

# Investment Analysis and Portfolio Management of Top 10 Stocks Picks in India Amid Market Turmoil in COVID-19

Supriya Shivnarayan Singh

**Abstract:** *The COVID-19 pandemic has disrupted economic activity and have caused recessionary situation. It has also disrupted an economy like India which is set to grow now at slower pace for a decade. Stock market reacted very sharply with the increased number of infected population. Amid all this, Macquarie, a Sydney based Investment Bank, is bullish on ten stocks mentioned in this paper. This paper analyses these ten stocks from Investment Perspective and shows how a portfolio can be created using these stocks. This paper, with the help of optimization model, tries to understand the effect of diversification and find out the optimal number of stocks considering the risk and return. The model duly considers the investor's appetite as well. The research indicates that if Financial Analysis is done in a right manner, we can analyze Investments rigorously and Manage Portfolios by using Excel and Google Sheets. It can be concluded that, the returns can be maximized and risk can be minimized by proper Investment Analysis and creating an optimized portfolio using top stock picks even in this Market Turmoil caused due to pandemic like COVID-19.*

**Keywords:** COVID-19, Investment Analysis, Portfolio Management

## 1. Introduction

In this market turmoil situation, people are looking for investments which would give them good returns amid COVID-19. In this paper we have taken a list of 10 stocks which according to an article in Bloomberg Quint published on April 03, 2020 are Top 10 Stock Picks in India Amid Market Turmoil caused by COVID 19.

We have analyzed these stocks by calculating the risk, Return and optimal weight and created an optimal portfolio.

Also we have tried to explore the effect of diversification and understand various concepts of Investment analysis and portfolio Management.

Investment analysis is the process of evaluating an investment for profitability and risk. It ultimately has the aim of measuring how the given investment can be a good fit to a portfolio.

Portfolio management is the science and art of choosing and overseeing a gaggle of investments that meet the long-term financial objectives and risk tolerance of a client, a company, or an establishment.

In this project, we have calculated the daily return, expected return, Risk and also understood the effect of diversification on a Portfolio. We have also analyzed Berkshire Hathaway Portfolio to find out the optimal number of stocks in a diversified portfolio. In this project we practically did investment analysis and Portfolio Management and created an optimized portfolio with the Top Stocks Picks in India Amid Market Turmoil caused by COVID-19 according to an article published in Bloomberg Quint.

## 2. Literature Review

Many research and theories are explained in the field of Investment Analysis and Portfolio Management. The research in this field is done either on Investment Analysis,

Portfolio Management or both at the same time. Literature reviews in these fields are as follows:

Markowitz Approach developed by Markowitz (1952) states that the investments must be assessed in terms of risk and returns and returns can be maximized for a given level of risk. It implies that an investor expects higher returns and lower risk.

Harry Markowitz (1952, 1959 Portfolio Selection) attempted to make an effort to quantify the risk. A portfolio model and method to obtain a portfolio model was introduced. This model works on expected rate of return and expected risk of the portfolio.

William F. Sharpe (1966) introduced Sharpe ratio i.e. Relationship between risk and return of portfolios.

Arbitrage Pricing Theory (1976) model explains a stock's return based upon fundamental factors.

Baker, Hargrove and Haslem (1977), in their study found that due to the impact of capital appreciation on investors' expectations of total returns there is positive association between risk and expected return.

Dr. John Lintner's (1983) in his paper, "The Potential Role of Managed Commodity-Financial Futures Accounts (and/or Funds) in Portfolios of Stocks and Bonds," explored how adding managed futures to institutional portfolios can give substantial diversification benefits.

Shalit & Yitzhaki (1984) suggested using the Mean-Gini (MG) method to build optimization models and risk analysis, which is simple in its practical applications.

Dr. G. P. Jakhotia and Mrs. M.G. Jakhotia (2001) elaborated the investment management techniques for individual investors in their book 'Finance for one and All'. It listed five important investment reasons. They also listed 12 sensitive factors for optional portfolio investments. They included a model for individual's portfolio mix assessment;

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he suggested that individual investors should assess each one's portfolio by forming a group and meeting.

Valery Polkovnichenko (2005) supports preferences on ranking his study 'Household Portfolio Diversification: A Case for Rank-Dependent Preferences'. The behavior of people, purchasing lottery tickets and insurance at the same time, one indicating risk preference and the other risk aversion preference was explained in this model. Consumer expenditure data was taken and it figured out two widespread patterns different from expected utility. One that there were poor portfolios of stocks and majority of investments in well diversified funds by households. Second that households invested very less in equity in spite of more savings. Rank-dependent preference portfolio models are used as much as possible with fully rational assumptions which are in alignment with the observed diversification. He suggested that portfolio theory and asset pricing are needed to be integrated with the models of rank-dependent preferences.

Gnana Desigan C, S. Kalaiselvi and L. Anusuya (2006) studied the perception of women investors towards investment. Investment pattern of women investors is focused by an empirical study. Research concluded with findings that the age of the women investors and level of awareness about investment are not associated and educational level and level of awareness about investment have no significant association. Occupation, monthly income and level of investment awareness have significant association between them. While, marital status and level of investment awareness are not associated.

