

## Sector Rotation Investment Strategy by Implementing Piotroski F-Score and Markowitz Portfolio Theory for Portfolio Construction: Indonesia Stock Market 2020 to 2022

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**ABSTRACT:** IHSG or IDX Composite Index crash during 2020 where the index fell 37.5% since beginning of 2020 until mid march to the level points of 3,938, recovered and marking up in 2021 where the index reaching the peak in November to the level points of 6,723, and then consolidating at the year of 2022 where the index move in a ranging movements of up and down within the level points of 6,500 to 7,300. The different cycles of stock market movement are happening because of changes and different economic factors, making investors presented with a different opportunities and risks at the stock market. In order to capitalize these changes at the market, investors need to analyzed their portfolio periodically for evaluation and assessment. These research were conducted to examines what are the best portfolio for each year of 2020, 2021, and 2022 using sector rotation investment strategy by implementing sector comparison analysis and Piotroski F-score for stock screening method, while using Markowitz portfolio optimization theory for portfolio construction.

**KEYWORDS:** Markowitz Theory, Piotroski F-Score, Portfolio Optimization, Stock Market Investment, Sector Rotation Strategy.

### 1. INTRODUCTION

IHSG (Indeks Harga Saham Gabungan) or IDX Composite, which compromising all the stock equity in Indonesia are facing various market cycles throughout the year of 2020 until 2022, with the main event of mid 2020 stock market crash.

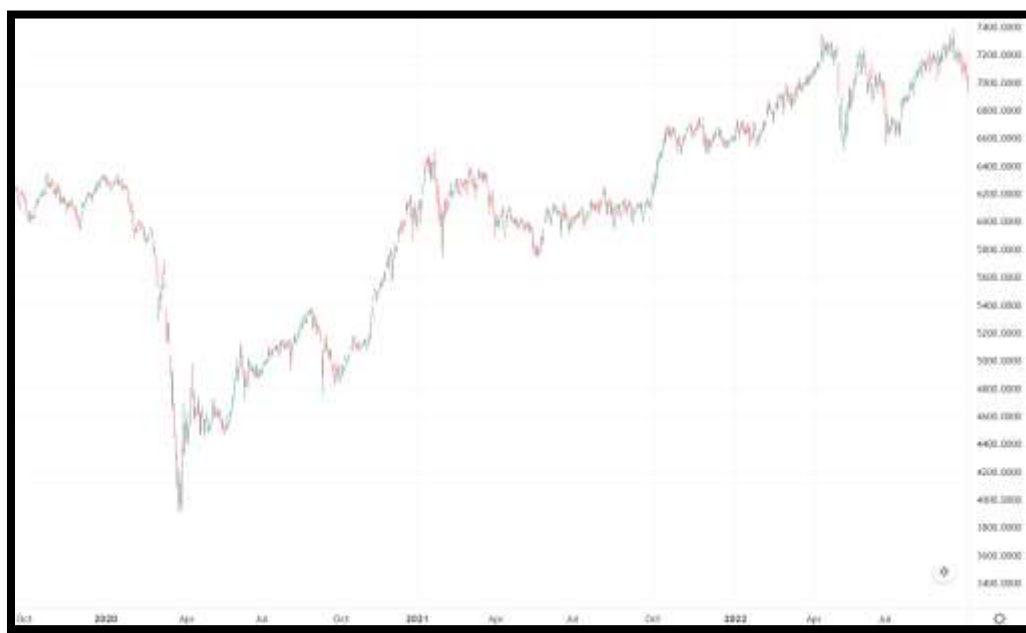


Figure-1.1: IHSG/IDX Composite During Period 2020 - Q3 2022

Sources: Tradingview.com



Indonesia stock market experiencing various volatilities and cycles during the period of these 3 years, composite index (IHSG-IDX Composite) fell around 37.5% since the beginning of 2020 to mid 2020 of March to the level points of 3.938 mainly because of economics constraint which are caused by Covid-19 pandemic. The stock market then fastly recovered within the same year of 2020, with the stock market composite index reaching the level points of 6.000 at the end of year 2020. Entering the year of 2021, the stock market composite index was consolidating until Q3 within the range level points of 5.800 and 6.500, then at Q4 2021 the stock market was breaking those consolidation level reaching the peak on November 2021 to the level points of 6,723. Indonesia stock market composite index in 2022 also move in a consolidation ranging movement of ups and downs within the range level points of around 6.500 to 7.300.

Through 2020 to 2022, Indonesia stock market was experiencing three market cycles of ups or mark-up phase, downs or mark-down phase, and consodilation which considered an accumulation or distribution phase. These different movement of market cycles are happening because of various changes that are happening within the economies which then reflected in the stock market. Investors need to always re-evaluate and re-assessed their existing portfolio, picking which equity or stocks that can provide better return and avoid equity or stocks with a high risks of loss. The stock market crash in the mid-2020 are one of the main event within these three years, crashing the market value by almost 40% in the short time period.

The main goal of a portfolio management is to come up with an optimal portfolio, and to achieve these an investors need to do a market analysis and understanding the elements of investing such as diversification. In doing the market analysis, investors should do an analysis in the macro and micro factors as part of their investment decision process, picking the sectors as the investment landscapes and choosing a good stocks as potential investment. While in diversification, investors should find an optimal balance of generating a return within the level of desirable risks.

Macro factors analysis look at the economy on much a bigger scale, such as at national or even regional level. Investors look at the overall climate of the investments, such as the nation political situations, the monetary and fiscal policies of those countries, the GDP growth, household spendings, consumers confidence, and other variables. The changes in these macroeconomic variables may benefit specific sectors on the stock market and unbeneficial for other sectors. This can be the basis for an investors to choose which sectors have the potential to invest.

After looking at the bigger scale and identifying which sectors that can be a potential landscape investments, investors then pick a company with a good fundamental. There are several things that need to be considered such as the growth of the revenue of those company, the balance sheet which reflect the debt and equity ratio, the company management, and the company competitive advantage to compete with their industry peers. As there are many stocks presented in the market, these can be a daring challenges for an investors to pick which companies and stocks that have a good fundamental.

The only way to create a portfolio that has the potential to provide appropriate levels of risk and return in various market scenarios is adequate diversification. Often investors think they can maximize returns by taking a large investment exposure in one stock. But when the market moves against such a concentrated position, it can be disastrous. Too much diversification and too many exposures can also affect performance, the best course of action in investing is to find a balance of risk and return.

If investors are invested in a diversified portfolio, there is an excellent chance that some stocks will go up while others go down. At the end of a quarter or a year, the portfolio an investors built with careful planning will start to look quite different. It is important for an investors to regularly (at a minimum once a year) assessing and evaluating a portfolio to make sure that the investments are still in a desirable performance. Investors can reduce risk through diversification, creating a portfolio of stocks whose returns are negatively correlated. That simply means that the change in return of one security is offset by the change in return on another security. These changes offset each other, which reduces the overall change on the portfolio's return from one period to the next. Reaching a balance diversification or optimal portfolio (maximizing return while minimizing risk) can be challenging for investors. How much stocks, which stocks, the weight of each individual stock composition, and finding the uncorrelated stock to do diversification but still maintaining a desirable return after minimizing the risk. These are the problems that need to be solved for an investor to have a good investment in the stock market.



## 2. MACROECONOMICS OVERVIEW

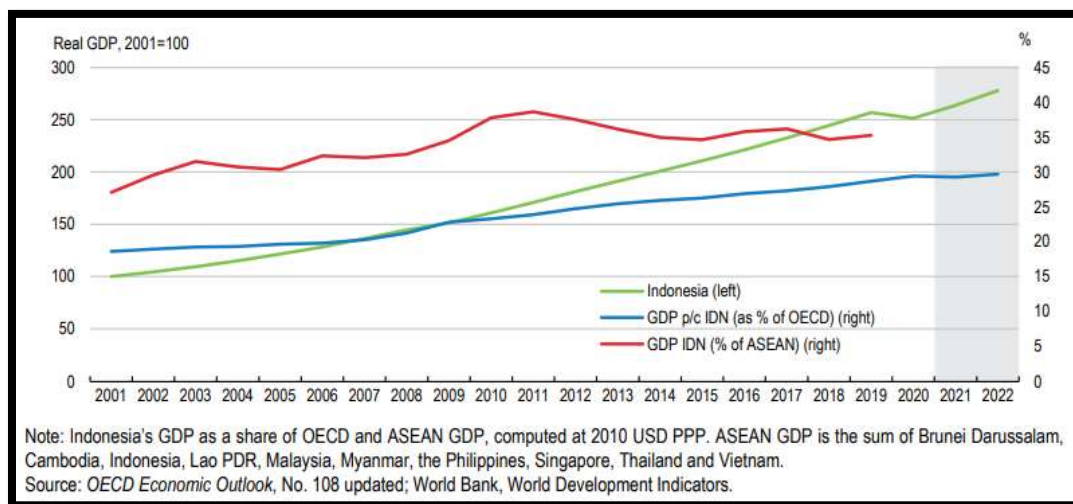
Predictive analysis is important step of an approach to financial market investment mangement. It is a process of monitoring the global or domestic macroeconomies and financial markets in order to mapping and mantaining an understanding of the market trends and sentiments (Lee and Lee, 2020).

Stock market is a reflection of market expectation about the economic conditions in the future because it show the willingness of an investors to buy at a higher level price of stocks when investors expect that the companies will be profitable and grow in the future (Mankiw, 2010).

