

BUILDING A “BEAR-PROOF” PORTFOLIO

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I. Introduction

2022 has certainly been a rough year for investors. To illustrate, the PSEi declined by as much as 19% this year, while the Dow Jones Industrial Average, S&P 500, and Nasdaq Indices have all fallen up to more than 20% within the year. This is what investors refer to as a *bear market*—wherein stock prices (generally represented by the indices mentioned above) experience large, prolonged declines due to a number of different factors such as high interest rates or inflation. It is important to note however that despite the grim outlook of the stock market this year, **this is not the first time it has happened**. In fact, between 1947 to 2022 alone, there have already been **14 different bear markets** in the US (Kolakowski, 2022).

If the history of the stock market has taught investors anything, it is that **stocks move in cycles**, and that **history tends to repeat itself**. That said, studying past bear markets may help investors today protect their portfolios and even outperform the index. The focus of this research is to create a portfolio of equities that is proven to be resilient to market downturns, and also performs well after a bear market. The study defines a “resilient” portfolio as one that can outperform key indices by a certain percentage **during and after bear markets**. Note that the study will be focusing on the Philippine stock market for this project. The bear markets that the study analyzes are the 2008 financial crisis, the 2018 “Taper tantrums”, and the most recent COVID 19 market crash. The decision was made to not use the Asian Financial Crisis (~1998) and the Political Crisis/Tech bubble (~2000 - 2001) bear markets due to the limited amount of data and Philippine stocks for that time period.



II. Data Source

The study involved the collection of historical stock price data from different sources, namely: Yahoo Finance, Investing.com, and Wall Street Journal. Stock prices were collected from October 1, 2007 (selected to include the bear market of late 2007 as part of the study) to November 18, 2022 (the most updated set of data at the time of writing). The prices used were the closing prices of each day.

III. Methodology

Absolute Performance

This section of the project attempts to create a portfolio that will produce the highest possible return by investing in specific stocks and sectors. For the purposes of the study, a constraint has been set such that no more than 30% of the total portfolio value can be allocated to a single stock or sector in order to reduce concentration risk.

Stock selection

The research looked to select a list of stocks that historically has proved to be resilient during market downturns and also outperforms during subsequent bull runs. The first criteria that the study used in choosing the stocks was outperformance over the PSEi during bear markets. Outperformance is defined as if the stock produced a greater return over the PSEi during the time period of a bear market (from peak to trough). The second criteria is outperformance after a bear market. The time “after” a bear market is the time period after the trough of a bear market that is equal to the length of the entire cycle. For example, the 2008 financial crisis took a total of 13 months from peak to trough. “After” the 2008 financial crisis would be 13 months after the bear market’s trough. The third criteria that is subsequent to the first two is for the stock to outperform the PSEi after a bear market by at least 10% while underperforming during a bear market by less than 10%. For example, ICT outperformed the PSEi after the bear market by 13.3%, despite underperforming during the bear market by 0.06%. Therefore ICT will be selected for the portfolio. Even if the stock did not perform better than the PSEi during a bear market, the excess return that it gives after will make up for the excess risk that an investor will take on by holding onto the stock during a bear (the underperformance during will be less than 10% only). Note that outperformance does not mean that the stock produced a positive return during that time. In fact, none of the stocks in the list produced a positive return during a bear market. The rationale behind these criteria is the goal to select the strongest stocks that will not only provide protection during bear markets, but also generate alpha after.

The research first got the absolute returns of the different stocks during and after the selected bear markets, as well as the return of the PSEi during those time periods. The outperformance level of the different stocks were taken by getting the difference between the return of the stock and the return of the PSEi during the period. For example, SM returned -58.06% during the 2008 financial crisis, vs. the PSEi’s return of -55.76%, meaning that SM underperformed by 2.31% during that bear market. Then, each of the stock’s returns throughout the three identified

bear market periods were averaged and listed down. Three different lists were created to rank the stocks in terms of total average return, outperformance during a bear, and outperformance after a bear. ACEN ranked first in all the categories, but it was not included in the list since it was only included in the PSEi in 2021 and its excess returns were brought about by speculation. The criteria mentioned above was then applied to determine the final list of stocks that will be included in the portfolio.