Efe Aksuyek Zurich, (2008) in his study "Information Theory and Portfolio Management" the relation between information theory and the theory of optimal investments in a stock market is focused. Two scenarios were considered, in the first scenario the problem of an optimal stock portfolio construction with known individual stock returns is investigated. Then the same is examined with a universal approach and unknown individual stock returns. It was observing that information theory and portfolio management are connected via data compression and universal codes. Unfortunately, long-optimal portfolio is not perfectly constructible. The properties of long-optimal portfolio are stiff, as the true distributions of stock returns are unknown in real sense. So in terms of practical usage, the universal portfolio makes more sense.

B. Raju and K.M Rao (2011) studied selected Indian Mutual funds and evaluated their risk adjustment performance. A study on 20 mutual fund schemes was done. Banking sector, FMCG sector index funds and infrastructure sector funds for 2008-2010 were part of this study. Six performance measures were taken into consideration during this study. It was found that Banking sector and FMCG sector fund performed better than index funds. It was concluded that many selected schemes that gave low average Beta failed to outperform the market. The researcher pointed out that the risk in mutual fund as a common factor of evaluating it is not justified in case of mutual fund selection in the portfolio. The performance of mutual fund must be considered in portfolio.

Chaitanya (2013) studied future prospects of gold loan Market in India. He explained, NBFC companies are playing important role in the development of gold loan market. It was concluded that in growing gold market, NBFCs entered as significant player. She mentioned that the consumer's perception towards gold loan is also a significant reason. She also included that the demand for gold will grow and require new methods to cater the hike in customer base in the long run.

Khaira Amalia Fachrudina, Hilma Tamiami Fachrudinb (2015), their study aims to analyze the property portfolio and sustainability in real assets companies registered in Indonesia Stock Exchange. The findings of the research show that by asset enhancements, the highest expected return is obtained and the hospitality services and infrastructures gives the lowest expected return. At 5% alpha, the company size influences the property portfolio and sustainability. There is positive and significant relation of Inventories of property and investment properties to the corporate performance.

Jet Singh & Pretty Yadav (2016) conducted their study on a sample 100 investors in Moradabad city of Uttar Pradesh to find out the major influencing factors on the investment decisions in shares. It made an attempt to find out the preconceived notions related to equity market investments that male and female investors have and their attitude towards variety of investment alternatives. The research included 60 males and 40 female investors from Jaipur and Moradabad cities. The hypothesis was tested using Independent t-test mean scores. It was concluded that fundamental, financial and technical analysis must be done before investing in the shares. All avenues must be taken into consideration while investing in different assets. The amount of risk to be taken, should be as per the age of investors.

Sandeep Bhattacharjee (2017) in his research paper "A COMPARATIVE ANALYSIS OF IMPACT OF ASSETS ALLOCATION ON PORTFOLIO PERFORMANCE AS MEDIUM TERM INVESTMENTS" shows how of allocation of stocks and bonds affect the performance of the portfolio. Three-year termed mutual funds beginning from (17/3/2014 to 17/3/2017) i.e. Medium term investments were taken. A combination of equity & debt has been tested, equity funds and debt funds were also tested separately. 23 stocks were taken in every portfolio and pooled together i.e. Equity basket, Debt basket and Balanced basket. With t-test analysis and its corresponding t-table value, the overall performance of each basket was tested. The result obtained can be used for effective investments with better return by midterm investors.

Ziqiang Wang, Xiaoping Ren (2018) in their research "Research on hedging theory of modern portfolio management" introduced the derivation process of linear regression model and linear mean-variance model in modern portfolio management, to obtain the optimal hedge ratio. The specific theory and equation of hedge model are introduced in detail on the basis of understanding other scholars, and the coefficients in the model are explained.

Andi Reskin Alameda Dg Macenning<sup>1</sup>, Dedy Bud man Hakim<sup>2</sup>, Tries Andati<sup>1</sup> (2019) in their research study “Analysis and Optimization of Investment Portfolio Performance (Case Study of PLN Pension Fund)”, Their research concluded that based on risk-adjusted performance, mutual funds have suboptimal performance. While time deposits, government securities, stocks, and bonds have good performance. Portfolio composition with tangency portfolio can be used by the PLN Pension Fund. As compared to the PLN Pension Fund historical portfolio and the single-index model, it has a lower risk level with a higher portfolio return. Also there is no much difference between the composition of Tangency portfolio and historical PLN Pension Fund, with bonds as the dominant assets in the portfolio formation.