Based on the research conducted by Satria (2020) in analyzing whether macroeconomics are affecting and matters to the Indonesia stock market in the past two decades, it was found that several macroeconomics variables such as GDP (Gross Domestic Product), interest rate, and inflation are correlate and significant to the stock market as these variables are affecting the investment decisions of investors in the stock market.

In order to create a portfolio of stocks, understanding the macroeconomics in Indonesia is one of the first step that need to be monitored. These research will monitored several macroeconomics variables such as GDP, interest rates, inflation, and etc., from several resources such as institution report to gain an insights about the economic condition in Indonesia.

Because of the Covid-19 pandemic, for the first time Indonesia recorded a negative GDP growth in 2020 since 1998, in which the previous year of +5% GDP growth to -2.1%. Indonesia growing middle class of almost 70 million people which was amounted to 55% of Indonesia GDP are the catalyst of the economy with the private domestic consumption as the key drivers. Based on OECD report, (Organization for Economic Co-Operation and Development) which is an organization of 38 member countries across the world in which Indonesia is one of them, it was stated in the report that recession which are happening to Indonesia in 2020 was interrupting a sustained economic expansion that Indonesia experienced from 2001 to 2019.



**Figure-2.1:** Covid-19 Pandemic in 2020 Interrupting Indonesia Growth  
**Sources:** OECD March 2021 Indonesia Economic Surveys Report

Indonesia GDP per capital rose from 19% of the OECD countries members average in 2001 up to 29% in 2019, while Indonesia contribution to the ASEAN GDP grew from 27% to 35%. During these period from 2001 to 2019, the annual growth of Indonesia was 5.1%, which is the third highest in the G20 countries members. Covid-19 pandemic hindered the growth, Indonesia economy is shrinking and experiencing -2.1% GDP growth in 2020.

In responding to the health crisis of Covid-19 pandemic, Indonesia government conducted a fiscal packages equivalent of 3.8% of GDP actual spending in 2020 and 4.2% of GDP in 2021, this was used to deal with the health impact of the pandemic to provide relief for firms and households, and also supporting the vaccine roll-out.

Indonesia central bank, Bank Indonesia, cutting its interest rate policy five times in 2020 and then again in 2021 February, by the total of 150 basis points. While also implementing quantitative easing and several macroeconomics policy to increase the money liquidity.

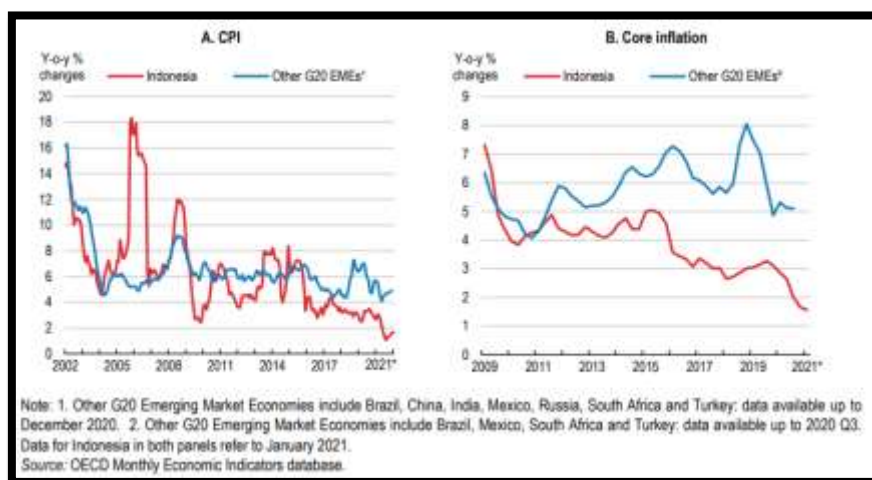
Then Indonesia economy grew for the first time after five quarters of consecutively negative GDP growth in the period of April-June of 2021. Indonesia recorded the strongest expansion on its economies in more than a decade, with GDP rose up to 7.07% compared to the second quarter of the previous year.

In 2021, the Indonesian economy was still recovering from the pandemic. Following a 2.1 percent recession in 2020, the economy recovered by 3.7 percent in 2021, thanks to robust exports and public spending. The recovery was greater than most counterparts in East Asia and the Pacific (EAP), with output exceeding pre-pandemic levels (World Bank EAP Update, April 2022). GDP per capita increased from USD 3,757 in 2020 to USD 3,856 in 2021, but remains below pre-pandemic levels.

The early phases of the recovery have been fueled by strong commodities prices and a pandemic relief fiscal package. Rising commodity prices, such as coal and palm oil, together with rising global demand, have maintained Indonesia's exports stable at 35.9 percent year on year in 2022 Q1. Exports contributed the most to GDP growth (4.7 percentage points in 2021). Because of fiscal growth in reaction to the epidemic, public consumption has also played a supportive role. In 2021, the government boosted funding for the Economic Recovery Program (PEN) to IDR 658.6 trillion. Authorities increased healthcare spending (from 0.4 percent of GDP in 2020 to 1.2 percent in 2021) while decreasing social assistance spending (down from 1.3 to 1.0 percent of GDP). The fiscal package has significant welfare ramifications. Social assistance expenditure in 2021 will avoid a 0.8pp increase in poverty. Despite the enhanced fiscal reaction, the fiscal deficit remained manageable, and the amount of government debt (40.7 percent of GDP) remained below the legal limit of 60 percent.

Sectors least affected by mobility limitations contributed the most to recovery. Except for some contact-intensive industries such as transportation and lodging, practically all supply sectors have recovered to pre-pandemic levels. Meanwhile, manufacturing, construction, wholesale and retail commerce, and telecommunications contributed more than 60% of GDP growth, indicating that demand is rebounding. Mining and health care were the fastest expanding industries in 2021 (contributing 9.0 and 1.3 percent to total GDP respectively). Mining benefited from high commodity prices and concomitant production growth, while the health sector benefited from government investment on immunization and hospital services.

The consumer price inflation are exceptionally low, reaching the level of 1.3% in August 2020 then rebounding to 1.6% January 2021. While the core measure of inflation (excluding volatile foods and administered prices) also recording a declined, falling into the level of 1.6% in January 2021. In both of these two inflation cases, Indonesia are still far lower compared to the other EMEs (Emerging Market Economies) of the G20 countries members.



**Figure-2.2:** Consumer Prices Inflation in Indonesia is Low  
**Sources:** OECD March 2021 Indonesia Economic Surveys Report



Amidst of global challenges, Indonesia economy continue to grow and recovered from the pandemic. World Bank reported that the global growth projections in early of 2022 to a significant slowdown because of the bottlenecks on the global supply chain and global monetary tightening policy. Then the environment just got worse as the war in Ukraine has made the commodity prices to increase significantly, these have intensifying the global inflation pressures and concerning the emerging market economies such as Indonesia over the tightening external finance.

As of 2022, the attention are shifting from recovering economy because of Covid-19 pandemic to the risks of global recession. This comes because of the slowing global economy as China lockdown locking the mobility as part of government zero-Covid policy, the US are trying to manage its inflation through hawkish interest rates policy and are also facing a tight labor markets, Europe are facing also a high inflation and energy supply crisis. Indonesia are facing an increasing inflation and external finance risks, but on the other hand experiencing economic growth because of increasing commodity price and rising consumer confidence which lead to spending and moving the wheel of domestic economy.

Since the beginning of 2022, the recovery has been sustained, albeit with a change in growth drivers toward private consumption and private investments. The most recent GDP figures show a steady rebound, with the economy rising by 5.0 percent in Q1-2022 (yoy). Private consumption (increased 4.4 percent year on year) and private investment are driving growth (up 4.1 percent yoy). Between Q4-2021 and May 2022, Bank Indonesia's Consumer Confidence Index and Consumer Expectations Index increased dramatically. Retail sales also increased through April (up 8.6 percent yoy). The robust gain in capital imports, cement sales, and commercial vehicle sales, as well as an increase in investment loans, indicate that private investment is rebounding.

On the supply side, contact-intensive industries led the drive in 2022 Q1 with mobility enhancements. Services (trade, tourism, transportation, and telecommunications) provided 40% of GDP growth, while manufacturing contributed 20%. The recovery occurs against the backdrop of rising global economic dangers, especially the consequences from the Ukraine conflict.

The pandemic appears to have subsided, and greater healthcare management has aided in the reopening of the economy. In January-February 2022, Indonesia had a brief rise in Omicron infections, with daily cases peaking at over 65,000 on February 16, 2022. Since then, the number of cases and deaths has been decreasing, with an average of less than 300 and 10 respectively by late May.

Because of immunization initiatives, Indonesia has flattened the curve earlier than peers and eased movement restrictions. Over 60% of the population is currently completely immunized. However, due to considerable provincial disparities, the immunization rate lags below that of certain peer nations. Indonesia has also taken steps to fortify its health system and infrastructure in order to deal with the hazards posed by the return of potential new varieties. This involves enhancing testing and tracking systems, including genome sequencing capability, as well as boosting isolation and critical care beds, especially outside of Jakarta.

