# Optimal Portfolio Spread on the Different Industries in the Philippines

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## Introduction

It seems that, for some investors, it is a good strategy to invest in an uptrending industry to be able to maximize market returns. However, this is not always the case as there may be risk involved that needs to be taken into account. In most cases, there exists a trade-off between risk and returns, where the possibility of gaining larger returns means exposing oneself to more risk. As such, an investor needs to be able to identify the risks involved in one's investments.

In financial markets, there are two major sources of risk involved when investing in stocks: (1) systematic and (2) idiosyncratic risk where the main difference lies between where the risk is attributed. In terms of the former, this is risk tied to the general market movement while the latter is specific to a certain industry or company. Given that systematic risk is largely unpredictable as it reflects numerous economic, geopolitical, and financial factors, an investor is able to better minimize idiosyncratic risk. However, even when investing in companies within the same industry, there are still idiosyncratic risks within individual companies that may negatively impact returns. Thus, to reduce this risk, according to Harry Markowitz's modern portfolio theory (MPT) in 1999, an investor should spread out their investment into multiple stocks, essentially creating a diversified portfolio. Despite this theory, there may still be inherent systematic risks a portfolio is exposed to when investing in a single industry that may negatively impact the returns of all the stocks within it. This could mean that, in order to minimize this exposure to risk, an investor should create a diversified portfolio that invests in the various industries in the market.

With this said, the team aims to investigate whether investing in multiple industries is a sufficient strategy to hedge an investor against systematic risk in the Philippines, especially at a time of crisis (i.e., the COVID-19 Pandemic). This would be done by identifying the portfolio which best minimizes CAPM Beta, which is a metric that measures a portfolio's

sensitivity to the general market movement (Machado, 2012). Once this optimal portfolio has been identified, a descriptive analysis will also be conducted to encapsulate the potential trade-offs of said strategy by looking at certain performance and risk assessment measures such as the following: (1) Jensen's Alpha, (2) Treynor's Ratio, (3) Sharpe Ratio, (4) Expected Shortfall, and (5) Composition of Systematic Risk.

**Data Sources**

With the objectives of the study, it was necessary for the group to analyze the daily returns of the stocks included in each of the six industry sectors of the Philippine market, namely: (1) Financial, (2) Property, (3) Service, (4) Industrial, (5) Holding Firms, and (6) Mining and Oil. The study focuses on the top three stocks with the highest market capitalization in each of the aforementioned industries. This takes into account that the stocks with the highest market capitalization are those which are most liquid and most actively traded, and therefore would be most relevant to the portfolio of any general investor. Table 1 showcases the specific stocks that were taken into account.

| **Industry** | **Top 3 Companies with the Highest Market Capitalization** | | |
|---|---|---|---|
| Financial | BDO | BPI | MBT |
| Property | SMPH | ALI | RLC |
| Service | HVN | ICT | BLOOM |
| Industrial | URC | JFC | MER |
| Holding Firms | SM | AC | AEV |
| Mining and Oil | SCC | NIKL | FNI |

***Table 1.*** *Top Three Companies with the Highest Market Capitalization for Each Philippine Industry*

Once these were identified, the historical prices of each stock was acquired from Investing.com Philippines. Table 2 illustrates the raw dataset acquired, at least for the Financial

Stock Sector. In this case, on January 4 of 2018, BDO closed with a price of 160.00 pesos per share, BPI closed with a price of 109.60 pesos per share, and MBT closed with a price of 90.44 pesos per share. Dates which were skipped signify weekends, which are timelines wherein the Philippine stock index is not open. The datasets of the other remaining stocks considered in the study offered the same information as this example.

| | **Historical Prices of Stock** | | |
|---|---|---|---|
| **Date** | **BDO** | **BPI** | **MBT** |
| 1/4/2018 | 160.00 | 109.60 | 90.44 |
| 1/5/2018 | 160.00 | 110.67 | 90.36 |
| 1/8/2018 | 156.30 | 110.67 | 91.20 |
| … | … | … | … |
| 11/23/2022 | 129.50 | 98.00 | 53.75 |
| 11/24/2022 | 132.80 | 99.00 | 54.20 |
| 11/25/2022 | 131.50 | 102.10 | 56.15 |
| 11/28/2022 | 131.00 | 102.20 | 56.80 |

***Table 2.*** *Financial Stock Sector Historical Returns*

Using these historical prices, the daily returns of each stock was calculated through the following formula: $\frac{Opening\ Price - Closing\ Price}{Opening\ Price}\ x\ 100$. Table 3 illustrates the information provided by the dataset containing the daily returns of each stock, at least for the Financial Stock Sector. The datasets for each of the remaining stocks considered in the study offers the same information.