Rank	Avg. Return	Ticker
1	103.00%	ACEN
2	46.46%	SCC
3	17.17%	AGI
4	16.09%	LTG
5	11.76%	RLC
6	7.89%	ICT
7	6.74%	AP
8	6.52%	URC
9	4.65%	SM
10	3.69%	ALI
11	3.18%	WLCON
12	2.25%	TEL
13	1.85%	AC
14	1.15%	PGOLD
15	-2.04%	SMC
16	-2.87%	MEG
17	-3.01%	BPI
18	-3.47%	SMPH
19	-3.58%	MPI
20	-3.81%	MBT
21	-3.89%	GLO
22	-5.39%	JFC
23	-6.39%	MER
24	-7.15%	JGS
25	-8.19%	RRHI

26	-9.31%	AEV
27	-9.32%	BDO
28	-21.04%	GTCAP

Rank	Performance During Bear Market	Ticker
1	35.41%	ACEN
2	22.93%	GLO
3	18.79%	TEL
4	18.29%	SCC
5	16.96%	PGOLD
6	15.13%	MER
7	14.71%	WLCON
8	14.27%	AP
9	9.10%	URC
10	8.20%	BDO
11	7.50%	SMPH
12	6.36%	BPI
13	6.25%	MPI
14	3.88%	JFC
15	3.00%	SM
16	2.77%	JGS
17	-0.06%	ICT
18	-1.01%	ALI
19	-1.43%	MBT
20	-2.46%	RRHI
21	-3.57%	GTCAP
22	-4.13%	AEV
23	-8.91%	AC
24	-10.98%	MEG
25	-11.46%	SMC
26	-13.70%	RLC

27	-14.52%	AGI
28	-14.55%	LTG

Rank	Performance After Bear Market	Ticker
1	178.94%	ACEN
2	72.11%	SCC
3	55.07%	LTG
4	46.34%	AGI
5	34.70%	RLC
6	15.71%	SMC
7	13.30%	ICT
8	10.09%	AC
9	5.85%	ALI
10	3.76%	SM
11	2.70%	MEG
12	1.41%	URC
13	0.00%	WLCON
14	-3.32%	AP
15	-5.07%	MPI
16	-5.57%	RRHI
17	-6.15%	AEV
18	-6.31%	PGOLD
19	-8.72%	MBT
20	-8.73%	JGS
21	-14.92%	BPI
22	-16.82%	TEL
23	-16.98%	SMPH
24	-17.20%	JFC
25	-19.56%	MER
26	-29.37%	BDO
27	-30.16%	GTCAP

28	-33.23%	GLO
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Creation of sector indices

Aside from choosing specific stocks to include in a portfolio, the study also looked to create another portfolio that will contain entire sectors instead of specific stocks. The idea behind this is to decrease the risk taken by purchasing individual stocks vs. diversifying and purchasing entire sectors. In other words, for banking, the sector portfolio will purchase BDO, BPI, and MBT to diversify instead of just purchasing BDO.

To determine how a sector can be represented, the decision was made to create “sector indices” that contain the stocks inside different sectors. To do this, the market capitalization of each stock was first determined. This was taken by multiplying the outstanding shares of each company (from PSE Edge) by its closing price on November 18, 2022. The stocks are then weighted in the indices by their market capitalization.

Example:

Stock	Market Cap.	Weight
BDO	587,816,335,876	46.89%
BPI	440,030,004,863	35.10%
MBT	225,770,260,861	18.01%
Total Banking Sector	1,253,616,601,599	100%

Based on the table above, if the portfolio invests in the banking sector, the portfolio will have a ~47% weight in BDO, ~35% in BPI, and ~18% in MBT. So if the portfolio has a 30% weight in the banking sector, the weights in the individual stocks will be 30%*the weight of the stock in the sector. The respective weights for each stock in each sector are listed below:

Stock	Weight	Sector
SM	39.73%	Conglomerate
AC	15.59%	Conglomerate
JGS	12.78%	Conglomerate
AGI	3.39%	Conglomerate
AEV	12.09%	Conglomerate
GTCAP	3.53%	Conglomerate