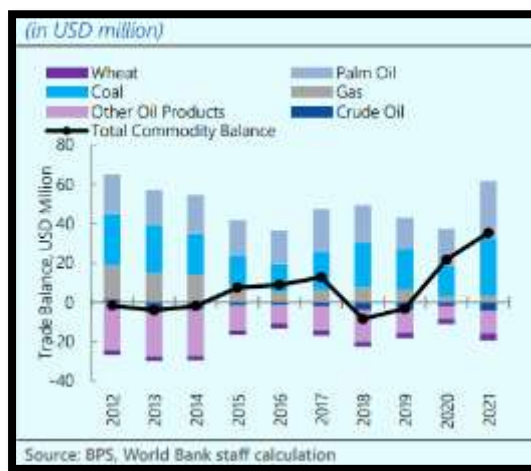
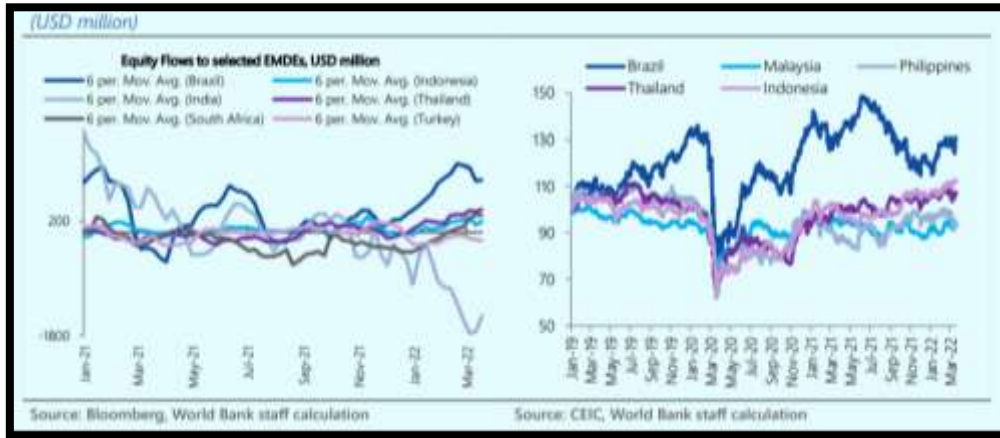
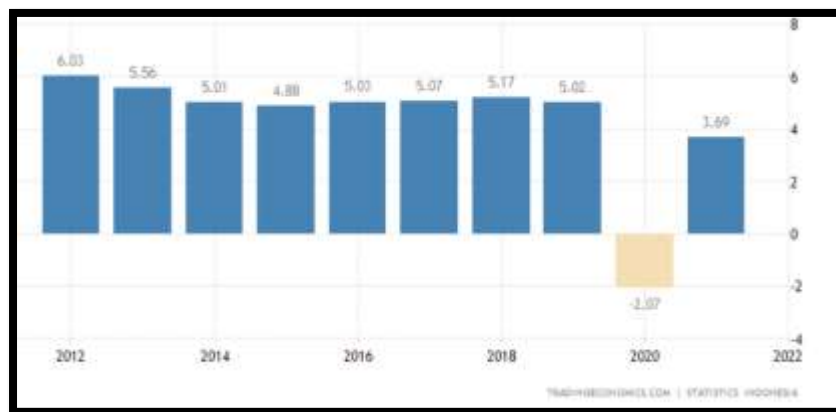


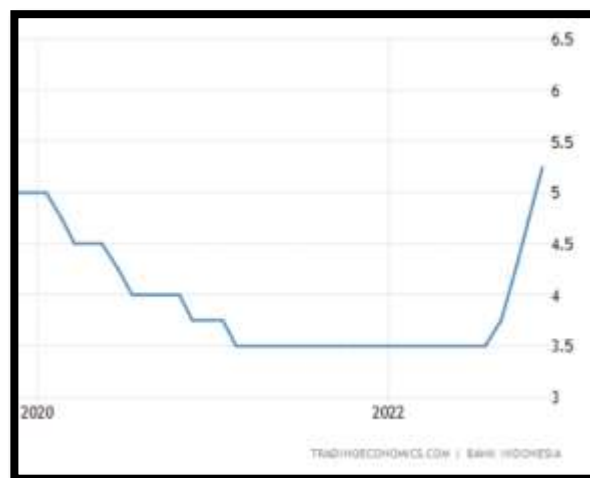
Figure-2.3: Increasing Commodities Price Benefitted  
Sources: World Bank June 2022 Indonesia Economic Prospects Report



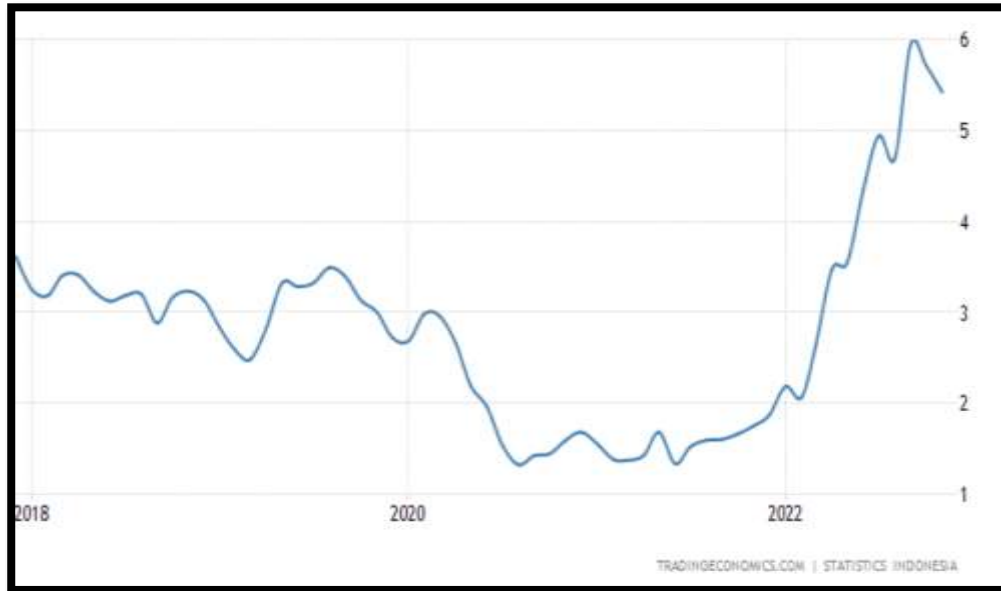
**Figure-2.4:** Increasing Commodity Prices Attract Equity Inflows to Indonesia and Contributing to The Stock Market Rally  
**Sources:** World Bank June 2022 Indonesia Economic Prospects Report



**Figure-2.5:** GDP Full Year Growth in Indonesia  
**Sources:** Tradingeconomics.com



**Figure-2.6:** Interest Rate in Indonesia  
**Sources:** Tradingeconomics.com



**Figure-2.7:** Inflation Rate in Indonesia

Sources: Tradingeconomics.com

**3. SCREENING ANALYSIS (PIOTROSKI F-SCORE & SECTOR COMPARISON)**

**A. Year of 2020**

**Table-3.1:** IHSG and Index Sectoral Performance FY 2020

Index	Performance (FY of 2020)
Mining	23.69%
Trade	-0.45%
Finance	-1.59%
Agriculture	-1.74%
Composite (JIX/IHSG)	-5.09%
Basic Industry	-5.84%
Consumer	-10.74%
Miscellaneous Industry	-11.67%
Infrastructure	-12.00%
Property	-21.23%



Piotroski F Score Breakdown	BYAN	ADRO	INCO	PTBA	MDKA	ANTM	MEDC	ITMG	DSSA
<b>Profitability</b>									
ROA	1	1	1	1	1	1	0	1	0
CFO	1	1	1	1	1	1	1	1	1
ΔROA	1	0	1	0	0	1	0	0	0
ACCRUAL	1	1	1	1	1	1	1	1	1
<b>Leverage, Liquidity, Source of Funds</b>									
ΔLEVER	0	1	1	0	1	1	1	0	1
ΔLIQUID	1	0	1	0	1	0	0	0	1
EQ_OFFER	1	1	1	1	1	0	0	0	1
<b>Operating Efficiency</b>									
ΔMARGIN	0	0	1	0	0	0	0	0	1
ΔTURN	0	0	0	0	0	0	0	0	0
<b>Total Score</b>	<b>6</b>	<b>5</b>	<b>8</b>	<b>4</b>	<b>6</b>	<b>5</b>	<b>3</b>	<b>5</b>	<b>6</b>

Figure-3.1: 2020 Top 10 Market Cap Mining Sector Stocks F-Score (GEMS excluded)

Stock that are pick to construct the 2020 portfolio after using sectoral comparison analysis and Piotroski f-score (based on market capitalization if having the same score) screening method are INCO, BYAN, and MDKA. These are several key factors that are happening in 2020 correlating to the stocks:

- Nickel overview :** Nickel prices significantly fell when the global economy shrank, mostly because fewer factories were operating, which reduced demand. After a recovery in China, there are a pick-up in the Asian market. Asia is more powerful than other continents, especially in China where the stainless market has the greatest impact on nickel demand. Chinese producers of stainless steel upped their output, and EV sales surged again. Chinese stainless steel output is still booming, and this situation persisted through the end of the year of 2020. Movement in the Chinese infrastructure market increased demand for nickel, which in turn raised nickel prices on the international market. The pandemic's effects were also felt in the nickel mining industry, which is a part of the metal and mineral mining industry. The London Metal Exchange (LME) said that in the second half of 2020 nickel prices had started to grow. However, the economic recovery in China helped gradually drive an increase in the demand for nickel throughout the world. Due to the hazards posed by the COVID-19 pandemic, nickel prices globally adjusted at the beginning of the reporting period. However, nickel prices rose in the next quarter, in part because to China's economic performance, which began to show indications of improvement in Q3/2020. This helped to boost the outlook for the global nickel market. The development of the Chinese infrastructure industry led to an increase in nickel demand and, as a result, nickel prices are rising on the global market.
- Coal overview :** In December 2020, the Indonesian coal market significantly recovered thanks to China's continuing opposition to Australian coal. In December, China's total coal imports from Indonesia reached a record-high monthly high of 26.3 MT. While imports from Australia fell to zero as Beijing strengthened its embargo. The volume in Indonesia was over five times more than the 4.4 MT in November.
- Gold and Copper overview :** The price of gold per ounce increased from US\$1,528 to US\$1,896 in 2020, supported by investors looking for a sanctuary amid the epidemic, continuous US-China tensions, and the global financial stimulus. Due to the early phases of COVID-19, copper prices per tonne fell to US\$4,625 in late March 2020 before rising to US\$7,749 at year's conclusion as China's demand increased and fears about supply disruptions in Latin America surfaced. While oil prices have declined, the prices of copper and gold have both increased significantly over the course of the year, driven up by COVID-19 and inflationary economic stimulus from governments throughout the world.