**Research Gap**

The research in Investment Analysis and portfolio management studies that many researches are done in this field. The researches at micro level have been rarely carried out by scholars in India. There is lack of research on Actual Investment Analysis and portfolio management of different investment options. There is also lack of research on various portfolios that are claimed to give good returns in Market turmoil conditions with its optimal weight allocation. There is also lack of research on practical Implementation of various concepts of Investment analysis and Portfolio Management. The research on effect of diversification on actual investment options and optimal no of stocks with good returns to be invested in is also rare. Also there is lack of research in variety of options available in one Investment option. There is also less research done on Investment Analysis and Portfolio Management for COVID-19 as this pandemic has started affecting people since December as per WHO reports internationally.

There is rare research paper on Investment Analysis and portfolio management using simple and easy to understand tool like MS Excel and how it can be done using various excel functions and tools can be used in analyzing and creating an optimal portfolio. This research paper has tried

to fill this gap by considering most of these gaps in our research.

**Research Objective**

To analyze the top 10 stocks picks in India amid COVID-19, calculate their risks and return, create an optimized portfolio using these stocks and understand the effect of diversification.

**3. Research Methodology**

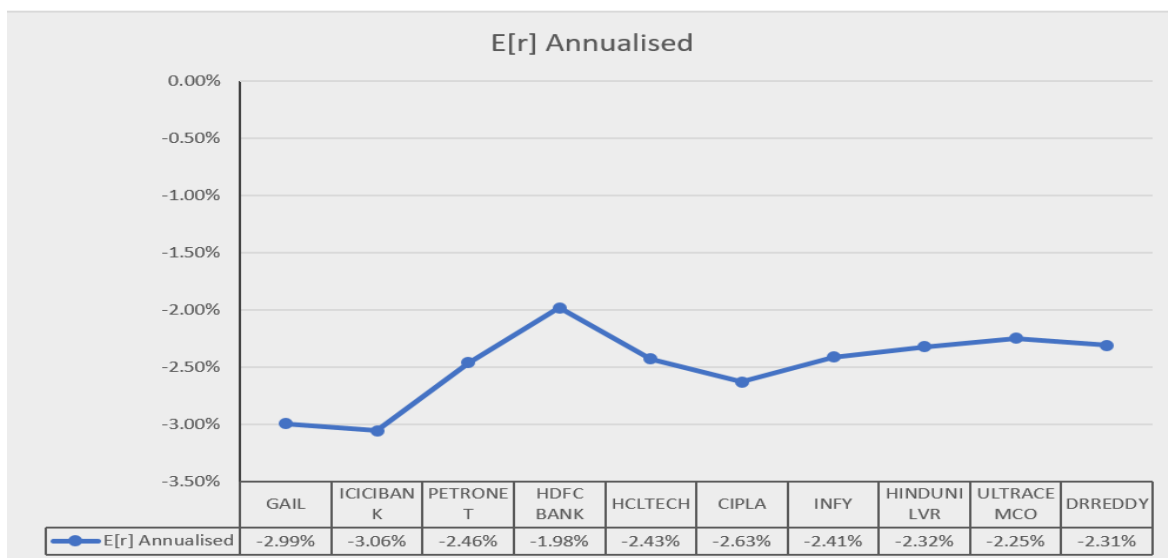
The objective of this research is to analyze the top 10 stocks picks in India amid COVID-19, calculate their risks and return, create an optimized portfolio using these stocks and understand the effect of diversification.

The research is based on historic data of last 5years (2 Jan, 2015 – 3 April, 2020). The research includes the first few days of lockdown period amid COVID-19 also. The research work is based on the secondary data from the published sources. The data is sourced from Financial Times, Research papers and a Bloomberg Quint article. (Secondary data is downloaded from any site like bse/nseetc)

Investment analysis and Portfolio Management concepts and principles are applied in this Research. We have analyzed the stocks in the portfolio, calculated the return and risk individual stock as well as portfolio risk and return, created an optimized portfolio and studied the effect of diversification on the portfolio in this research.

**4. Data Analysis**

The top 10 stock picks amid COVID-19 are GAIL, ICICIBANK, PETRONET, HDFC BANK, HCLTECH, CIPLA, INFY, HINDUNILVR, ULTRACEMCO, DR REDDY. The historic data of these stocks of last 5 years is taken as data for the research. Using this data, we calculated the Expected Return and risk of these individual stocks.



**Figure:** Graph showing Annualized Expected Return of Each stock in the Portfolio

The expected Return of each of these stocks is calculated by using Arithmetic Mean Method. The Expected Return of

HDFC stock is highest among all of these stocks.