LTG	3.76%	Conglomerate
SMC	8.82%	Conglomerate
MPI	0.31%	Conglomerate
BDO	46.89%	Banking
BPI	35.10%	Banking
MBT	18.01%	Banking
PGOLD	31.71%	Retail
WLCON	40.36%	Retail
RRHI	27.93%	Retail
TEL	51.76%	Telco
GLO	48.24%	Telco
JFC	48.45%	F&B
URC	51.55%	F&B
AP	28.52%	Power
MER	39.44%	Power
ACEN	32.03%	Power
ICT	100.00%	Transportation
SMPH	63.18%	Property
ALI	27.06%	Property
MEG	4.42%	Property
RLC	5.34%	Property
SCC	100.00%	Mining

To get the expected returns of each sector, the research first collated the average returns of each of the stocks inside each sector (using the methods listed under “stock selection”). The sumproduct of these returns and the stocks’ respective weights in their sectors is then the expected return of the sector.

Optimal Portfolio Using Mean-Variance Optimization and Portfolio Frontier

Aside from creating a portfolio that will produce greater absolute returns over the market in difficult conditions, the study also wants to find the optimal allocations to several stocks that will have a good risk-adjusted return over the market. To accomplish this, the study will use the Mean-Variance optimization method and the portfolio frontier to create an optimal portfolio of

stocks that will shield an investor from the bear market. The stock selection strategy is more relaxed in this scenario to allow for a larger portfolio and more diversification. The decision was made to include stocks that outperformed the index during the bear market. After screening, 15 stocks were included: GLO, TEL, SCC, PGOLD, MER, WLCON, AP, URC, BDO, SMPH, BPI, MPI, JFC, SM, and JGS. On average, these stocks beat the PSEi by 11.21% during bear markets.

The Mean-Variance Optimization and Portfolio Frontier allows the research to identify a portfolio of stocks that will provide minimum variance given an expected target return. In other words, it is a method to craft a portfolio that is optimized to provide the least amount of volatility (or risk) to achieve a target return.

Mean-Variance Optimization was done through the use of Excel. The first step is to organize the dataset of the returns, aligned across a period of time in a table (rows = dates, columns = returns per stock). From this, expected returns per stock can be calculated by averaging the returns per column. This will allow us to generate the portfolio frontier, which visualizes the optimal level of expected returns given the standard deviation—the risk of each portfolio. Afterwards, the expected returns, variances, correlation, and covariances will be calculated given a percent allocation between the different stocks in the portfolio. This allocation would then be the objective to be optimized, wherein given the expected return E of a portfolio, the objective would be to minimize the variance $Var R$ through finding the optimal allocation of stocks. Given that this optimization is done in the context of a bear market, it adds importance to the need to minimize variance for assured returns despite the market situation, and at the same time also assumes that there are no riskless assets in this scenario.

A Portfolio Frontier is then created to display the different scenarios of weight allocations for the different stocks with varying expected returns and variances. Excel solver was utilized with set parameters on how the weights would be allocated to the 15 stocks. The excel solver was set to minimize the variance of the portfolio by changing the weights to reach the expected return values arbitrarily indicated. The first parameter was to ensure that no stock would be given 30% or higher allocation to ensure that the portfolio would not be heavily reliant on one outperforming stock or industry. The second parameter ensured that a stock would not be given a negative allocation since there is no short selling in the Philippines. The third parameter was that the sum of the allocated weights for all stocks should be equal to one since they are all part of a portfolio.

After the Excel solver, a graph that represents the standard deviation of the different portfolios against their expected returns. From this graph, it is possible to visualize the Portfolio Frontier and compare the different portfolio allocations to the expected returns and standard deviation of the PSEi.

IV. Results & Discussion

Absolute Performance

After going through the methodology above under “stock selection”, a list of 5 stocks that can be included in the portfolio was identified. These stocks are SM, AC, URC, ICT, and SCC.

Stock	Avg. Return	Performance During Bear	Performance After Bear
SM	4.65%	3%	3.76%
AC	1.85%	-8.91%	10.09%
ICT	7.89%	-0.06%	13.30%
URC	6.52%	9.10%	1.41%
SCC	46.46%	18.29%	72.11%

Given these 5 stocks’ average total returns during and after bear markets, the study used Excel Solver to determine the weights that should theoretically be allocated to each stock to achieve the highest possible return. To beat the average yearly return of the PSEi (10.72%), the portfolio must have a 10% weight in SM, and 30% weighting each in URC, ICT, and SCC. This will produce an expected return of 18.73%.