| | **Daily Returns of Company or Stock** |
|---|---|

| Date | BDO | BPI | MBT |
|---|---|---|---|
| 1/4/2018 | -0.62% | 2.46% | 2.19% |
| 1/5/2018 | 0.00% | 0.98% | -0.09% |
| 1/8/2018 | -2.31% | 0.00% | 0.93% |
| … | … | … | … |
| 11/23/2022 | -0.38% | 0.20% | 1.42% |
| 11/24/2022 | 2.55% | 1.02% | 0.84% |
| 11/25/2022 | -0.98% | 3.13% | 3.60% |
| 11/28/2022 | -0.38% | 0.10% | 1.16% |

***Table 3.*** *Financial Stock Sector Daily Returns*

Noticeably, the dataset of both the daily returns of each stock covers a five-year period from January of 2018 to November of 2022, which was the most recently available data. This allowed for the consideration of an equal timeframe for newer stocks considered in the study such as HVN. Other than being divided into industries, the dataset was also subdivided into two time periods (i.e., pre-pandemic and post-pandemic). Doing so revealed any important differences in analysis before and after the time of crisis (i.e., the COVID-19 pandemic). Table 4 illustrates the exact division as to when pre and post pandemic data was subdivided. Given that the pandemic officially started on March 11th of 2020, post-pandemic datasets start at this particular date.

| Period | Date |
|---|---|
| Pre-Pandemic | January 04, 2018 to March 10, 2020 |
| Post-Pandemic | March 11, 2020 to November 28, 2022 |
| All Periods | January 04, 2018 to November 28, 2022 |

***Table 4.*** *Historical Time Period of Compiled Dataset*

**Methodology**

***Step 1: Calculating the Daily Returns of Each Stock***

As mentioned, the study began by acquiring the daily returns of each of the top three stocks with the highest market capitalization in the Philippines for each of the six stock sectors over the pre-pandemic and post-pandemic time periods. Aside from this, the daily returns of the market (i.e., PSEi), as well as the risk-free rates (as embodied by T-bills), were also obtained for these time periods. Obtaining such information becomes crucial especially in the latter parts of the analysis given that performing CAPM regression, calculating Treynor's Ratio, calculating Sharpe Ratio, and calculating Expected Shortfall requires these specific inputs.

***Step 2: Creating a Representative Portfolio for the Six Stock Sectors***

Once the daily returns of each stock were calculated, a portfolio representative of each stock sector was created. Given that there are six stock sectors in the Philippine index, there were a total of six representative portfolios created (i.e., (1) Financial portfolio, (2) Property portfolio, (3) Service portfolio, (4) Industrial portfolio, (5) Holding Firms portfolio, and (6) Mining and Oil portfolio) for *each* time period. Each portfolio comprised only the top three stocks with the highest market capitalization in that particular industry as previously illustrated in Table 1.

In order to calculate the optimal allocation to each stock in these representative portfolios, the team made use of Mean-Variance optimization. This particular process calculates for the optimal weights allotted to each stock in the portfolio by minimizing the risk (i.e., standard deviation) of the portfolio to reach a certain level of expected returns. For the sake of standardization, all portfolios created targeted a uniform expected return of 2 percent. Figure 1 illustrates a sample of how Mean-Variance optimization was performed on Microsoft Excel. As can be seen, the process requires the following inputs: (1) the expected returns of

each stock, (2) the variance of each stock, and (3) the covariance matrix of the stocks included in the portfolio. Using these inputs, Microsoft Excel Solver was then used to calculate for the optimal allocation to each stock in the representative portfolio. The objective function was set to minimize the standard deviation of the portfolio by changing the weights allocated to each stock. Two constraints were added into Microsoft Solver namely: (1) total portfolio weight must be equal to 100 percent and (2) portfolio expected return must be equal to 2 percent. It must be noted that negative weights were allowed which means that short-selling of stocks is permitted.

| Stock Sector | FINANCIAL | | |
|---|---|---|---|
| Company | BDO | BPI | MBT |
| Expected Return | 0.02% | 0.08% | 0.04% |
| Sample Variance | 0.07% | 0.05% | 0.05% |

| FINANCIAL COVARIANCE MATRIX | BDO | BPI | MBT |
|---|---|---|---|
| BDO | 0.07% | 0.03% | 0.03% |
| BPI | 0.03% | 0.05% | 0.02% |
| MBT | 0.03% | 0.02% | 0.05% |

| Fund Allocation | BDO | BPI | MBT |
|---|---|---|---|
| Weights | -2878.20% | 4249.17% | -1270.97% |
| Sum of Weights | 1.00 | | |

| | |
|---|---|
| Portfolio Expected Return | 2% |
| Portfolio Variance | 0.73 |
| Portfolio Standard Deviation | 0.85 |

