TSX/S&P	y= - 0.03318x+ 1481.1944	-0.5365	0.2879
TSX/S&P Energy	y= -0.0308x + 1359.36234	-0.6834	0.4670
TSX/S&P Real Estate	y = -0.2044x + 9152.3808	-0.4200	0.1764
TSX/S&P Technology	y = 0.0043x -160.9716	0.0785	0.0062
TSX/S&P Consumer Staples	y = -0.0382x + 1736.4483	-0.5026	0.2526

Table 4: Regression equation, correlation and coefficient of determination for each index.

Data Set 4: Economic

The same analysis was conducted on the values of 10 economic indicators. These indicators were:

- National Population of Canada
- CPI
- USD/CAD Currency Conversion Rate
- Gasoline
- Unemployment
- GDP Growth
- Retail Sales
- New Home Price Index (Property and Land)
- Median National Income of Canada
- National Trade Balance of Canada

Each economic indicator was analyzed with a five-number summary initially. The interquartile range and box plot were then generated, followed by a calculation of the maximum and minimum non-outlier values.

Economic Indicator	Recent Value	Minimum Non-Outlier	Maximum Non-Outlier
Population	37,894,799	36,824,269	38,381,433
CPI	2.1	1.25	2.45
USD/CAD	$1.4056	$1.23	$1.39
Gasoline	111	111.90	119.10
Unemployment	5.6%	5.6%	5.6%
GDP Growth (x1M)	$1,985,301.00	$1,977,445.00	$1,980,317.00
Retail Sales	$51,973,972	$51,353,918	$51,981,938
New Home Price Index	103.80	103.15	103.55
Median Income	$69,600	$63,950	$71,550
Trade Balance (x1M)	-1,473.50	- 2,586.50	381.50

Table 5: Minimum and maximum outlier values for 10 economic indicators, based on IQR.

Analysis

Preface

It should be noted that at the time of this writing, the COVID-19 virus has created a significant impact on Canada and the stock market as the government mandated closure of non-essential businesses continues. Therefore, many security prices have seen a drastic drop in recent times, which is reflected in the data. This will be considered and noted as relevant during the analysis.

Data Set 1: TSX Analysis

The TSX data found that ETPs are the most populous TSX listing type, based on number of listings. This makes sense, as an ETP tracks underlying securities, indices or financial instruments. For example, for many investors, it is more efficient and practical to purchase an ETF once, rather than purchases tens or hundreds of the underlying securities separately. Furthermore, it is possible for a single corporation to list multiple ETPs. Although many ETP's exist, they only comprise of 6.76% of the market capitalization of the TSX, indicating that there are larger players in the TSX.

The largest sector by market capitalization on the TSX is financial services. In fact, the largest single stock by market cap on the TSX is RBC at $147B, which is in this sector. Although this sector only makes up 4.70% of TSX listings, it comprises of 27.56% of the total TSX market cap. The financial services sector has an average market capitalization of $11.18B. Evidently, the financial services sector is a significant industry in both the TSX and Canadian economy. However, this sector is behind the energy sectors in terms of average number of trades YTD.

The sector with the largest average number of trades YTD is the utilities and pipelines sector. At 150,324.89 average YTD trades, it is significantly higher than the other sectors. One reason for this is the pipeline news in recent times, as protests and uncertainty has created volatility in this sector. Furthermore, the price of oil has been volatile as of late.

Among the smallest sectors by market cap are life science and clean technology, which is a result of the capital-intensive nature of these types of businesses. The total market capitalizations of these two sectors are $38.18B and $54.69B respectively.

Data Set 2: Index Constituents Analysis

Using Python, the EPS, dividend yield, P/E, volume, market cap and price of each constituent of several indices was generated for March 20, 2020. Upon analysis, it was discovered that although equities belonged to the same index, there were significant individual variations among the constituents. This indicates that although equities may be grouped together, their individual characteristics may be significantly different from their peers. Therefore, it is important to understand the details of a specific equity when looking at it in isolation.

It was also discovered that different indices have significant variation in the number of constituents. The lowest number of constituents was 11, and the highest was 230. Investors look to invest into ETFs tracking indices in order to purchase a diversified investment. Therefore, it is important to check how many constituents an ETF has in order to understand the magnitude of this diversification.