Ticker	SM	AC	URC	ICT	SCC	
Avg Return	4.7%	1.85%	7.89%	6.52%	46.46%	
Weight	10.0%	0.0%	30.0%	30.0%	30.0%	100.0%
PSEi Avg. Yearly Return 10.72%						
Expected Return 18.7%						

The study also looked to create a portfolio that will invest in specific sectors in order to increase diversification. After going through the methodology mentioned above, the study was able to get a portfolio of 4 sectors that will produce a return greater than the PSEi. These 5 sectors identified are Conglomerates, Power, Transportation, F&B, and Mining.

Sector	Expected Return
Conglomerate	0.35%
Banking	-6.11%
Retail	-0.64%
Telco	-0.71%
F&B	0.75%
Power	32.40%
Transportation	7.89%

Property	-0.70%
Mining	46.46%

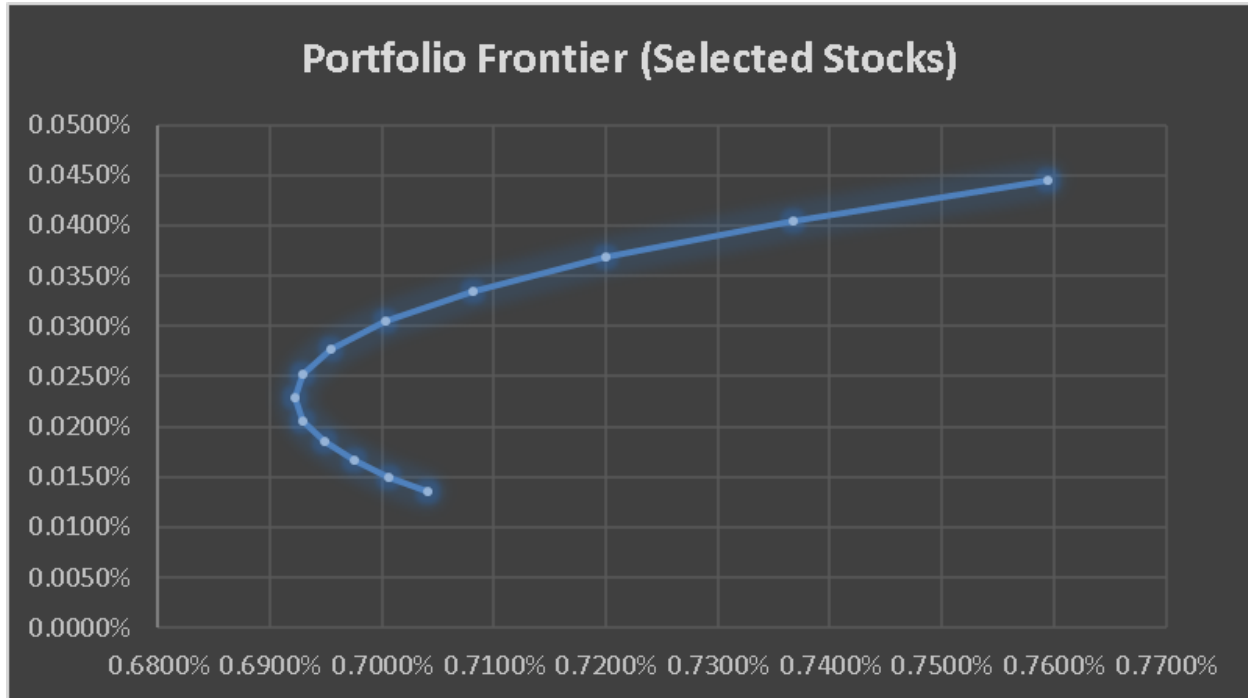
The following weights were determined using Excel Solver analysis: 0% Conglomerates, 10% F&B, 30% Power, 30% Transportation, and 30% in Mining. This portfolio produces an expected return of 26.10%.