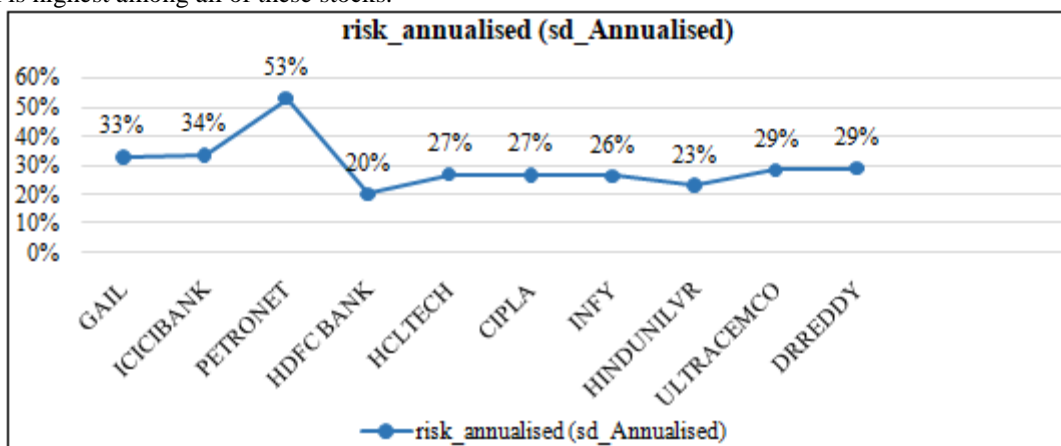


Figure: Graph showing Risk of Each stock in the Portfolio

The risk of each stock in the portfolio is calculated by taking standard deviation of Expected Return. The graph shows that the riskiest stock is PETRONET and the least risky stock is HDFC.

A portfolio is created using these 10 stocks and equal weight is allocated to all of these stock such that sum of weights of all these stocks is equal to 1.

The Expected return of the portfolio is then calculated using portfolio return formula.

The Expected Return of Portfolio is calculated as:

$$E[r_p] = \sum_{i=1}^k \omega_i r_i$$

Where:  $E[r_p]$  = Expected Return on the portfolio.

$r_i$  = Return on an asset.

$\omega_i$  = Weight of (or proportion invested in) asset  $i$ .

We can calculate it by using SUMPRODUCT function.

Annualized Portfolio return is calculated by using the formula:

$$E[r_p] \text{ Annualized} = (1 + E[r_p])^{250} - 1$$

Portfolio with equal weights		
Stocks	Weights	E[r]
GAIL	10%	-0.012%
ICICIBANK	10%	0.015%
PETRONET	10%	-0.012%
HDFC BANK	10%	0.049%
HCLTECH	10%	0.015%
CIPLA	10%	-0.012%
INFY	10%	0.022%
HINDUNILVR	10%	0.092%
ULTRACEMCO	10%	0.024%
DRREDDY	10%	0.014%
Sum_weights	100%	

E[r_p]	0.020%	0.020%
E[r_p] Annualised	5%	5%

Figure: Portfolio Return E[r\_p]

Stocks in the Portfolio	risk_daily (sd)	Risk_Annualised (sd_Annualised)	Equal Weight Portfolio Risk (sd_p) Daily	Equal Weight Portfolio Risk (sd_p) Annual
GAIL	2%	33%	<b>0.81%</b>	<b>13%</b>
ICICIBANK	2%	34%		
PETRONET	3%	53%		
HDFC BANK	1%	20%		
HCLTECH	2%	27%		
CIPLA	2%	27%		
INFY	2%	26%		
HINDUNILVR	1%	23%		
ULTRACEMCO	2%	29%		
DRREDDY	2%	29%		

Figure: Risk of each Stock in the Portfolio and the Portfolio Risk

The portfolio risk is further calculated as:

$$\sigma^2 p = \text{var}(\Omega' \Sigma \Omega)$$

Where  $\Omega$  = Vector of 'weights';

$\sigma^2 p$  = Variance of portfolio;

$\Sigma$  = Variance-Covariance Matrix.

The VCV matrix is obtained as follows:

=MMULT (TRANSPOSE (array of return stock-array of

E[r]), array of return stock-array of E[r])/COUNT (no of daily stock return-1).

Further by taking square root of variance we obtain the daily risk of the portfolio and it is annualized by multiplying the sd\_daily by square root of 250.

From the table above we can see that the risk of portfolio is less as compared to the risk of individual stocks. Hence

diversification in the same asset type reduces risk to certain extent.

No of stocks	variance	SD_Daily (Risk)	SD_annual (Risk)
1Asset	0.0004301	2.07%	32.79%
2Asset	0.000224355	1.50%	23.68%
3Asset	0.000230732	1.52%	24.02%
4Asset	0.000154594	1.24%	19.66%
5Asset	0.000119286	1.09%	17.27%
6Asset	9.79072E-05	0.99%	15.65%
7Asset	8.44557E-05	0.92%	14.53%
8Asset	7.23048E-05	0.85%	13.44%
9Asset	7.19206E-05	0.85%	13.41%
10Asset	6.53808E-05	0.81%	12.78%

Fig: Risk of Portfolios with increasing number of Assets

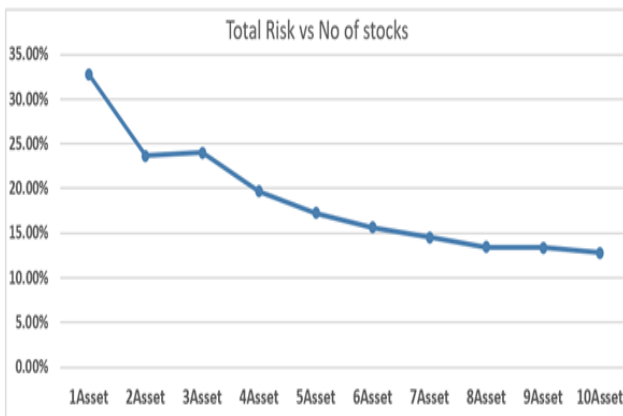


Figure: Total Risk Vs No of stocks

To further understand the effect of diversification on risk, 10 different portfolios were created by increasing a single asset in each portfolio starting from 1Asset Portfolio.