***Figure 1.*** *Performance of Mean-Variance Optimization on the Financial Sector Representative Portfolio*

***Step 3: Performing CAPM Regression to Acquire Jensen's Alpha and CAPM Beta of Representative Portfolios***

After solving for the optimal allocation to each stock in the representative portfolio, the team then proceeded to calculate for the first two metrics considered (i.e., Jensen's Alpha and CAPM Beta) by performing CAPM regression on every stock considered through Microsoft Excel. The dependent variable being the daily returns of the stock, whereas the independent variable being a column of data containing the difference of market returns and the risk-free rate. Doing so provided each stock's Jensen's Alpha (as denoted by the Coefficient of the Intercept) and each stock's CAPM Beta (as denoted by the Coefficient of the Daily Returns of $R_m - R_f$). The Jensen's Alpha and CAPM Beta of each representative portfolio was then calculated by getting the sum-product of each stock's Jensen's Alpha or CAPM Beta with their respective weights. Specifically, $\alpha_p = \Sigma \alpha_i w_i$ and $\beta_p = \Sigma \beta_i w_i$, where $w_i = weight\ of\ stock$, $\alpha_i = Alpha\ of\ stock$, and $\beta_i = Beta\ of\ stock$.

***Step 4: Calculating for Treynor's Ratio and Sharpe Ratio of Representative Portfolios***

The next two performance metrics (i.e., Treynor's Ratio and Sharpe Ratio) were then calculated for each representative portfolio through the following formulas:

$$Treynor's\ Ratio = \frac{R_p - R_f}{\beta_p} \quad \textbf{(1)}$$

$$Sharpe\ Ratio = \frac{R_p - R_f}{\sigma_p} \quad \textbf{(2)}$$

where $R_p$ = returns of portfolio, $R_f$ = risk-free rate, $\beta_p$ = portfolio beta, and $\sigma_p$ = standard deviation of portfolio.

***Step 5: Creating a Portfolio with 2, 3, 4, 5, and 6 Industry Stocks***

Moving forward, each representative portfolio was then considered as a stock in itself which will henceforth be referred to as an "industry stock." This allows for the creation of a portfolio containing stocks from more than one industry sector to investigate the benefits or consequences of investing across multiple industries in the Philippines. If a portfolio holds two industry stocks, then it contains a total of six stocks from two distinct stock sectors. For instance, a portfolio with the financial and property industry stocks would mean that it holds the following stocks: BDO, BPI, MBT, SMPH, ALI, and RLC. The same logic applies to a portfolio with three, four, five, or six industry stocks. All possible combinations of industry stocks were investigated for a more comprehensive analysis. Table 5 illustrates all combinations considered. As can be seen, a total of 63 portfolios were considered in the study.

| **Number of Industry Stocks in Portfolio** | **Combinations** | **Number of Combinations** |
|---|---|---|
| 1 Industry Stock | F, P, S, I, H, M | 6 |
| 2 Industry Stocks | FP, FS, FI, FH, FM, PS, PI, PH, PM, SI, SH, SM, IH, IM, HM | 15 |
| 3 Industry Stocks | FPS, FPI, FPH, FPM, FSI, FSH, FSM, FIH, FIM, FHM, PSI, PSH, PSM, PIH, PIM, PHM, SIH, SIM, SHM, IHM | 20 |
| 4 Industry Stocks | FPSI, FPSH, FPSM, FPIH, FPIM, FPHM, FSIH, FSIM, FSHM, FIHM, PSIH, PSIM, PSHM, PIHM, SIHM | 15 |
| 5 Industry Stocks | FPSIH, FPSIM, FPSHM, FPIHM, FSIHM, PSIHM | 6 |
| 6 Industry Stocks | FPSIHM | 1 |
| Total Combinations | | 63 |

**Legend: F = Financial, P = Property, S = Service, I = Industrial, H = Holding Forms, M = Mining and Oil*

***Table 5.*** *Different Portfolio Combinations*

For each combination considered, step two was repeated to calculate for the new optimal allocation to each stock included in the portfolio. Once accomplished, steps three and four were repeated to calculate the Jensen's Alpha, CAPM Beta, Treynor's Ratio, and Sharpe Ratio of each portfolio. An optimal portfolio was then identified for a portfolio containing one, two, three, four, five, and six industry stocks based on which combination yielded the lowest CAPM beta in each of the two time periods. This means that there were a total of twelve optimal portfolios obtained (6 optimal portfolios per time period x 2 time periods = 12 total optimal portfolios).