Ticker	Conglomerate	F&B	Power	Transportation	Mining	Total Weight
Avg Return	0.4%	0.75%	32.40%	7.89%	46.46%	
Weight	0.0%	10.0%	30.0%	30.0%	30.0%	100.0%
PSEi Avg. Yearly Return 10.72%						
Expected Return 26.1%						

Looking at the historical performance of the stocks, it is noticeable that the strong sectors during a market downturn are mining, transportation, and power. Conglomerates and F&B sectors produce positive returns but are only less than 1%. Logically, the 5 sectors could be resilient to bear markets because of the nature of the businesses within them. Whatever the economic condition of the country and the world, Filipinos will continue to pay for their electricity bills and spend on consumer goods, especially food. Given the data, the study can also conclude as a general statement that companies within these sectors can be good places to preserve capital during a bear market.

Relative Performance

After inputting the data into the methodology prescribed above, the following portfolio frontier was created with the different expected returns and standard deviations.

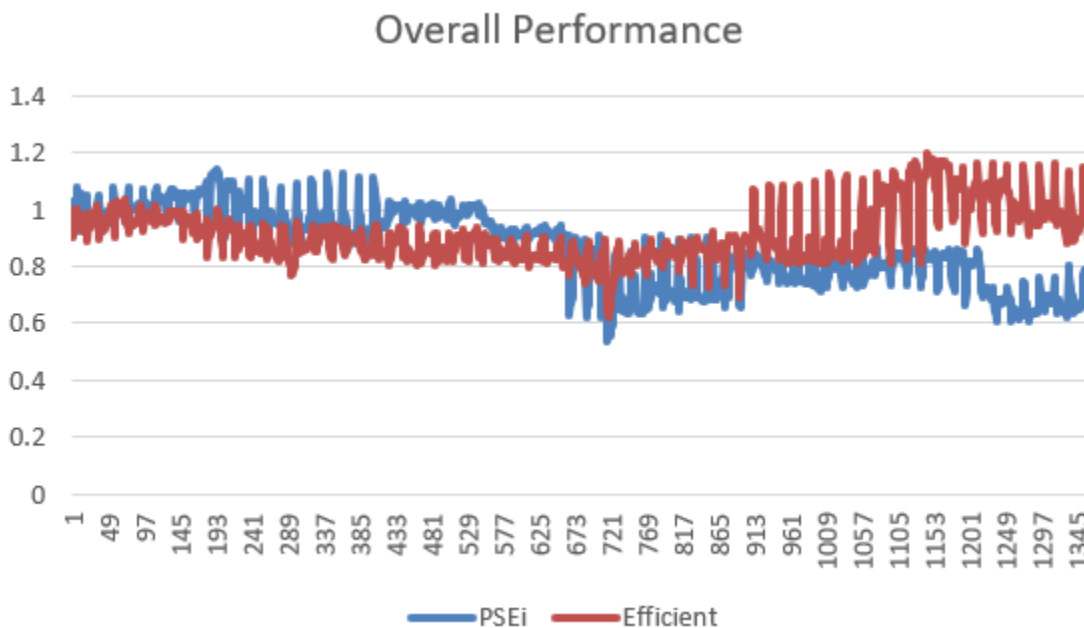


From the frontier above, the optimum portfolio has the minimum standard deviation of 0.06923% with an expected daily return of 0.0229%. This portfolio consists of 7.2998% allocated in SM, 0% allocated in JGS, 1.9650% allocated in MPI, 6.4982% allocated in BDO, 6.8001% allocated in BPI, 12.9174% allocated in PGOLD, 7.2045% allocated in WLCON, 13.1064% allocated in TEL, 5.1482% allocated in GLO, 5.4288% allocated in JFC, 8.9972% allocated in URC, 6.1511% allocated in AP, 9.9804% allocated in MER, 2.5823% allocated in SMPH, and 5.9296% allocated in SCC.