**B. Year of 2021**

Table-3.2: IHSG and Index Sectoral Performance FY 2021

Index	Performance (FY of 2021)
Technology	707.56%
Energy	45.56%
Consumer Cyclical	21.21%





Finance	21.14%
Industrials	11.6%
Composite (JIX/IHSG)	10.08%
Healthcare	8.37%
Infrastructure	6.5%
Basic Industry	0.12%
Transportation	-1.03%
Consumer Non-Cyclical	-16.04%
Property	-19.11%

Piotroski F Score Breakdown	EMTK	DMMX	MTDL	TFAS	MCAS	MLPT
<b>Profitability</b>						
ROA	1	1	1	1	1	1
CFO	1	1	1	1	1	1
ΔROA	1	1	1	1	1	1
ACCRUAL	0	0	0	0	1	1
<b>Leverage, Liquidity, Source of Funds</b>						
ΔLEVER	1	1	1	1	1	1
ΔLIQUID	1	0	0	0	0	0
EQ_OFFER	0	1	1	1	1	1
<b>Operating Efficiency</b>						
ΔMARGIN	1	1	0	0	0	1
ΔTURN	1	0	1	1	1	0
<b>Total Score</b>	<b>7</b>	<b>6</b>	<b>6</b>	<b>6</b>	<b>7</b>	<b>7</b>

Figure-3.2: 2021 Top 10 Market Cap Tech Sector Stocks F-Score (DCII, BUKA, EDGE, and TECH excluded)

Piotroski F Score Breakdown	BYAN	ADRO	TCPI	DSSA	PGAS	PTBA	HRUM	ITMG	AKRA
<b>Profitability</b>									
ROA	1	1	1	1	1	1	1	1	1
CFO	1	1	1	1	1	1	1	1	1
ΔROA	1	1	1	1	1	1	1	1	1
ACCRUAL	1	1	1	1	1	1	1	1	1
<b>Leverage, Liquidity, Source of Funds</b>									
ΔLEVER	1	0	1	0	1	0	0	1	1
ΔLIQUID	0	1	0	1	1	1	0	1	0
EQ_OFFER	1	1	1	1	1	1	1	1	1
<b>Operating Efficiency</b>									
ΔMARGIN	1	1	1	1	0	1	1	1	0
ΔTURN	1	1	1	1	1	1	1	1	1
<b>Total Score</b>	<b>8</b>	<b>8</b>	<b>8</b>	<b>8</b>	<b>8</b>	<b>8</b>	<b>7</b>	<b>9</b>	<b>7</b>

Figure-3.3: 2021 Top 10 Market Cap Energy Sector Stocks F-Score (GEMS excluded)



Piotroski F Score Breakdown	MASA	MSIN	SCMA	ACES	MNCN	MAPI	LPPF	ERAA	FILM	KPIG
Profitability										
ROA	1	1	1	1	1	1	1	1	1	1
CFO	1	1	1	1	1	1	1	1	1	0
ΔROA	1	1	1	0	1	1	1	1	1	0
ACCRUAL	1	0	0	1	1	1	1	1	0	0
Leverage, Liquidity, Source of Funds										
ΔLEVER	1	1	1	1	1	1	1	1	0	0
ΔLIQUID	1	0	1	1	0	1	1	1	1	0
EQ_OFFER	1	0	0	1	1	1	0	1	1	1
Operating Efficiency										
ΔMARGIN	1	1	0	0	0	1	1	1	1	0
ΔTURN	1	1	1	0	1	0	0	1	1	1
<b>Total Score</b>	<b>9</b>	<b>6</b>	<b>6</b>	<b>6</b>	<b>7</b>	<b>8</b>	<b>7</b>	<b>7</b>	<b>7</b>	<b>4</b>

Figure-3.4: 2021 Top 10 Market Cap Consumer Cyclical Sector Stocks F-Score

Piotroski F Score Breakdown	BBCA	BBRI	BMRI	ARTO	BBNI	BBHI	SMMMA	BRIS	MEGA	BNLI
Profitability										
ROA	1	1	1	1	1	1	1	1	1	1
CFO	1	1	1	0	1	0	1	1	1	1
ΔROA	0	1	1	1	1	1	1	1	1	1
ACCRUAL	1	1	1	0	1	0	1	1	1	1
Leverage, Liquidity, Source of Funds										
ΔLEVER	1	0	1	1	0	0	1	1	1	1
ΔLIQUID	1	1	0	1	1	1	0	1	1	1
EQ_OFFER	1	0	1	0	0	0	1	0	1	0
Operating Efficiency										
ΔMARGIN	1	1	1	1	1	0	1	1	1	0
ΔTURN	0	1	1	1	0	1	0	1	1	0
<b>Total Score</b>	<b>7</b>	<b>7</b>	<b>8</b>	<b>6</b>	<b>6</b>	<b>4</b>	<b>7</b>	<b>8</b>	<b>9</b>	<b>6</b>

Figure-3.5: 2021 Top 10 Market Cap Financial Sector Stocks F-Score

Piotroski F Score Breakdown	ASII	UNTR	IMPC	ARNA	MLPL	BHIT	BMTR	MARK	ABMM	HEXA
Profitability										
ROA	1	1	1	1	1	1	1	1	1	1
CFO	1	1	1	1	1	1	1	1	1	1
ΔROA	1	1	1	1	1	1	1	1	1	1
ACCRUAL	1	0	1	1	1	1	1	0	1	0
Leverage, Liquidity, Source of Funds										
ΔLEVER	1	1	1	1	1	1	1	1	1	1
ΔLIQUID	1	0	1	1	1	1	0	1	1	0
EQ_OFFER	1	1	1	1	0	0	1	1	1	1
Operating Efficiency										
ΔMARGIN	0	1	1	1	0	1	0	1	1	0
ΔTURN	1	1	1	1	0	1	1	1	1	1
<b>Total Score</b>	<b>8</b>	<b>8</b>	<b>9</b>	<b>9</b>	<b>6</b>	<b>8</b>	<b>7</b>	<b>8</b>	<b>9</b>	<b>6</b>

Figure-3.6: 2021 Top 10 Market Cap Top 10 Market Cap Industrial Sector Stocks F-Score

Stocks that are pick to construct the 2021 portfolio after using sectoral comparison analysis and Piotroski f-score (based on market capitalization if having the same score) screening method are; EMTK, MCAS, and MLPT from technology sector; ITMG, BYAN, and ADRO from energy sector; MASA, MNCN, and MAPI from consumer cyclical sector; MEGA, BMRI, and BRIS from financial sector; ABMM, IMPC, and ARNA from industrial sector. These are several key factors that are happening in 2021 correlating to the stocks:



- 1. Technology sector overview :** The digital transformation in all spheres of life was expedited by the pandemic. The usage of the internet and online apps has grown quickly in order to satisfy fundamental requirements like food and education as well as secondary and tertiary demands like domestic items and content services. The social isolation and stay-at-home rules benefited digital firms, which saw better development during the epidemic. The number of internet data users in Indonesia increased by 25.5 million during the pandemic.

The number of clients for video on demand and online transactions both increased by nearly twice. Not to mention, there was a 50% increase in the number of people using e-payment applications. The pandemic, which was still happening, continued to support the development of sectors centered on digital technology. The public's increased use of different digital platforms, including e-commerce, OTT video streaming services, e-payments, and other digital goods and services, was evidence of this. As a result, businesses closely related to such digital platforms had stronger growth in 2021.

The transition to a digital economy and advanced technology has never been more inevitable as Indonesia emerges from the new normal. The result is the modern Indonesian customer, who is smart, tech-savvy, and up-to-date on industry trends. Businesses must adjust and stay up with the shifts in client preferences to remain relevant, from the ways in which information is sent to the ways in which goods and services are purchased and disseminated. The rapid growth of third-party services during the pandemic, which has elevated practicality to the forefront of customers' concerns, is proof that consumers are becoming more and more prepared to pay more for convenience.

Indonesia's digital economy is growing tremendously in the midst of a pandemic. Digital activities are becoming prevalent due to the epidemic and activity constraints. This encourages the public to adopt new habits and gives entrepreneurs greater motivation to install new digital systems.

According to Google, Temasek, and Bain & Company's "Roaring 20s: The Sea Digital Decade" research, Indonesia's digital economy would rise 49% YoY from USD47 billion in 2020 to USD70 billion in 2021, accounting for 41.9% of the USD44 billion ASEAN economy. The country's digital economy will quadruple from US\$44 billion in 2020 to US\$124 billion in 2025, per a research by Google, Temasek, and Bain & Company. Digital technology start-ups have already benefited from economic potential, especially in the e-commerce, health, and education sectors, which increased digital usage and encouraged additional innovation.