***Step 6: Calculating for Expected Shortfall***

Aside from the four metrics that have been calculated, the Expected Shortfall (ES) of the optimal portfolio was also acquired. This allows for further analysis on the potential trade-offs given that ES encapsulates the worst possible losses an investor could suffer from holding these specific stocks. With this in mind, the 1 percent ES was calculated to illustrate the worst possible scenario an investor could experience.

To solve for this metric, the team first calculated for the one 1 percent Value at Risk (VaR) of each stock by using the percentile function on its daily returns. Once accomplished, the ES was solved by using the "AVERAGEIF" function to calculate for the tail ends of the stock's returns. Each portfolio's ES was then calculated by multiplying the stocks' ES to their respective weights.

***Step 7: Calculating for the Composition of Systematic Risk***

Finally, the team also computed for the composition of the optimal portfolio's systematic risk over its entire risk using the following formula:

$$Portfolio\ Composition\ of\ Systematic\ Risk\ = \frac{\beta^2{}_P \sigma^2{}_M}{Var_P} \quad \textbf{(3)}$$

where $\beta^2_P$ = the squared CAPM beta of the portfolio, $\sigma^2_M$ = the variance of market , and $Var_P$ = the variance or the entire risk of the entire portfolio.

**Analysis**

After doing the aforementioned process to get the performance metrics for each combination of stocks (i.e., Jensen's Alpha, CAPM Beta, Treynor's Measure, and Sharpe Ratio), an investor will now be able to identify which is the most optimal portfolio. Afterward, we verify the results by looking into its validity in a market that is affected by great systematic risk, investigating further the strategy an investor should take, as well as the negative implications of the previous strategy.

***Identifying the Most Optimal Portfolio***

| **Industry Stock/s** | 1 | 2 | 3 | 4 | 5 | 6 |
|---|---|---|---|---|---|---|
| **Optimal Combination** | Property | Property, Mining and Oil | Property, Holding Firms, Mining and Oil | Service, Industrial, Holding Firms, Mining and Oil | Financial, Property, Industrial, Holding Firms, Mining and Oil | Financial, Property, Service, Industrial, Holding Firms, Mining and Oil |
| **Jensen's Alpha** | -0.05 | -0.002 | 0.02 | 0.06 | 0.01 | 0.04 |
| **CAPM Beta** | -1.64 | -0.51 | -0.11 | -0.17 | -0.17 | 1.11 |
| **Treynor's Ratio** | 0.01 | 0.05 | 0.22 | 0.14 | 0.14 | -0.02 |
| **Sharpe Ratio** | -0.02 | -0.10 | -0.13 | -0.19 | -0.12 | -0.20 |
| **Composition of Systematic Risk in Overall Risk of Portfolio** | 0.08% | 0.13% | 0.01% | 0.05% | 0.02% | 2.56% |

***Table 6.*** *Optimal Combinations of Industry Stocks with Pre-Pandemic Data*

The main objective of this paper is to be able to find which combination of industries will give the most optimal portfolio. Given that the focus is to hedge an investor against systematic risk, we define this to be the portfolio that comprises the smallest CAPM beta. With

the two time periods, Tables 6 and 7 present the various optimal portfolios for each type of combination (e.g., 1 Industry Stock, 2 Industry stocks, etc.) based on the computed CAPM Beta, as well as other respective performance metrics which will be discussed later on in the paper.

Focusing on the CAPM Beta, in terms of pre-pandemic data, the Property industry holds the smallest value of -1.64, which is also the most minimal out of all pre-pandemic data. This is followed by the 2 Industry Stocks with a CAPM Beta of -0.51 with the combination of the industries of Property and Mining and Oil, then a tie between 4 Industry Stocks (Service, Industrial, Holding Firms, Mining and Oil) and 5 Industry Stocks (Financial, Property, Industrial, Holding Firms, Mining and Oil) with a CAPM Beta of -0.17. The last two combinations are 3 Industry Stocks (Property, Holding Firms, Mining and Oil) and 6 Industry Stocks (Financial, Property, Service, Industrial, Holding Firms, Mining and Oil) with a higher CAPM Beta of -0.11 and 1.11, respectively.