From the above graph we can see that the Risk is reducing with increasing number of assets in the Portfolio. We can also see that for the 3 Asset Portfolio, the risk has increased as compared to the 2Asset Portfolio, this is because a significantly risky stock (SD ≈ 53%) was added to a poorly diversified portfolio. Thus, the reduction or elimination of firm specific risk causes the total risk of a portfolio to decrease as the number of stocks increase. To study this effect of diversification more deeply we further added more assets in the portfolio, calculated its risk and expected

return and observed its effect on the Portfolio.

5 more stocks one by one were added to the portfolio with equal weight allocated to each portfolio and observed its effect and at last made a 15 Asset Portfolio and observed how it affected the risk and return of the portfolio.

No of stocks	variance	SD	SD_annual
1Asset	0.0004301	2.07%	32.79%
2Asset	0.000224	1.50%	23.68%
3Asset	0.000231	1.52%	24.02%
4Asset	0.000155	1.24%	19.66%
5Asset	0.000119	1.09%	17.27%
6Asset	9.79E-05	0.99%	15.65%
7Asset	8.45E-05	0.92%	14.53%
8Asset	7.23E-05	0.85%	13.44%
9Asset	7.19E-05	0.85%	13.41%
10Asset	6.54E-05	0.81%	12.78%
11Asset	5.59E-05	0.75%	11.82%
12Asset	5.37E-05	0.73%	11.58%
13Asset	5.19E-05	0.72%	11.39%
14Asset	5.18E-05	0.72%	11.38%
15Asset	5.16E-05	0.72%	11.36%

Figure: Risk of Portfolios with increasing number of Assets.

The weight of each portfolio with an addition of one asset in every new portfolio is obtained by dividing one by total number of assets in the portfolio. Such portfolio is called equally weighted portfolio and the sum of weights of all the portfolios must be equal to one. The variance is obtained by using VCV matrix obtained in the same way as obtained while calculating Portfolio Risk. The Variance for each portfolio with increasing number of single stock is obtained by using:

$$=MMULT (TRANSPOSE (array of weight of assets in the portfolio), MMULT (array of n*n VCV matrix, array of weight of assets in the portfolio))$$

where n is number of assets in the portfolio for which we are calculating variance. Further by taking Square root of Variance we obtain the daily Risk of the Portfolio.



Figure: Total Risk versus Number of stocks

In the figure, we can see that the decrease in the risk after a particular number of assets in the portfolio is very less and

after particular number of stocks in the portfolio, the decrease will become negligible. Hence there should be an optimal number of Assets in the portfolio. While diversification is imperative, it can be suboptimal to over-diversify. The optimal number of stocks lies in the range of 15-20 stocks after which effect of diversification becomes negligible.

To verify this an analysis of Berkshire Hathaway portfolio was also done and the same was observed in it.

After understanding the effect of diversification, an optimized portfolio was created using these 10stocks.The weights can be optimized according to the investors' appetite. Generally, a high return, less risk is preferred by investors. Using solver, we can obtain the optimized weights by setting the desired risk and return.

Optimised weights 10 stocks			
Stocks	Weights	E[r]	E[r]Annualised
GAIL	0%	-0.012%	-3%
ICICIBANK	0%	0.015%	4%
PETRONET	0%	-0.012%	-3%
HDFC BANK	36%	0.049%	13%
HCLTECH	0%	0.015%	4%
CIPLA	0%	-0.012%	-3%
INFY	5%	0.022%	6%
HINDUNILVR	59%	0.092%	26%
ULTRACEMCO	0%	0.024%	6%
DRREDDY	0%	0.014%	4%
Sum_weights	100%		

E[r_p]	0.073%	0.073%
E[r_p]Annualised	20%	20%
var_p	9.86926E-05	
sd_p	0.99%	
sd_p annual	16%	

Figure: Optimized 10 Asset Portfolio with an Expected Return of 20% and minimum Risk.

Using the above model in the figure, we can create an optimized portfolio according to the investors' appetite.