Expected Return	0.0135%	0.0150%	0.0167%	0.0185%	0.0206%	0.0229%	0.0252%	0.0277%	0.0304%	0.0335%	0.0368%	0.0405%	0.0446%	0.0490%	0.0539%	0.0593%	0.0653%
Portfolio Variance	0.0050%	0.0049%	0.0049%	0.0048%	0.0048%	0.0048%	0.0048%	0.0048%	0.0049%	0.0050%	0.0052%	0.0054%	0.0058%	0.0062%	0.0068%	0.0077%	0.0091%
Portfolio Standard Deviation	0.7041%	0.7007%	0.6975%	0.6949%	0.6930%	0.6923%	0.6930%	0.6955%	0.7003%	0.7081%	0.7200%	0.7367%	0.7594%	0.7891%	0.8269%	0.8747%	0.9543%
SM	6.4076%	6.6467%	6.7627%	7.0003%	7.1618%	7.2998%	7.4333%	7.5766%	7.7367%	7.7588%	7.7583%	7.7629%	7.7712%	7.7355%	7.5283%	7.0402%	7.4452%
JGS	1.0628%	0.7798%	0.5261%	0.1541%	0.0000%	0.0000%	0.0000%	0.0000%	0.0000%	0.0000%	0.0000%	0.0000%	0.0000%	0.0000%	0.0000%	0.0000%	0.0000%
MPI	4.0884%	3.7525%	3.3809%	3.0092%	2.5327%	1.9650%	1.3978%	0.7740%	0.0864%	0.0000%	0.0000%	0.0000%	0.0000%	0.0000%	0.0000%	0.0000%	0.0000%
BDO	6.2841%	6.3234%	6.3606%	6.3974%	6.4400%	6.4892%	6.5368%	6.5854%	6.6396%	6.6386%	6.6237%	6.6153%	6.5922%	6.5951%	6.4439%	6.2475%	4.8750%
BPI	8.3160%	8.1447%	7.8626%	7.5942%	7.2377%	6.8001%	6.3661%	5.8879%	5.3650%	4.5537%	3.6593%	2.6745%	1.5736%	0.4106%	0.0000%	0.0000%	0.0000%
PGOLD	14.3043%	14.1047%	13.8520%	13.5870%	13.2743%	12.9174%	12.5609%	12.1677%	11.7350%	11.1856%	10.5641%	9.8839%	9.1360%	8.3334%	7.2622%	5.8790%	0.0000%
WLCON	2.1496%	2.9612%	3.8309%	4.8132%	5.9333%	7.2045%	8.4740%	9.8702%	11.4069%	13.2363%	15.2673%	17.5012%	19.9615%	22.6663%	25.7090%	29.2626%	30.0000%
TEL	13.3889%	13.3471%	13.3016%	13.2533%	13.1879%	13.1064%	13.0256%	12.9385%	12.8411%	12.7051%	12.5632%	12.3937%	12.2129%	12.0071%	11.7897%	11.4285%	9.5464%
GLO	4.7359%	4.8097%	4.8936%	4.9444%	5.0434%	5.1482%	5.2656%	5.3897%	5.5241%	5.6644%	5.8147%	5.9763%	6.1745%	6.3559%	6.5803%	6.6650%	7.5337%
JFC	5.3670%	5.3811%	5.3925%	5.4243%	5.4338%	5.4288%	5.4211%	5.4189%	5.4074%	5.4013%	5.3949%	5.3996%	5.3816%	5.3435%	5.3229%	5.0735%	4.9017%
URC	10.5406%	10.3003%	10.0325%	9.7365%	9.3912%	8.9972%	8.6027%	8.1704%	7.6949%	7.1168%	6.4697%	5.7562%	4.9791%	4.0918%	3.1273%	1.8570%	0.0000%
AP	7.4672%	7.2616%	7.0366%	6.7856%	6.4867%	6.1511%	5.8093%	5.4308%	5.0213%	4.4659%	3.8213%	3.1131%	2.3461%	1.4950%	0.3742%	0.0000%	0.0000%
MER	8.7094%	8.9232%	9.1162%	9.3626%	9.6441%	9.9804%	10.3134%	10.6795%	11.0862%	11.5371%	12.0526%	12.6172%	13.2311%	13.9686%	14.7273%	15.4404%	20.5661%
SMPH	0.8870%	1.0447%	1.4942%	1.8468%	2.2184%	2.5823%	2.9509%	3.3590%	3.8092%	4.2425%	4.6875%	5.1734%	5.7163%	6.3085%	6.7341%	7.1170%	13.8915%
SCC	6.2910%	6.2194%	6.1571%	6.0910%	6.0146%	5.9296%	5.8425%	5.7514%	5.6461%	5.4938%	5.3235%	5.1328%	4.9242%	4.6887%	4.4008%	3.9896%	1.2403%