| **Industry Stock** | 1 Industry Stock | 2 Industry Stocks | 3 Industry Stocks | 4 Industry Stocks | 5 Industry Stocks | 6 Industry Stocks |
|---|---|---|---|---|---|---|
| **Optimal Combination (based on the lowest Beta)** | Industrial | Industrial, Holding Firms | Property, Industrial, Holding Firms | Financial, Property, Industrial, Holding Firms | Financial, Service, Industrial, Holding Firms, Mining and Oil | Financial, Property, Service, Industrial, Holding Firms, Mining and Oil |
| **Jensen's Alpha** | -0.02 | -0.03 | 0.02 | 0.00 | 0.00 | 0.02 |
| **CAPM Beta** | -1.92 | -0.69 | -0.26 | -1.07 | 0.15 | 0.01 |
| **Treynor's Ratio** | -0.00 | -0.00 | -0.01 | -0.00 | 0.01 | 0.11 |
| **Sharpe Ratio** | 0.00 | 0.002 | 0.00 | 0.00 | 0.02 | 0.01 |
| **Composition of Systematic Risk in Overall Risk of Portfolio** | 0.18% | 0.06% | 0.02% | 0.34% | 0.22% | 0.00% |

***Table 7.*** *Optimal Combinations of Industry Stocks with Post-Pandemic Data*

Moving onto the data acquired for the post-pandemic time period, the 1 Industry Stock of the Industrial industry holds the smallest CAPM Beta of -1.92. The 4 Industry Stocks combination (Financial, Property, Industrial, Holding Firms) follows this with a CAPM Beta of -1.07. The third and fourth on the list are 2 Industry Stocks (Industrial, Holding Firms) and 3 Industry Stocks (Property, Industrial, Holding Firms) with CAPM Betas of -0.69 and -0.26, respectively. The final two are the 6 Industry Stocks (Financial, Property, Service, Industrial, Holding Firms, Mining and Oil) and 5 Industry Stocks (Financial, Service, Industrial, Holding Firms, Mining and Oil) with positive CAPM Betas of 0.01 and 0.16, respectively. Out of all of these CAPM Betas, the most optimal portfolio can be identified to be the Industrial industry of post-pandemic data.

**Verification of Results During the Russian-Ukraine War.** In order to verify that a portfolio holding one industry stock, specifically the Industrial industry stock, could hedge an investor against systematic risk, the group analyzed the performance of this portfolio in a different market crisis from the COVID-19 pandemic. Fortunately, the current dataset also encapsulated the time period of the Russian-Ukraine war, which is another recent issue that has affected the financial market on a global scale. Given that the war made its most significant impact on the Philippine economy in March of 2022, the performance of the optimal portfolio was tested in this specific time period. (Department of Finance, 2022). With this said, the group calculated for the rolling beta of the optimal portfolio during March 2022. This essentially means that for each day in the month of March 2022, the CAPM beta of the optimal portfolio was obtained over a year's worth of data. For instance, the rolling beta of March 01, 2022 was obtained by performing CAPM regression on the portfolio from March 01, 2021 up until March 01, 2022. The rolling beta of March 02, 2022 was then obtained by performing CAPM regression on the portfolio from March 02, 2021 up until Match 02, 2022. The same process was conducted until all days in the month of March were completed.

| | URC | JFC | MER | |
|---|---|---|---|---|
| **Weight** | -1319% | 3429% | -2010% | |
| **Date** | **Beta** | | | **Portfolio Beta** |
| March 01, 2022 | 0.13 | 0.04 | 0.05 | -1.28 |
| March 02, 2022 | 0.13 | 0.04 | 0.05 | -1.22 |
| March 03, 2022 | 0.14 | 0.05 | 0.05 | -1.21 |
| March 04, 2022 | 0.13 | 0.05 | 0.05 | -1.19 |
| March 05, 2022 | 0.13 | 0.05 | 0.05 | -1.16 |
| March 07, 2022 | 0.13 | 0.05 | 0.05 | -1.16 |
| March 08, 2022 | 0.14 | 0.04 | 0.05 | -1.63 |
| March 09, 2022 | 0.14 | 0.03 | 0.05 | -1.69 |
| March 10, 2022 | 0.14 | 0.03 | 0.05 | -1.76 |
| March 11, 2022 | 0.14 | 0.03 | 0.05 | -1.35 |
| March 12, 2022 | 0.14 | 0.05 | 0.06 | -1.37 |
| March 14, 2022 | 0.16 | 0.06 | 0.06 | -1.35 |
| March 15, 2022 | 0.15 | 0.06 | 0.06 | -1.32 |
| March 16, 2022 | 0.17 | 0.06 | 0.07 | -1.44 |
| March 17, 2022 | 0.17 | 0.06 | 0.07 | -1.46 |
| March 18, 2022 | 0.17 | 0.06 | 0.06 | -1.46 |
| March 21, 2022 | 0.17 | 0.06 | 0.06 | -1.41 |
| March 22, 2022 | 0.18 | 0.06 | 0.07 | -1.86 |
| March 23, 2022 | 0.17 | 0.06 | 0.06 | -1.41 |
| March 24, 2022 | 0.19 | 0.07 | 0.07 | -1.68 |
| March 25, 2022 | 0.18 | 0.07 | 0.08 | -1.59 |
| March 28, 2022 | 0.18 | 0.07 | 0.07 | -1.58 |
| March 29, 2022 | 0.18 | 0.07 | 0.08 | -1.54 |
| March 30, 2022 | 0.18 | 0.07 | 0.08 | -1.59 |
| March 31, 2022 | 0.18 | 0.07 | 0.08 | -1.64 |