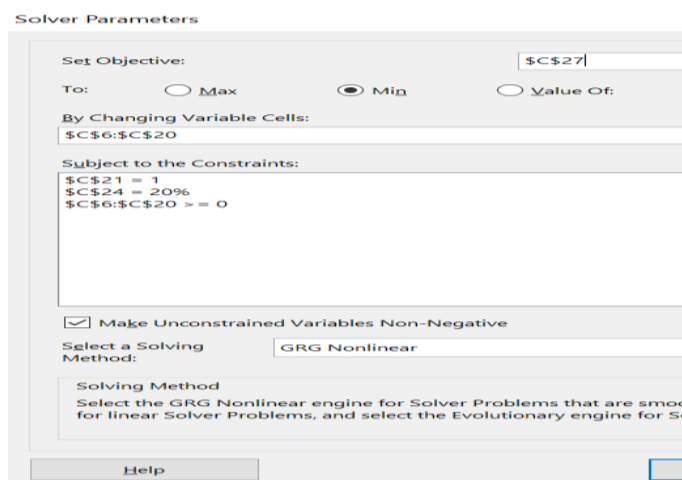


Figure: Optimized portfolio using the solver function.

The model for the optimized portfolio is made using the solver function where we set our objective according to the investors' appetite. In this case risk is required to be

minimum, so we set the risk at a minimum value. As the sum of the weights should be always equal to 1, it is a constraint. Also a return of 20% annually was set so enter The Expected return cell equal to 20% in the constraints. As we have considered going long, we have considered the weight of each stock in the portfolio to be greater than or equal to zero as a constraint. As explained above we choose GRGN onlinear solving method and click solve to obtain the optimised portfolio in which weights are optimised for minimum risk with are turn of 20%. Hence we can obtainan optimised portfoliofor any desirable risk and return by using this model.

## 5. Conclusion

If Financial Analysis is done in a right manner, we can analyze Investments rigorously and Manage Portfolios using Excel and Google Sheets. Investment risk can be quantified and measured by exploring the powerful relationships between stock prices, returns and risk. We found that risk can be minimized and return can be maximized to a certain extent by diversification.

We can find out how much to invest in individual stocks of a portfolio for desired return and risk. We can also find out, the maximum return that can be obtained from a portfolio by using the model used in this research.Investment analysis and Portfolio Management, helps us identify the way in which we should invest in stocks with some initial calculations and identify the portfolio which would help us to gain better returns.

## 6. Recommendations

This research has captured the historical data for first few months after COVID -19 pandemic started affecting the market. These 10 stocks are claimed to be top stock picks amid COVID-19. Hence, more data for the COVID-19 period must be captured for better analysis. While doing this analysis the tax factor on this investment should also be considered to analyze these stock and more accurately calculate the return from this portfolio.

This portfolio is not the only option to invest amid COVID-19. There can be other investment options that can give better returns than this portfolio amid COVID-19. Further , different investment alternatives that would prove to give high returns despite this turmoil should also be analysed taking into consideration , the interest of the investor .Research on each of these individual stocks can be done to find out the reasons why these are top 10 stock picks amid market turmoil due to COVID-19 to have a better understanding of this portfolio.The effect of diversification on various investments alternatives in pandemic situation like COVID-19 can also be explored, which can help built a portfolio with high returns taking into consideration the risk amid pandemic like situations.

## 7. Acknowledgement

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**Data Source**

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**Annexure I**

Price of stocks in the Portfolio

DATE	GAIL Close	ICICIBANK Close	PETRONET Close	HDFC BANK Close	HCLTECH Close	CIPLA Close	INFY Close	HINDUNILVR Close	ULTRACEMCO Close	DRREDDY Close
02-01-2015 15:30	125.04	329.36	105.6	482.65	401.31	630.15	7.98	755.95	2742.1	3221.4
05-01-2015 15:30	125.44	330.05	106	478.58	394.56	633	7.88	760.3	2747.7	3148.4
09-03-2020 15:30	100.45	486.35	221.45	1107.3	540.45	426.15	11.06	2188.9	4097.35	3170.95
11-03-2020 15:30	90.5	457.75	213.3	1113.8	536.8	417.1	11.06	2121.5	3993.4	3061.25
12-03-2020 15:30	79.95	465.65	229.45	1021.3	493.35	394.75	10.96	2155	3663.5	3000.6
13-03-2020 15:30	84.55	425.65	207.75	1069.8	492.9	425.55	10.94	2055.95	3788.9	2850.4
16-03-2020 15:30	78.15	447.2	202.05	999.5	450.7	396.4	11.1	2033.2	3518.05	2885.1
17-03-2020 15:30	74.65	402.9	191.05	975.1	450.65	401.75	11.04	1941.9	3470.45	2826.95
18-03-2020 15:30	70.85	367.25	197.65	876.9	434.25	386	10.96	2004.05	3303.55	2781.2
19-03-2020 15:30	69.4	355.05	206.8	895.55	413.45	374.7	10.85	1923.8	3166.05	2668.45
20-03-2020 15:30	80.8	338.55	189.3	882.85	444.9	392.8	10.92	1838.3	3573.85	2623.95
23-03-2020 15:30	78	345.7	176.95	771.55	417.15	375.25	10.95	2051.7	3054.85	2897.25
24-03-2020 15:30	76.45	284	175.65	767.7	442.05	377.45	11.22	1869.7	3018.1	2768.4
25-03-2020 15:30	75.55	296.5	190.05	856.75	457.6	376.45	11.1	2027.85	3228.6	2857.95
26-03-2020 15:30	73.1	316.9	193.45	901.1	447.7	386.15	11.01	2088.15	3229.15	2922
27-03-2020 15:30	69.5	330.25	190.05	904.45	430.65	407.65	11.21	2194.9	3143.6	2948.55
30-03-2020 15:30	70.85	339.85	199.7	831.65	419	431.75	11.3	2140.55	3085.9	2916.5
31-03-2020 15:30	76.55	313.4	200	861.9	436.4	422.85	11.36	2184.35	3244.85	2994.25
01-04-2020 15:30	75.75	323.75	195.8	829.65	413.55	413.75	11.41	2298.5	3140.65	3120.75
03-04-2020 15:30	80.9	298.65		813.85	405.8	449.2	8.820357	2166.875	3041.6	3120.9