With 202 million users in Indonesia, Internet penetration was 73.7% in January 2021 as a result of the country's widespread adoption of the technology. This provides a sizable consumer base for marketing goods and services to digital firms.

The government is still dedicated to finishing the construction of strategic infrastructure relating to key areas, including ICT. The government authorized Rp30.5 trillion for ICT development from the state budget for 2021. This budget was designed to hasten the digital transformation of government and to boost communication access dependability in diverse public service sites, particularly those lacking 4G infrastructure.

- 2. Coal overview :** In October 2021, coal reached an all-time high price of USD 270 per ton, a fourfold rise from the average price per ton in 2020 of USD 50–60. The restoration of brisk demand in nations with high energy consumption was the cause of this price increase. In some mining regions where Covid-19 mobility limitations were in effect, extreme weather conditions and a lack of heavy equipment have prohibited mines from working at their best in 2021.

China's protracted political conflict with Australia, historically one of its main coal suppliers, had a detrimental influence on the country's acute coal shortage in mid-2021. The lack of supplies hampered industrial development throughout the nation. In 2021, Indonesia's role as a supplier of coal to China grew in importance. As winter progressed and weather-related difficulties hindered coal production and transportation activities in China's coal-producing areas, demand for Indonesian coal is anticipated to remain strong through early 2022. As a result, during 2021, Indonesia's domestic coal price (HBA) outperformed the overall market.

In the coal industry, 2021 experienced a remarkable increase in demand over 2020. A major factor in this was the energy crisis in China, which was brought on by the political dispute between China and Australia and caused China to stop importing coal



from Australia. Australia had been China's leading coal supplier up until 2020, but Indonesia surpassed Australia in 2021. The harsh winter that gripped the northern hemisphere, which drove up natural gas costs and forced several European nations to convert from gas to coal for heating requirements, was another exacerbating element.

In October 2021, coal prices rose to a peak of USD270 per ton. The Indonesian Reference Coal Price (HBA), meantime, increased dramatically from USD76 per ton in January to USD215 per ton in November 2021. After the economic and industrial collapse the year before, this was a monumental event that caused coal companies to go into high gear.

The thermal coal market in 2021 was mostly driven by the global economic recovery, geopolitical difficulties, governmental regulations, weather interruptions, and COVID-19 pandemic. A very powerful La Nina at the start of 2021 depleted gas supplies in Asia and Europe. At the same time, the world economy started to recover from the COVID-19 pandemic's effects, which set the stage for a significant increase in demand for electricity. For instance, China saw the fastest yearly rise in electricity generation in the previous ten years as a result of government stimulus measures that increased their economic activity. China has worked to enhance domestic coal supplies since the Lunar New Year in order to meet the increasing demand. China was forced to increase import amounts to roughly pre-pandemic levels because it was unable to manufacture at its maximum capacity after a string of fatalities that prompted nationwide safety checks.

Geopolitical tensions between China and Australia persisted, and China continued to impose import restrictions on Australian coal until 2021, creating new trade flows in the seaborne market and forcing China to get coal from Indonesia and other non-Australian producers. China increased its need for coal from Indonesia. Due to the strong demand, the supply from Indonesia and other exporting nations increased, but it is still insufficient to meet the demand for imported coal.

Coal prices reached record highs as a result of the restricted volume growth in exports despite the strong demand. In 2021, seaborne pricing showed significant year-over-year growth, with average increases from the first through the third quarters. The largest q-o-q increase occurred in 3Q21, when the average price of Indonesian 5,000 GAR and 4,200 GAR increased by more than 35%. In the fourth week of October 2021, Indonesian prices reached an all-time high, with 5,000 GAR valued at US\$210/t and 4,200 GAR priced at US\$155/t. Australia's Newcastle 6,000 NAR prices had a q-o-q increase of more over 50% in 3Q21. As China's government applied domestic coal price controls and increased mine output to record-high levels, seaborne coal prices began to decline after rising steadily for weeks. Despite the year-end volatility, seaborne thermal coal prices completed the year with a net improvement over the results of the previous year.

- 3. Consumer sector overview :** According to figures from the Central Bureau of Statistics, Indonesia was able to post positive economic growth of 3.69% in 2021, an improvement over the contraction of 2.07% in 2020. This growth was further aided by household consumption rising by 2.02% in 2021, a marked improvement from the contraction of household consumption in 2020 to minus 2.63%.

The relaxation of COVID-related regulations will boost retail. In comparison to 2020, Indonesia's economy grew by 3.69%, which was an improvement. This was primarily caused by a 2.02% increase in household spending, which made up 54.42% of Indonesia's GDP (GDP). The wholesome expansion of household consumption was sparked by increases in consumer confidence on spending. The Consumer Confidence Index for Bank Indonesia increased from 96.5 in December 2020 to 118.3 in December 2021. The outlook for Indonesia's retail sector was largely optimistic in 2021. It was unnecessary to extend the temporary mall and shopping center closures, which was one of the Indonesian government's measured limitations, past the third quarter. Effective immunization campaigns reduced the incidence, severity, and death rate of new cases. Despite a setback by Delta variant, the continuous rise in customer confidence has been a major driver of consumers product and services sector comeback in 2021.

- 4. Financial sector overview :** The banking sector can once again effectively execute its intermediation role in conjunction with the national economic recovery. In addition, the government and the Financial Services Authority (OJK) have also given the banking sector a number of incentives so that they can continue to effectively perform their intermediation role.

According to statistics from the FSA's publication of Indonesian Banking Statistics, bank loans have risen by 5.21% (yoy) to the end of 2021. Almost all business sectors and uses of credit have experienced growth. The assets of the banking sector



increased from IDR9,178 trillion in 2020 to IDR9,735 trillion (as of October 2021) as a result of this loan expansion. In addition, the Third Party Funds (DPK) that the bank was able to realize in 2021 increased 12.21% to IDR7,480 trillion from IDR6,665 trillion. The bank's capital adequacy ratio grew in 2021 from 23.89% at the end of 2020 to 25.67% (as of December 2021).

However, the banking sector needs to pay close attention to the caliber of loans given in order for this positive trend to continue. The industry's net non-performing loan (NPL) gross was remained rather high at 3% by the end of 2021.

Performance in the banking sector improved during 2021 as the economy recovered. Intermediation saw a 3.88% yoy contraction in the first quarter of 2021, the lowest growth since the pandemic hit, according to data from the Financial Services Authority (FSA). However, intermediation has since progressively recovered since the first semester of 2021. Commercial bank loans increased 5.24% (yoy) to Rp5,768.59 trillion end of December 2021.

To maintain macroeconomic and financial stability and support ongoing efforts in economic recovery, BI continued to pursue macroprudential measures that were slack or accommodating.

The rupiah rate was stabilized, monetary operations were continued to improve the effectiveness of accommodating monetary policies, and an analysis of the biggest banking groups—whose combined credit market share accounted for 70% of the sector—was used to increase the transparency of the credit base rate.

- 5. Industrial sector overview :** The IMF predicted that Indonesia's economy will rise by 3.2% in 2021. The manufacturing and domestic service sectors of the real economy expanded, with the Purchasing Manager's Index rising to 57.2 in October 2021 from 47.2 in the same month of the previous year.

In the second quarter of 2021, the manufacturing sector took over as the engine of economic expansion. The manufacturing business was slow as a result of the COVID-19 and PPKM case explosion, but it still has a high level of resilience and can bounce back rapidly. In the second quarter of 2021, the non-oil and gas manufacturing sector's performance increased by 6.9% annually. The industries for transportation equipment, base metal, machinery and equipment, rubber and plastic goods, and chemical, pharmaceutical, and traditional medicine had the highest growth rates among non-oil and gas industrial sectors.

Indonesia's economy grew by 7.07% in the second quarter of 2021, with growth of 6.91% despite pressure from the COVID-19 epidemic. A significant portion of this increase was due to the industrial sector. In the meantime, the manufacturing sector expanded by 3.68% and boosted Indonesia's economy by 0.75% in the third quarter of 2021.

Investment realization in the manufacturing sector was IDR 236.79 trillion during January to September 2021. When compared to investment realization in the same time in 2020 of IDR 201.87 trillion, this amount is up to 17.3%.

Even in the middle of a pandemic, the manufacturing industry sector's contribution to reaching export values is growing. Manufacturing exports during January through November 2021 were USD 160 billion, or 76.51 percent of all exports made by the country. This amount is larger than both the export achievement in 2019 and the manufacturing export achievement of IDR 131 billion in 2020.

The dynamics also showed up in the manufacturing Purchasing Managers Index results for Indonesia (PMI). In 2020, Indonesia's manufacturing PMI was unstable because to limitations on people's activities, notably in the field of manufacturing, but it has since steadily increased and reached a high level.

With the exception of July and August in 2021, owing to activity constraints during the Emergency PPKM and PPKM Level 4 periods, Indonesia's manufacturing PMI readings for the entirety of 2021 are normally at an expanding level. In addition, Indonesia's Manufacturing PMI, which peaked at 57.2 in October, smashed many historical record highs. It was rated 53.2 in March, 54.6 in April, 55.3 in May, and 57.2 in June.