***Table 8.*** *Rolling CAPM Betas of the Industrial Industry*

Table 8 illustrates the data acquired from the aforementioned procedure. At the very least, having a CAPM beta lower than one would have verified that the strategy suggested by the study does hedge an investor against the systematic risk brought about by the Russian-Ukraine war. However, given that all rolling betas for the month of March were observed to be

less than negative one, it can be said that the results definitely confirm that the optimal portfolio suggested by the study does protect an investor against the potential risks of a market crash.

**Comparison of Portfolios: a Portfolio with the Highest Market Capitalization Stocks and a Portfolio with the Entire Industrial Sector.** From the results of the study, it has been established that a portfolio holding only the Industrial industry stock is most optimal in terms of minimizing systematic risk with a CAPM Beta of -1.92. It must be noted, however, that this portfolio only contains the top three highest market capitalization stocks in the sector. With this said, it is also worthwhile to investigate whether the minimization of systematic risk is attributable to the Industrial sector as a whole, or to these three stocks specifically. This is because an investor might comprehend the results of the study as a signal to start investing in all stocks of this particular industry as a whole.

| Stock | Weight | Individual Beta |
|---|---|---|
| ACEN | 7.98% | 4.48% |
| ANI | 0.49% | -3.04% |
| AP | 7.32% | 14.02% |
| AXLM | 0.44% | -4.05% |
| CHP | 0.27% | -0.35% |
| CNPF | 3.90% | 0.74% |
| DNL | 2.32% | 0.77% |
| EEI | 0.19% | 2.71% |
| EMI | 6.85% | 5.46% |
| FPH | 1.74% | 1.06% |
| FRUIT | 0.13% | 2.59% |
| GSMI | 1.06% | 1.16% |
| IMI | 0.50% | 5.70% |
| JFC | 16.27% | 1.32% |
| MAXS | 0.20% | 6.12% |
| MER | 11.98% | 12.57% |
| MONDE | 11.84% | 4.45% |
| MWC | 2.89% | -3.30% |
| MWIDE | 0.31% | 6.33% |
| PCOR | 0.86% | -2.11% |

| | | |
|---|---|---|
| PHN | 0.18% | -2.30% |
| PIZZA | 0.42% | 4.52% |
| RCI | 0.07% | -2.01% |
| SGP | 1.98% | -12.40% |
| SHLPH | 0.92% | 3.06% |
| TECH | 0.18% | 6.89% |
| URC | 18.67% | 4.07% |
| VITA | 0.07% | 10.59% |
| Portfolio Beta | | 0.05 |

***Table 9.*** *Post-Pandemic CAPM Betas of the Industrial Industry*

To answer this query, the group compared how the original optimal portfolio would perform against a portfolio holding all twenty-eight stocks in the industrial sector as a whole. CAPM regression was performed on the latter portfolio over the post-pandemic time period. From this, Table 9 illustrates the individual CAPM betas of each stock within the Industrial sector, and these were multiplied to their respective weights in order to get the entire portfolio's CAPM Beta. It must be noted that the allocation of each stock in this new Industrial sector portfolio was obtained based on the percentage of its market capitalization over the entire industry's market capitalization to be on par with the study's strategy of choosing the top three highest market capitalization stocks. Based on this, it can be seen that a portfolio holding the Industrial sector stocks as a whole holds a CAPM beta of approximately 0.05. Though this does still suggest that such a portfolio is able to hedge an investor against systematic risk due to the fact that the value obtained is less than one, there is still more merit to investing only in the stocks with the top three highest market capitalization as it would have a CAPM Beta of -1.92.