**Annexure III**

Weight of stocks in the Portfolio

Stocks	Weights
GAIL	0.1
ICICIBANK	0.1
PETRONET	0.1
HDFC BANK	0.1
HCLTECH	0.1
CIPLA	0.1
INFY	0.1
HINDUNILVR	0.1
ULTRACEMCO	0.1
DRREDDY	0.1
Sum_weights	1

**Annexure IV**

VCV Matrix for 10 Asset Portfolio

	GAIL	ICICIBANK	PETRONET	HDFC BANK	HCLTECH	CIPLA	INFY	HINDUNILVR	ULTRACEMCO	DRREDDY
GAIL	0.0004301	0.0000077	-0.0000401	0.0000575	0.0000599	0.0000810	-0.0000110	0.0000062	0.0001187	0.0000202
ICICIBANK	0.0000077	0.0004519	0.0000680	0.0000267	-0.0000075	0.0000167	0.0000155	0.0000816	0.0000170	0.0000722
PETRONET	-0.0000401	0.0000680	0.0011235	0.0000320	0.0000098	-0.0000635	0.0001726	0.0000407	0.0000476	-0.0000075
HDFC BANK	0.0000575	0.0000267	0.0000320	0.0001644	0.0000479	0.0000526	-0.0000014	0.0000035	0.0001022	0.0000055
HCLTECH	0.0000599	-0.0000075	0.0000098	0.0000479	0.0002886	0.0000430	0.0000038	-0.0000050	0.0000591	-0.0000069
CIPLA	0.0000810	0.0000167	-0.0000635	0.0000526	0.0000430	0.0002829	-0.0000116	-0.0000001	0.0000860	0.0000332
INFY	-0.0000110	0.0000155	0.0001726	-0.0000014	0.0000038	-0.0000116	0.0002778	0.0000104	0.0000005	0.0000019
HINDUNILVR	0.0000062	0.0000816	0.0000407	0.0000035	-0.0000050	-0.0000001	0.0000104	0.0002146	0.0000055	0.0000587
ULTRACEMCO	0.0001187	0.0000170	0.0000476	0.0001022	0.0000591	0.0000860	0.0000005	0.0000055	0.0003249	0.0000166
DRREDDY	0.0000202	0.0000722	-0.0000075	0.0000055	-0.0000069	0.0000332	0.0000019	0.0000587	0.0000116	0.0003345

Activate Windows

Annexure V

Weight of Portfolios with increasing number of assets

PORTFOLIO WEIGHTS										
Num_assets	1	2	3	4	5	6	7	8	9	10
w_1	1	0.5	0.33333333	0.25	0.2	0.16666667	0.14285714	0.125	0.11111111	0.1
w_2		0.5	0.33333333	0.25	0.2	0.16666667	0.14285714	0.125	0.11111111	0.1
w_3			0.33333333	0.25	0.2	0.16666667	0.14285714	0.125	0.11111111	0.1
w_4				0.25	0.2	0.16666667	0.14285714	0.125	0.11111111	0.1
w_5					0.2	0.16666667	0.14285714	0.125	0.11111111	0.1
w_6						0.16666667	0.14285714	0.125	0.11111111	0.1
w_7							0.14285714	0.125	0.11111111	0.1
w_8								0.125	0.11111111	0.1
w_9									0.11111111	0.1
w_10										0.1
sum_weights	1	1	1	1	1	1	1	1	1	1