The operational permit and industrial activity mobility (IOMKI) policy released by the Ministry of Industry exposed the gas and brake policies in the manufacturing industry sector. The manufacturing industry sector's health and economic interests have been balanced over time because to IOMKI's regulations, which have also encouraged industry participants to be confident and promptly adjust to pandemic circumstances. The Ministry of Industry has also implemented strategic programs and policies



such as the Increasing Use of Domestic Products (P3DN) program, developing the halal industry, and the 35% import substitution program.

C. Year of 2022

Table-3.3: IHSG and Index Sectoral Performance (BY2022-Q32022)

Index	Performance (BY2022-Q32022)
Energy	68.52%
Industrials	22.57%
Composite (JIX/IHSG)	10.08%
Transportation	10.02%
Healthcare	5.48%
Non Cyclical	4.87%
Infrastructure	2.26%
Basic Industry	0.29%
Finance	-2.67%
Cyclical	-5.63%
Property	-11.15%
Technology	-22.62%

Piotroski F Score Breakdown	BYAN	ADRO	PTBA	ITMG	TCPI	PGAS	DSSA	AKRA
Profitability								
ROA	1	1	1	1	1	1	1	1
CFO	1	1	1	1	1	1	1	1
ΔROA	1	1	1	1	1	1	1	1
ACCRUAL	0	1	0	0	1	1	1	1
Leverage, Liquidity, Source of Funds								
ΔLEVER	1	1	1	1	1	1	0	1
ΔLIQUID	0	1	0	1	0	1	0	0
EQ_OFFER	1	1	1	1	1	1	1	1
Operating Efficiency								
ΔMARGIN	1	1	1	1	1	1	1	0
ΔTURN	1	1	1	1	1	1	1	1
<b>Total Score</b>	<b>7</b>	<b>9</b>	<b>7</b>	<b>8</b>	<b>8</b>	<b>9</b>	<b>7</b>	<b>7</b>

Figure-3.1: 2022 Top 10 Market Cap Energy Sector Stocks F-Score (GEMS and ADMR excluded)

Piotroski F Score Breakdown	ASII	UNTR	IMPC	ABMM	ARNA	HEXA	BHIT	BMTR	MLIA	TOTO
Profitability										
ROA	1	1	1	1	1	1	1	1	1	1
CFO	1	1	1	1	1	1	1	1	1	1
ΔROA	1	1	1	1	1	0	0	0	1	1
ACCRUAL	1	1	0	1	0	1	1	1	1	0
Leverage, Liquidity, Source of Funds										
ΔLEVER	1	1	1	0	1	1	0	1	1	1
ΔLIQUID	0	0	0	1	1	0	1	1	1	1
EQ_OFFER	1	1	1	1	1	1	1	1	1	1
Operating Efficiency										
ΔMARGIN	1	1	0	1	1	0	1	1	1	1
ΔTURN	1	1	1	1	0	1	0	0	1	1
<b>Total Score</b>	<b>8</b>	<b>8</b>	<b>6</b>	<b>8</b>	<b>7</b>	<b>6</b>	<b>6</b>	<b>7</b>	<b>9</b>	<b>8</b>

Figure-3.2: 2022 Top 10 Market Cap Industrial Sector Stocks F-Score



Stock that are pick to construct the 2022 portfolio after using sectoral comparison analysis and Piotroski f-score (based on market capitalization if having the same score) screening method are; ADRO, PGAS, and ITMG for energy sector; MLIA, ASII, and UNTR for industrial sector. These are several key factors that are happening in 2022 correlating to the stocks :

**1. Coal overview :** In 3Q22, coal prices skyrocketed to USD417, a 14.1% QoQ rise. A rise in coal is due to strong demand. The 1Q22 jump in coal prices, which saw the average price of Newcastle coal increase by 36.5% quarter over quarter and 186.9% year over year, was extremely beneficial to coal issuers. The benchmark coal price for Indonesia is at USD 319/t, while the Newcastle coal price (for August delivery contract) is USD 350/t. Due in part to Russia's strategy of stopping gas shipments to numerous European nations, which caused those countries to convert to coal.

Since the end of February 2022, Newcastle coal prices have surged once more as a result of Russia's invasion of Ukraine. In response, the United States and many other European Union nations imposed economic penalties on Russia, one of which was a prohibition on the import of goods from Russia. It should be mentioned that Russia, after Australia and Indonesia, exports the third-largest volume of coal in the world, accounting for 17% of all thermal coal exports in 2021. The usage of air conditioning rises due to the heat wave that is now affecting India, which also has an influence on the demand for thermal coal for electricity generation.

The price of several commodities, including coal, has fluctuated due to geopolitical decisions made by US and European Union (EU) members to apply economic sanctions in the form of a restriction on imports of goods from Russia for its invasion of Ukraine.

Russian gas supplies, which make up around 30% of all gas supply, are very important to the European Union. Then, other sizable nations, like Germany, Italy, and France, receive gas supplies from Russia at rates of 49%, 46%, and 24%, respectively. The European Union and the United States are attempting to replace Russian gas with alternative energy sources, including coal and the reuse of steam power stations, as a result of the enforcement of these sanctions.

Since the European Union banned the import of coal from Russia, Indonesia, and other nations like the United States, Australia, and South Africa, the European Union has turned to Colombia as its primary source of coal, as the supply from Russia, the third-largest exporter of coal in the world, has "disappeared." pushing up coal prices globally and improving Indonesian coal issuers' performance.

The majority of European nations have converted to coal power generation as a result of the continued high gas prices in the EU. The price of coal briefly reached USD 460 per ton as the price of European gas spiked to 272 euros per MWh. Germany, which had advocated strongly for the phase-out of coal, boosted its coal-fired output by 31% year to date. Meanwhile, supplies from other nations that produce coal, such as Australia and Indonesia, are still scarce.

**2. Oil & gas overview :** Oil and gas supplies are under strain in 2022, which led to high prices. Only 12% less than its all-time high of over USD140/bbl in June 2008, Brent reached a price of USD123/bbl in June 2022. Given the absence of new investment, ESG constraints, and financial assistance, the probability of the price dropping by USD100/bbl is difficult given the limited new supply. From around 450 billion dollars at 2010 to barely 300 billion dollars in 2021, fresh capex has been steadily declining.

Aramco estimates that worldwide oil & gas spending should increase by a factor of three from levels in 2021 to anywhere between US\$450 and US\$500 billion in order to satisfy the 2030 expectations.

It's important to note that despite being the largest producer in the world, Aramco needs about 4 years to increase its 1 million barrel per day oil production limit, indicating that the new extra volume will take a long time to develop.

In contrast, there is a very high demand, particularly in the US market (20% of worldwide consumer shares). Additionally, after the Russian invasion in February 2022, the oil industry's supplies got worse. There are sanctions on Russia, and a number of international oil and gas companies have stopped operating there. Due to these circumstances, Russia's oil production—which accounts for 12.4% of world oil production—is lower than it should be, falling from a quota of 10.8 million barrels per day to just 9.1 million.



OPEC increased the pace of incremental quota increase to 648k barrels/d in June 2022 from 432k barrels/d in April 2022 as a result of this underproduction. However, the decision still falls short of filling the gap that Russia left.

Due to the relaxation of COVID-19 restrictions, which led to an increase in energy demand and consumption, as well as the reduction in natural gas imports from Russia to the EU as a result of geopolitical unrest, the price of natural gas was recorded as having significantly increased as of 26-July, rising by 123.95% YoY to USD8.82/MMBtu. By contributing 40% of the total quantity of natural gas imported into Europe, Russia was the largest gas importer; as a result, the EU's energy deficit increased significantly when Russia's gas supply was cut off. In fact, a natural gas storage facility in Rehden, Germany, which is reputed to be the biggest in Europe, had its gas capacity drop to only 5% (from an average of 87% before the crisis).

- 3. **Industrial sector overview** : Manufacturing sector's recovery from the Covid-19 epidemic would be accompanied by a resurgence of the industrial sector. Demand from outside of Indonesia is increasing once again, and activity limitations are not significantly obstructing the flow of products and services (lockdown). Businesses are once more moving quickly, and this has helped issuers in the industrial sector have good performance growth over the first half of the year. especially for issuers with interests in mining, heavy industry, and commodities. Machinery and equipment sub-sectors are experiencing a growth of 17,67%. In the third quarter of 2022, the non-oil and gas processing industry saw growth of 4.83 percent, greater than the same quarter the previous year's growth of 4.12 percent. This shows that despite uncertain global economic conditions, Indonesia's manufacturing industry is nevertheless prospering.

An upsurge in industrial activity is still being seen in the Indonesian manufacturing sector. In September 2022, Indonesia's Manufacturing Purchasing Managers' Index (PMI) rose to 53.7. In fact, the PMI for Indonesia in September 2022 was noted to be higher than the ASEAN average, which was ranked 53.5. Airlangga Hartarto, the Coordinating Minister for the Economy, said: "The PMI for Indonesia is continuing expanding and showing strong development. This demonstrates both the acceleration of the post-pandemic national economic recovery and a constant improvement in the manufacturing industry sector in Indonesia, at least during the past several months."

According to the S&P Global PMI Release for the ASEAN PMI, in September 2022, the status of the ASEAN manufacturing sector has rapidly improved over the previous year. Production output, new orders, purchasing activity, and employment all increased significantly at the companies. This demonstrates the robust and stable level of business confidence in the ASEAN area. According to the press release, advances in the ASEAN region's manufacturing sector have been ongoing over the previous 12 months. Since October 2021, this growth rate has been the fastest, and manufacturing has been expanding steadily overall.