***Minimum Beta Strategy Trade-offs***

It must be noted that an investor who proceeds with the strategy of minimizing beta (i.e., minimizing systematic risk) comes with noteworthy tradeoffs. To illustrate this, the last portion of the study will compare the Jensen's Alpha, Treynor's Ratio, Sharpe Ratio, Expected

Shortfall, and systematic risk composition of the aforementioned optimal portfolio in terms of minimizing beta with other possible portfolios. Given that the optimal portfolio identified is one which holds one industry stock, specifically the industrial sector in the post-pandemic setting, this portion will focus on other possible portfolios which hold one industry stock within the same time period. Doing so also allows for a more comprehensive view of the industry stocks' more recent performance.

| Industry Stock | Beta Value | Jensen's Alpha |
|---|---|---|
| Financial | 0.99 | 0.04 |
| Property | 1.59 | 0.05 |
| Service | 3.44 | 0.08 |
| Industrial | -1.92 | -0.02 |
| Holding Firms | 1.78 | 0.06 |
| Mining & Oil | -0.15 | 0.02 |

***Table 10.*** *Industry Stocks and their Corresponding Beta Values and Jensen's Alpha values*

**Jensen's Alpha.** Jensen's Alpha is a risk-adjusted performance measure that shows the abnormal returns that one incurs in relation to the returns predicted by the capital asset pricing model. Having a positive alpha in a portfolio indicates that an investor is gaining excess returns in comparison to the expected returns of said portfolio. A negative alpha refers to the opposite, meaning that the investor is experiencing excess losses. Thus, investors focused on earning excess returns will naturally seek to form a portfolio that tries to maximize this alpha. Given this, these investors will not be favorable to the identified optimal Industrial stock as out of the industry stocks analyzed, the Industrial stock is the only one featuring a negative alpha.

Despite having the lowest systematic risk by a considerable margin, its alpha value suggests that the stock is underperforming in terms of returns given that it is lower than the expected returns of the market. Noticeably, it can be observed that there is a positive correlation

between an industry stock's beta and its Jensen's Alpha. This can be seen in the fact that following the Industrial stock, the Mining and Oil stock which has the second smallest beta (-0.15) also has the second smallest alpha (0.02). The opposite can be seen with the Service stock as it has the largest beta (3.44) while also having the largest alpha (0.08). With this observation, it can be stated that should an investor take a similar approach to this study, although they will be able to hedge themselves against the effects of a market crash, they will not be able to maximize abnormal returns.

| Industry Stock | Beta Value | Treynor's Ratio |
|---|---|---|
| Financial | 0.99 | 0.14% |
| Property | 1.59 | 0.09% |
| Service | 3.44 | 0.04% |
| Industrial | -1.92 | -0.07% |
| Holding Firms | 1.78 | 0.08% |
| Mining & Oil | -0.15 | -0.91% |

***Table 11.*** *Industry Stocks and their Corresponding Beta Values and Treynor's Ratio*

**Treynor's Ratio.** Treynor's Ratio refers to an investment's risk-adjusted return when a portfolio is assumed to be diversified and it is obtained by dividing said portfolio's excess returns by the portfolio's beta. Again, with this ratio, it can be observed that selecting a stock portfolio based on the lowest beta has its disadvantages. If an investor were to assume that these industry stocks are diversified, given the fact that they contain the three most lucrative stocks in their respective industries, then they would find that the two industry portfolios with the lowest beta are also those with negative risk-adjusted returns. Looking at the table above, if an investor were primarily interested in the Treynor's ratio of a portfolio, they would select to invest in the financial industry as it has the highest Treynor ratio out of the six industries while also having a beta value less than one. Although there is no observable correlation

between the beta of an industry stock and its Treynor Ratio, it can be stated that seeking to minimize the beta of a portfolio using a similar approach as this study may come at the cost of having negative risk-adjusted returns.

| Industry Stock | Beta Value | Sharpe Ratio |
|---|---|---|
| Financial | 0.99 | 0.16% |
| Property | 1.59 | 0.08% |
| Service | 3.44 | 0.21% |
| Industrial | -1.92 | 0.16% |
| Holding Firms | 1.78 | 0.14% |
| Mining & Oil | -0.15 | 0.18% |