Source: www.ftcom

Annexure II

Daily Return of Individual Stocks in the Portfolio

r_GAIL	r_ICICIBANK	r_PETRONET	r_HDFCBANK	r_HCLTECH	r_CIPLA	r_INFY	r_HINDUNILVR	r_ULTRACEMCO	r_DRREDDY
0.003199	0.00209497	0.003787879	-0.00843261	-0.0168199	0.004523	-0.01253	0.005754349	0.00204223	-0.022661
-0.06818	-0.0359762	-0.00404767	-0.02431932	-0.0454786	-0.01899	-0.0036	-0.013119928	-0.016915196	-0.004239
-0.09905	-0.0588054	-0.03680289	0.005870135	-0.0067536	-0.02124	0	-0.030791722	-0.025370056	-0.034595
-0.11657	0.01725833	0.075714955	-0.08304902	-0.0809426	-0.05358	-0.00904	0.015790714	-0.082611309	-0.019812
0.057536	-0.0859014	-0.09457398	0.047488495	-0.0009121	0.078024	-0.00182	-0.045962877	0.034229562	-0.050057
-0.07569	0.05062845	-0.02743682	-0.06571322	-0.0856157	-0.0685	0.014625	-0.011065444	-0.071485128	0.0121737
-0.04479	-0.0990608	-0.05444197	-0.02441221	-0.0001109	0.013496	-0.00541	-0.044904584	-0.013530223	-0.020155
-0.0509	-0.0884835	0.03454593	-0.10070762	-0.0363919	-0.0392	-0.00725	0.032004738	-0.048091746	-0.016184
-0.02047	-0.0332199	0.046293954	0.021268104	-0.0478987	-0.02927	-0.01004	-0.040043911	-0.041621892	-0.04054
0.164265	-0.0464723	-0.08462282	-0.01418123	0.0760672	0.048305	0.006452	-0.044443289	0.12880403	-0.016676
-0.03465	0.02111948	-0.06524036	-0.12606898	-0.0623736	-0.04468	0.002747	0.116085514	-0.14522154	0.1041559
-0.01987	-0.1784784	-0.00734671	-0.00498996	0.0596908	0.005863	0.024658	-0.088706926	-0.012030051	-0.044473
-0.01177	0.04401408	0.081981213	0.115995832	0.035177	-0.00265	-0.0107	0.084585762	0.069745867	0.0323472
-0.03243	0.0688027	0.017890029	0.051765392	-0.0216346	0.025767	-0.00811	0.029735927	0.000170352	0.0224112
-0.04925	0.04212685	-0.0175756	0.003717678	-0.0380835	0.055678	0.018165	0.051121806	-0.02649304	0.0090862
0.019424	0.02906889	0.050776112	-0.08049091	-0.0270521	0.059119	0.008029	-0.024761948	-0.018354753	-0.01087
0.080452	-0.0778285	0.001502253	0.036373474	0.0415274	-0.02061	0.00531	0.020462031	0.051508474	0.0266587
-0.01045	0.03302489	-0.021	-0.03741733	-0.0523602	-0.02152	0.004401	0.052258109	-0.032112424	0.0422476
0.067987	-0.077529	-1	-0.01904418	-0.0187402	0.08568	-0.22696	-0.057265608	-0.031538057	4.807E-05

Annexure VI



Portfolio with equal weights for increasing number of stocks

PORTFOLIO WEIGHTS															
Num_assets	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
w_1	1	0.5	0.3333333	0.25	0.2	0.16666667	0.142857143	0.125	0.111111111	0.1	0.090909091	0.083333333	0.076523077	0.071428571	0.066666667
w_2		0.5	0.3333333	0.25	0.2	0.16666667	0.142857143	0.125	0.111111111	0.1	0.090909091	0.083333333	0.076523077	0.071428571	0.066666667
w_3			0.3333333	0.25	0.2	0.16666667	0.142857143	0.125	0.111111111	0.1	0.090909091	0.083333333	0.076523077	0.071428571	0.066666667
w_4				0.25	0.2	0.16666667	0.142857143	0.125	0.111111111	0.1	0.090909091	0.083333333	0.076523077	0.071428571	0.066666667
w_5					0.2	0.16666667	0.142857143	0.125	0.111111111	0.1	0.090909091	0.083333333	0.076523077	0.071428571	0.066666667
w_6						0.16666667	0.142857143	0.125	0.111111111	0.1	0.090909091	0.083333333	0.076523077	0.071428571	0.066666667
w_7							0.142857143	0.125	0.111111111	0.1	0.090909091	0.083333333	0.076523077	0.071428571	0.066666667
w_8								0.125	0.111111111	0.1	0.090909091	0.083333333	0.076523077	0.071428571	0.066666667
w_9									0.111111111	0.1	0.090909091	0.083333333	0.076523077	0.071428571	0.066666667
w_10										0.1	0.090909091	0.083333333	0.076523077	0.071428571	0.066666667
w_11											0.090909091	0.083333333	0.076523077	0.071428571	0.066666667
w_12												0.083333333	0.076523077	0.071428571	0.066666667
w_13													0.076523077	0.071428571	0.066666667
w_14														0.071428571	0.066666667
w_15															0.066666667
sum_weights	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1

Annexure VII

VCV matrix for a portfolio with diversified Investment alternatives

VCV MATRIX				
Investments	Equity	PPF	FD	G-sec
Equity	0.0025	0.00029	0.000783333	0.00154525
PPF	0.00029375	5.7E-05	0.000115604	0.000201502
FD	0.000783333	0.00012	0.0002805	0.000509724
G-sec	0.00154525	0.0002	0.000509724	0.000981581