4. **PORTFOLIO CONSTRUCTION (MARKOWITZ PORTFOLIO THEORY)**

A. **Equally Weighted Portfolio**

Equally weighted portfolio are constructed to see neutral state of portfolio (portfolio without specific objectives and no implementation of optimum portfolio method of Markowitz). The equal weight of each stocks are calculated by dividing the total number of stocks that are used to construct the portfolio by one.

Table-4.1: Equally Weighted Portfolio for Year 2020

Equally Weighted Portfolio	
Stock	Weight
MDKA	33%
INCO	33%
BYAN	33%
Sum	1.0
Results	
Expected Return	4.54%
Standard Deviation	9.89%
Sharpe Ratio	0.427106





**Table-4.2:** Equally Weighted Portfolio for Year 2021

<b>Equally Weighted Portfolio</b>	
<b>Stocks</b>	<b>Weight</b>
MASA	6.67%
MNCN	6.67%
MAPI	6.67%
ITMG	6.67%
BYAN	6.67%
ADRO	6.67%
MEGA	6.67%
BMRI	6.67%
BRIS	6.67%
ABMM	6.67%
IMPC	6.67%
ARNA	6.67%
EMTK	6.67%
MCAS	6.67%
MLPT	6.67%
Sum	1.0
<b>Results</b>	
Expected Return	6.00%
Standard Deviation	6.43%
Sharpe Ratio	0.8878813

**Table-4.3:** Equally Weighted Portfolio for Year 2022

<b>Equally Weighted Portfolio</b>	
<b>Stocks</b>	<b>Weight</b>
ADRO	16.67%
PGAS	16.67%
ITMG	16.67%
MLIA	16.67%
ASII	16.67%
UNTR	16.67%
Sum	1.0
<b>Results</b>	
Expected Return	5.54%
Standard Deviation	7.45%
Sharpe Ratio	0.6956623



**B. Optimum Portfolio (Maximum Sharpe Ratio)**

Maximum sharpe ratio or so called an optimum portfolio is a composition of stocks which produced the highest possible returns with the least risk, resulted into a portfolio with the highest value of sharpe ratio. Excel solver are being used to calculate the solution of producing the portfolio which produced the highest value of sharpe ratio, settings on the excel solver are :

1. The excel cell of sharpe ratio are being used as the excel solver calculation target, with an objective producing the maximum value of calculation.
2. The weight of each stock are a subject to the changing variables of the excel solver calculation.
3. The total sum of stock weight are a subject to the constraint of the excel solver calculation with the condition that the total sum of stock weight must be 1 or 100%.
4. Additional constraint is that changing variables must be non-negative (weight of each stock must not be negative meaning a short buy).

**Table-4.5:** Max Sharpe Portfolio Year of 2020

<b>Optimum Portfolio (Sharpe)</b>	
<b>Stock</b>	<b>Weight</b>
MDKA	77.79%
INCO	22.21%
BYAN	0%
Sum	1.0
<b>Results</b>	
Expected Return	7.33%
Standard Deviation	13.88%
Sharpe Ratio	0.505792

**Table-4.6:** Max Sharpe Portfolio Year of 2021

<b>Optimum Portfolio (Sharpe)</b>	
<b>Stocks</b>	<b>Weight</b>
MASA	0%
MNCN	8.74%
MAPI	0%
ITMG	0%
BYAN	15.08%
ADRO	9.92%
MEGA	0%
BMRI	0%
BRIS	0%
ABMM	0%
IMPC	6.04%
ARNA	0%
EMTK	41.17%
MCAS	19.05%
MLPT	0%
Sum	1.0



Results	
Expected Return	5.21%
Standard Deviation	1.04%
Sharpe Ratio	4.724332

Table-4.7: Max Sharpe Portfolio Year of 2022

Optimum Portfolio (Sharpe)	
Stocks	Weight
ADRO	61.13%
PGAS	0%
ITMG	38.87%
MLIA	0%
ASII	0%
UNTR	0%
Sum	1.0
Results	
Expected Return	8.44%
Standard Deviation	9.65%
Sharpe Ratio	0.8372069

**C. Maximum Return Portfolio (With Given Risk)**

Maximum return portfolio is a composition of stocks which produced the highest possible return with the level of a certain risk as the constraint, the risk being a constraint is to maintain the basis of diversification on constructing the portfolio (without a given risk as a constraint, the portfolio will only include one stock that having the highest return compare to others individual stock, neglecting diversification). Within the stock pool that can be choose to construct the portfolio, the lowest standard deviation of an individual stock are being picked as the given risk on constructing the portfolio. Excel solver are used to calculate the solution of producing the portfolio which produced the highest return with a given risk, settings on the excel solver are :

1. The excel cell of portfolio return are being used as the excel solver calculation target, with an objective producing the maximum value of calculation.
2. The weight of each stock are a subject to the changing variables of the excel solver calculation.
3. The total sum of stock weight are a subject to the constraint of the excel solver calculation with the condition that the total sum of stock weight must be 1 or 100%.
4. Additional constraint is that changing variables must be non-negative (weight of each stock must not be negative meaning a short buy).
5. Additional constraint of a given risk (standard deviation of the portfolio must not be greater than the given risk), using the lowest standard deviation of an individual stock within the stock pool.

Table-4.8: Max Return Portfolio (With Given Risk) Year of 2020

Max Return with Given Risk	
Stocks	Weight
MDKA	33.86%
INCO	17.26%
BYAN	48.88%
Sum	1.0



Results	
Expected Return	3.85%
Standard Deviation	9.17%
Sharpe Ratio	0.385667

**Table-4.9:** Max Return Portfolio (With Given Risk) Year of 2021

Max Return with Given Risk	
Stocks	Weight
MASA	9.92%
MNCN	0.00%
MAPI	0.00%
ITMG	0.00%
BYAN	0.00%
ADRO	14.72%
MEGA	0.00%
BMRI	0.00%
BRIS	0.00%
ABMM	0.00%
IMPC	46.13%
ARNA	0.00%
EMTK	2.86%
MCAS	19.64%
MLPT	6.74%
Sum	1.0
Results	
Expected Return	9.42%
Standard Deviation	5.51%
Sharpe Ratio	1.6572728

**Table-4.10:** Max Return Portfolio (With Given Risk) Year of 2022

Max Return with Given Risk	
Stocks	Weight
ADRO	57.40%
PGAS	8.79%
ITMG	25.23%
MLIA	8.58%
ASII	0.00%
UNTR	0.00%
Sum	1.0
Results	
Expected Return	7.61%
Standard Deviation	8.79%
Sharpe Ratio	0.82495749



**D. Minimum Risk Portfolio**

Minimum risk portfolio is a composition of stocks that produce the lowest risk as possible neglecting on how much the return of the portfolio will be, which resulted on the low standard deviation value. Excel solver are used to calculate the solution of producing the portfolio which produced the highest return with a given risk, settings on the excel solver are :

1. The excel cell of standard deviation are used as the excel solver calculation target, with an objective producing the minimum value of calculation.
2. The weight of each stock are a subject to the changing variables of the excel solver calculation.
3. The total sum of stock weight are a subject to the constraint of the excel solver calculation with the condition that the total sum of stock weight must be 1 or 100%.
4. Additional constraint is that changing variables must be non-negative (weight of each stock must not be negative meaning a short buy).

**Table-4.11:** Minimum Risk Portfolio Year of 2020

Minimum Risk Portfolio	
Stocks	Weight
MDKA	14.39%
INCO	13.89%
BYAN	71.73%
Sum	1.0
Returns	
Expected Return	2.25%
Standard Deviation	8.45%
Sharpe Ratio	0.229007

**Table-4.12:** Minimum Risk Portfolio Year of 2021

Minimum Risk Portfolio	
Stocks	Weight
MASA	0.04%
MNCN	11.04%
MAPI	0.00%
ITMG	0.00%
BYAN	15.15%
ADRO	9.55%
MEGA	0.02%
BMRI	0.00%
BRIS	0.00%
ABMM	0.00%
IMPC	3.29%
ARNA	0.00%
EMTK	42.24%
MCAS	18.67%
MLPT	0.00%
Sum	1.0



Results	
Expected Return	5.00%
Standard Deviation	1.02%
Sharpe Ratio	4.6175515

Table-4.13: Minimum Risk Portfolio Year of 2022

Minimum Risk Portfolio	
Stocks	Weight
ADRO	7.90%
PGAS	29.59%
ITMG	0%
MLIA	30.20%
ASII	32.31%
UNTR	0.00%
Sum	1.0
Results	
Expected Return	4.06%
Standard Deviation	6.27%
Sharpe Ratio	0.59038123

5. SECTOR ROTATION STRATEGY PERFORMANCE

Table-5.1: Investment Without Sector Rotation

Implemented From 2020 to Q32022 Without Changing The Stock Composition (Actual Return)									
Prtf 1	Prtf 2	Prtf 3	Prtf 4	Prtf 5	Prtf 6	Prtf 7	Prtf 8	Prtf 9	IHSG
281%	250%	188%	225%	315%	233%	158%	246%	258%	19%

Table-5.2: Investment With Sector Rotation

Implementing Sector Rotation			
Optimum Portfolio			
Results	2020	2021	2022
Actual Return (Each Year)	97.41%	57.25%	82.44%
Return Until 2021	210.43%		
Return Until Q32022	466.36%		

To find out the performance and the effectiveness of the sector rotation investment strategies, these research conducting a back testing comparison of the portfolio performance (actual returns) in two scenario.