***Table 12.*** *Industry Stocks and their Corresponding Beta Values and Sharpe Ratio*

**Sharpe Ratio.** The Sharpe Ratio is similar to Treynor's Ratio in the sense that they are both indicators of risk-adjusted returns. The difference between these two ratios is that the Sharpe ratio is used in examining undiversified portfolios as its ratio comes from dividing excess returns by the standard deviation of a portfolio. If an investor were to assume that these portfolios are undiversified then the aforementioned identified optimal Industrial stock would have positive risk-adjusted returns. Although this stock may not have the highest returns as the Service stock has the highest Sharpe ratio with approximately 0.002, the significantly lower systematic risk of the Industrial stock in addition to its positive Sharpe Ratio allows it to be both a lucrative and feasible investment. Another stock of this nature would also be the Mining & Oil stock as it has the second highest Sharpe ratio while also having the second lowest beta value. The Property stock and the Holding Firms stock have the lowest Sharpe ratios as well as having considerably high beta values meaning that these stocks underperform in relation to the other industry stocks. Given these observations, the Sharpe ratio shows that investing in

industry stocks with a negative beta to hedge against the effects of market crashes can still allow an investor to earn positive abnormal returns.

| Industry Stock | Beta Value | Expected Shortfall |
|---|---|---|
| Financial | 0.99 | -45.84% |
| Property | 1.59 | -261.61% |
| Service | 3.44 | -28.20% |
| Industrial | -1.92 | -124.14% |
| Holding Firms | 1.78 | -40.58% |
| Mining & Oil | -0.15 | -11.83% |

***Table 13.*** *Industry Stocks and their Corresponding Beta Values and Expected Shortfall*

**Expected Shortfall.** Expected Shortfall is a risk measure that shows the expected loss of a portfolio conditional on if its value at risk (VaR) has been violated. It gives the average of returns in the distribution of the portfolio that are worse than the VaR, showing the extreme losses an investor can incur based on the selected confidence level (the values above have a 99% confidence level). Looking at the table, it can be seen that investing in an industry stock will not result in a lower expected shortfall. Despite the low systematic risk, the Industrial stock is still susceptible to high extreme losses as seen by the fact that it has the second worst expected shortfall percentage. Although there is only a 1% chance for this to occur on each day, the possible incurable losses are still significantly lower than that of other industry stocks as within the remaining 99% probability, it can incur losses between -124.14% and 0%. It can be observed that the Mining & Oil stock is better with regards to expected shortfall as it has both the lowest extreme losses while still having a negative beta value. Seeing as the identified optimal Industrial stock, although allowing investors to best hedge against systematic risk, can still incur significant losses in extreme situations, investors will have to be wise in weighing out the benefits and drawbacks if they are to use the same approach as the study.

| Industry Stock | Beta Value | Composition of Systematic Risk in Overall Risk of Portfolio |
|---|---|---|
| Financial | 0.99 | 0.05% |
| Property | 1.59 | 0.03% |
| Service | 3.44 | 1.03% |
| Industrial | -1.92 | 0.18% |
| Holding Firms | 1.78 | 0.13% |
| Mining & Oil | -0.15 | 0.00% |

***Table 14.*** *Industry Stocks and their Corresponding Beta Values and Composition of Systematic Risk*

**Composition of Systematic Risk in Overall Risk of Portfolio.** This metric shows the percentage of systematic risk present in a portfolio with the remaining percentage being attributed to idiosyncratic risk. For this metric, it is good to have a low percentage as systematic risk, unlike idiosyncratic risk, cannot be diversified away. Although there is no clear observable trend as to the correlation between an industry portfolio's beta in relation to the composition of systematic risk in the overall risk of the portfolio, it can be seen that having the lowest beta does not translate to having the least amount of systematic risk in the portfolio. This is evidenced by the fact that the Industrial stock has the second-highest composition out of all the stocks present. Overall, however, it can be seen that this study's approach in creating industry stocks will result in a considerably low percentage of systematic risk with the highest only being 1.03%, making this attractive to investors as it will allow them to hedge against the general macroeconomic movement.

## Conclusion

Overall, this study finds that investing in different industries using the industry stock methodology will not result in a lower beta as evidenced by the findings in *Table 7* which

shows that the Industrial stock on its own has the lowest beta out of the different portfolio permutations. The study also finds that there are considerable tradeoffs that come with opting to use a strategy that seeks to minimize the beta when investing in industry stocks as other relevant and widely-used metrics such as the Jensen's Alpha, Treynor's Ratio, Sharpe Ratio, Expected Shortfall, and Composition of Systematic Risk in Overall Risk of Portfolio will not always produce the best outcomes for the portfolio with the lowest beta value. This calls for investors to take caution when it comes to creating a portfolio with these industry stocks as there is no clear superior stock out of the available six. Instead, investors will need to discern, deciding as to whether or not being able to hedge against systematic risk is worth the risks of having possible negative risk-adjusted returns and extreme losses relative to those of other industry stocks.

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