It is key to note that the portfolio tested (with >10 stocks so as to maintain diversification), with the maximum expected daily return of 0.0593% has both a lower standard deviation (0.8747%) than that of the PSEi and a higher expected daily return than the index. The PSEi has an expected daily return of 0.031% and a standard deviation of 1.234%. This demonstrates that the

different portfolio allocations can perform strongly in relation to the performance of the index. The different allocations can be utilized by different investors with different risk appetites. A very risk averse investor can opt for the optimum portfolio allocation that has a lower expected daily return but also a lower standard deviation as compared to the PSEi; daily return of 0.02291% v.s. 0.031% but a standard deviation of 0.06923% v.s. 1.234% respectively. On the other hand, more risk tolerant investors can opt for the portfolio allocation with a higher expected daily return and a lower standard deviation as compared to the PSEi. The bear-proof portfolios found have overall lower risk when compared to the PSEi as the VaR and standard deviation of the efficient and risky portfolios (0.0048%, 0.0077% and 0.6923%, 0.8747%) are lower than those of the PSEi.



Applying the efficient portfolio to historical data from January 6, 2017 to November 18, 2022 shows how it fares against the PSEi. The dates were chosen as this is the earliest that data on Wilcon was available. The index would have a return of 12.6% over the period while the suggested portfolio would have had a return of 16.65%.

	2018 TT	Covid-19
Intial	469.31495	374.92425
End	309.72286	309.72286
After	478.06742	430.68672
Returns	-0.340053	-0.173906
Returns Aft	0.5435329	0.3905552
PSEi	-0.475252	-0.356736
PSEi After	0.2952728	0.5431347

Furthermore, looking at the performance during and after a bear market, the portfolio outperforms the PSEi in both scenarios. For the purposes of this comparison, only the 2018 Taper Tantrums and the COVID-19 bear markets were compared. For the two bear markets, the portfolio outperformed the index by 28.45% and 51.25% respectively. As for the bounce back, the portfolio outperformed the index by 84.09% in the 2018 Taper Tantrums but the reverse was true during the COVID-19, as the PSEi was 28.09% better.

V. Limitations of the Study

A big limitation to the project was the amount of data collected. The study only contained historical stock price data for select index companies because of its large quantity and the scarcity of non-index stock data online. Therefore, the study does not include non-index stocks that are of high quality and can possibly be included in the criteria of its portfolio. Certain sectors that were chosen also only contain one stock, such as Transportation (ICT) and Mining (SCC). There are other stocks in this category such as ALLHC or CEB for Transportation or NIKL for Mining, however given the limitations mentioned above these stocks were not included in the analysis. There were also some index stocks such as EMI that were producing several inconsistencies in its data and were very difficult to clean. To conclude, the study would have better results if the study had access to a larger database of stock prices (e.g. Bloomberg Terminal).

VI. Conclusion

Given the cyclical movement of stocks, studying past market patterns is crucial to protecting and optimizing one's portfolio for future scenarios. With this, the study aimed to create a portfolio of equities that is proven to be resilient to market downturns, and performs well after a bear market. A combination of stock selection (to maximize absolute returns over the market in bad conditions) and risk-management (through finding optimal allocations with the goal of having good risk-adjusted return) was used to build and identify portfolios that are as "bear-proof" as possible. With this, the study was able to identify multiple potential portfolios, which cater to different investors with varying risk-appetites. Given the current market (and the state of the

global community), this information would be very valuable to anyone interested in building a portfolio in the Philippines, which would withstand and even perform well should stock prices continue to experience unpredictable, large declines. In a sense, the portfolios created through the methodology would provide investors with the tools necessary to navigate and flourish through tumultuous times.

Moving forward, the study would benefit greatly if it were to be replicated using a larger array of more accurate, complete sets of historical data. The inclusion of non-index stocks, for example, would provide more all-encompassing, extensive ideal portfolio combinations—better representing real world trends and options. Furthermore, the effectiveness of the portfolios generated could be evaluated further, given more time or technical expertise. For one, a retrospective review of suggested portfolios after some time, and an analysis of their effectiveness given their actual performance could be used. Alternatively, technical expertise could be used to continuously run forward-looking simulations, in order to measure performance. After such evaluations, the methods outlined by the study can be adjusted or improved, if opportunities are identified.

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