The first scenario is where the investment strategies are implemented without any changes or modification such as the sector rotation. All of the generated stock composition from Markowitz method are being used as a portfolio data set and implemented as an investment from the year of 2020 until Q3 of 2022 without any changes and modification in the stock composition. (Prtf 1, 2, and 3 are a portfolio minimum risk, max return, and max sharpe from the year of 2020 respectively. Prtf 4, 5, and 6 are portfolio minimum risk, max return, and max sharpe from the year of 2021 respectively. Prtf 7, 8, and 9 are portfolio minimum risk, max return, and max sharpe from the year of 2022 respectively)



The second scenario is where the sector rotation investment strategies are implemented. During the year of 2020 the investment are implementing the stock composition of 2020 optimum portfolio, then in the year of 2021 the investment changes into the stock composition of 2021 optimum portfolio, and continue to the year of 2022 in which the investment changes into the stock composition of 2022 optimum portfolio.

Based on the result of these back testing (seen at Table 4-16 and 4-17), implementing a sector rotation as investment strategies generate a higher return compared to the investment strategies of holding to an investment without implementing any changes or modification on the stock composition (sector rotation).

**6. CONCLUSION AND RECOMMENDATION**

Based on the analysis results of sector comparison and Piotroski F-score as a screening method to create a stock pool for portfolio construction, there are several conclusion that can be made :

1. In year of 2020, sectors that are performing is **mining (23.69% return)**. Stocks to be picked as potential investment are **INCO, BYAN, and MDKA**.
2. In year of 2021, sectors that are performing is **technology (707.56% return), energy (45.56% return), consumer cyclical (21.21% return), finance (21.14% return), and industrials (11.6% return)**. Stocks to be picked as potential investment are **MASA, MNCN, MAPI, ITMG, BYAN, ADRO, MEGA, BMRI, BRIS, ABMM, IMPC, ARNA, EMTK, MCAS, and MLPT**.
3. In year of 2022, sectors that are performing is **energy (68.52% return) and industrials (22.57% return)**. Stocks to be picked as potential investment are **ADRO, PGAS, ITMG, MLIA, ASIL, and UNTR**.

**Table-6.1:** 2020 Portfolio Optimization

<b>2020 Portfolio Optimization</b>					
Results	Equal	Min Risk	Max Return (Given Risk)	Max Sharpe	IHSG
Expected Return (Average Montly)	4.54%	2.25%	3.85%	7.33%	0.35%
SD	9.89%	8.45%	9.17%	13.88%	7.81%
Sharpe Ratio	0.427	0.229	0.386	0.506	0.005

**Table-6.2:** 2021 Portfolio Optimization

<b>2021 Portfolio Optimization</b>					
Results	Equal	Min Risk	Max Return (Given Risk)	Max Sharpe	IHSG
Expected Return (Average Monthly)	6.00%	5.00%	9.42%	5.00%	1.09%
SD	6.43%	1.02%	5.51%	1.02%	2.83%
Sharpe Ratio	0.888	4.619	1.657	4.618	0.283

**Table-6.3:** 2022 Portfolio Optimization

<b>2022 Portfolio Optimization</b>					
Results	Equal	Min Risk	Max Return (Given Risk)	Max Sharpe	IHSG
Expected Return (Average Monthly)	5.54%	4.06%	7.61%	8.44%	0.78%
SD	7.45%	6.27%	8.79%	9.65%	2.65%
Sharpe Ratio	0.696	0.590	0.825	0.837	0.162

Based on the analysis results of Markowitz portfolio optimization method, there are several conclusion that can be made :

1. For the year of 2020, the calculation generated an optimum portfolio with an **expected return of 7.33% (average monthly), standard deviation of 13.88%, and sharpe ratio of 0.506**. The portfolio have a stock composition of **MDKA**



(77.79%) and INCO (22.21%). The IHSG composite index have a standard deviation of 7.81%, an expected return of 0.35% (average monthly), and sharpe ratio of 0.005. **The 2020 optimum portfolio compared to the IHSG, eventhough having a tradeoff of a higher standard deviation of almost 2 times, the portfolio generate a higher return of around 20 times resulting a far more higher sharpe ratio.**

2. For the year of 2021, the calculation generated an optimum portfolio with an **expected return of 5.00% (average monthly), standard deviation of 1.02%, and sharpe ratio of 4.618**. The portfolio have a stock composition of MNCN (8.74%), BYAN (15.08%), ADRO (9.92%), IMPC (6.04%), EMTK (41.17%), and MCAS (19.05%). The IHSG composite index have a standard deviation of 2.83%, an expected return of 1.09% (average monthly), and sharpe ratio of 0.283. **The 2021 optimum portfolio compared to the IHSG is better in all of the performance measurement aspects, having a lower standard deviation but still maintaining a higher return of almost 5 times resulting a higher sharpe ratio.**
3. For the year of 2022, the calculation generated an optimum portfolio with an expected return of 8.44% (average monthly), standard deviation of 9.65%, and sharpe ratio of 0.837. The portfolio have a stock composition of ADRO (61.13%) and ITMG (38.87%). **The 2022 optimum portfolio compared to the IHSG, eventhough having a tradeoff of a higher standard deviation of almost 4 times, the portfolio generate a higher return of around 11 times, resulting a higher sharpe ratio.**
4. From the analysis of implementing sector rotation as an investment strategies during the time frame of 2020 to 2022, **sector rotation investment generating a returns of 466.36% which beating the general market IHSG which only generate a return of 19%.**

Based on the research findings and analysis results, these are several recommendation for an investors in implementing investment and for future research in similar topics :

1. It is best to implement sector rotation for an investors to capitilize more returns on their investment. Sector rotation can be used to take advantage of changing market conditions. For example, if a particular sector is experiencing strong growth, an investor who is invested in that sector may be able to capitalize on that growth. On the other hand, by rotating between sectors, investors may be able to reduce the risk of their portfolio by avoiding sectors that are prone to votality or experiencing negative performance, if a sector is underperforming, an investor may want to rotate out of that sector and into another sector that is performing better. Based on the results of these research, sector rotation can be effective for an investors in improving their investment portfolio performance.
2. Future research can implement other additional screening method to create a stock pool for portfolio construction, as these research are only implementing fundamental tools of Piotroski F-score for screening. Implementing technical analysis screening method to analyze a trend, such as moving avareage and trading volume to see a stock that are in trend of upwards, making an investors to gain a better momentum to capturing and capitalizing the market trends.
3. Investors can implement Markowitz method in order to construct an optimal stocks portfolio, based on the risk and return tradeoff. Eventhough the results of Markowitz method are through back testing and past results, doing a back testing on potential investment are necessary to be done for an investors. Through back testing, investors can be able to compare the performance of the stocks and portfolio that are gonna be purchased. Back testing are important as a references, it can provide investors an information and ideas for investment decision process.

## REFERENCES

1. Alexiou, C., & Tygi, A. (2020). Gauging the Effectiveness of Sector Rotation Strategies: Evidence from the U.S and Europe. *Journal of Asset Management Volume 21*, 239-260.
2. Bank Indonesia. (2021). *Monetary Policy Report Quarter 3 2021*. Jakarta: Bank Indonesia.
3. Duan, Y. C. (2007). A Multi-Objectives Approach to Portfolio Optimization. *Rose-Hulman Undergraduate Mathematics Journal Volume 8 Issue 1*, Article 12.
4. Lee, C. F., & Lee, J. C. (2020). *Handbook of Financial Econometrics, Mathematics, Statistics, and Machine Learning*. World Scientific Publishing Company.





5. Lo, A. W. (2002). The Statistics of Sharpe Ratios. *Financial Analysts Journal* Volume 8, 36-52.
6. Mankiw, N. G. (2014). *Principles of Macroeconomics 7th Edition*. New York: South-Western College Pub.
7. Markowitz, H. (1952). Portfolio Selection. *The Journal of Finance* Volume 7, 77-91.
8. OECD. (2021). *OECD Economic Surveys: Indonesia*. Paris: OECD.
9. Parulian, A., & Soekarno, S. (2013). Sector Rotation Investment Strategy in Indonesia Stock Exchange. *World Applied Sciences Journal* Volume 28, 60-65.
10. PT Bursa Efek Indonesia (BEI). (2021). *IDX Annual Report 2021*. Jakarta: PT Bursa Efek Indonesia (BEI).
11. PT Bursa Efek Indonesia. (2020). *IDX Annual Statistics 2020*. Jakarta: PT Bursa Efek Indonesia.
12. PT Bursa Efek Indonesia. (2021). *IDX Annual Statistics 2021*. Jakarta: PT Bursa Efek Indonesia.
13. PT Bursa Efek Indonesia. (2022). *Third Quarter 2022 Statistics*. Jakarta: PT Bursa Efek Indonesia.
14. Vo, D. H., Pham, T. N., Pham, T. T., Truong, L. M., & Nguyen, T. C. (2019). Risk, Return, and Portfolio Optimization for Various Industries in the ASEAN Region. *Borsa Istanbul Review* Volume 19 Issues 2, 132-138.
15. Walkshausl, C. (2020). Piotroski's FSCORE: International Evidence. *Journal of Asset Management* Volume 21, 106-118.
16. World Bank. (2022). *Indonesia Economic Prospects: Financial Deepening for Stronger Growth and Sustainable Recovery*. Washington: World Bank.

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*Cite this Article: Jhon Heryanto, Dr. Subiako Sukarno (2023). Sector Rotation Investment Strategy by Implementing Piotroski F-Score and Markowitz Portfolio Theory for Portfolio Construction: Indonesia Stock Market 2020 to 2022. International Journal of Current Science Research and Review, 6(2), 875-899*