The index with the highest average dividend yield was the energy sector. This is likely because the energy sector has dropped especially low recently. As the price of oil has fallen drastically, as well as COVID-19 uncertainty and pipeline protests, the energy sector has especially dropped in price. This results in high dividend yields. For example, XEG is an ETF that tracks the S&P/TSX Capped Energy Index and it has dropped over 60% in price year to date, at the time of writing.

Consumer staples, on the other hand, has been relatively less effected by COVID-19, as investor sentiment is greater for this industry. This is because consumer staples are still being bought during the current shutdown.

Data Set 3: Index Analysis

The prices from Nov 7/19 to Mar 27/20 of ETFs that track several indices were analyzed to find the maximum and minimum non-outlier values based on IQR. It was found that every index's price was below the minimum non-outlier value, except the S&P/TSX technology index. This indicates that the TSX prices are now below their usual value.

Furthermore, the correlation coefficient was determined for each index. The value and interpretation of these values are as follows:

Index	Correlation Coefficient	Interpretation
TSX60	-0.5403	Negative Moderate
TSX/S&P	-0.5365	Negative Moderate
TSX/S&P Energy	-0.6834	Negative Moderate
TSX/S&P Real Estate	-0.4200	Negative Weak
TSX/S&P Technology	0.0785	Weak/No Correlation
TSX/S&P Consumer Staples	-0.5026	Negative Moderate

Table 6: Correlation coefficients and the interpretation of the value for indices.

Aligned with the correlation analysis, the regression analysis also shows that the prices of all the indices is negatively correlated with time, except for the TSX/S&P technology index, which has little current correlation.

Data Set 4: Economics Analysis

For 10 economic indicators, five number summary and IQR was utilized to find the maximum in minimum non-outliers. The following table establishes the analysis:

Economic Indicator	Interpretation	Last Updated
Population	Within Range	Jan/20
CPI	Within Range	Feb/20
USD/CAD	Outlier: Higher than usual	Mar 27, 2020
Gasoline	Outlier: Lower than usual	Feb/20
Unemployment	Within Range	Feb/20
GDP Growth (x1M)	Outlier: Higher than usual	Dec/19
Retail Sales	Within Range	Jan/20
New Home Price Index	Outlier: Higher than usual	Feb/20
Median Income	Within Range	2018
Trade Balance (x1M)	Within Range	Jan/20

Table 7: The interpretation of the IQR analysis on 10 economic indicators.

Most of the economic indicators are within a usual range based on the IQR analysis. The reason that this is the case, despite a stock market with falling prices, is because these indicators are yet to be updated. Most of the economic values are released intermittently, and these values are reflective of the economy before the shutdown.

Conclusions

Conclusion

The findings in the research created a visualization of the components and factors of the TSX. Furthermore, different statistical analyses have been in line each other. IQR and regression has indicated a general negative price action, as can be explained by the COVID-19 virus.

Analysis shows that the TSX/S&P technology index is the only index of those analyzed without a negative linear regression equation or correlation. This may be explained by the expected continued use of technology by consumers during the current shutdown.

Through the understanding of the data aggregated and analyzed in this research, a clearer view of the TSX has been achieved.

Learning and Next Steps

Things that I have learned in this course include:

- Statistics concepts: Interquartile range, linear regression, box plot, correlation
- Python programming skills
- Excel skills: Importing and cleaning data, functions
- Report writing and time management skills
- Stock market trends and relationships

A few potential next steps I would be interested in are:

- Applying similar analysis to other markets, such as futures or forex markets
- Adding more economic indicators
- Adding more indices for analysis
- Analyzing sectors in more detail
- Increasing the number of data points for certain economic indicators
- Increased fundamental analysis: News, releases, etc.

I would like to thank Professor Spektor and Professor Winter for supervising this project. I would especially like to thank Professor Spektor for taking the time to discuss any questions or concerns I had.

Glossary

Exchange Traded Product (ETP): Exchange traded product. A type of security listed on a stock exchange that tracks underlying securities, an index, or other financial instruments (Investopedia, 2020).

Exchange Traded Fund (ETF): A type of ETP that allows an investor to purchase multiple stocks through a single security.

Index: A measure of the state of the stock market, based on the performance of a basket of stocks (TMX Group, 2020).

Real Estate Investment Trust (REIT): A type of income trust that owns the debt and equity of underlying real estate. The trust distributes cash flows back to investors that are generated as part of the active ongoing business (TMX Group, 2020).

Stock Market: The facilitator of buyers and sellers exchanging securities.

Toronto Stock Exchange (TSX): The largest stock market in Canada, operated by TMX group.

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