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# Optimal Portfolio Construction using Sharpe's Single Index Model: Evidence from Emerging Markets

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**ABSTRACT:** The study of security and portfolio administration has become vital for making rational investment decisions. A portfolio combines securities namely stocks, bonds, and money market instruments, and the process of mixing these asset classes to achieve the highest possible return with the least risk is known as portfolio construction. The primary goal is to balance the investor's risk and return preferences.

In this final phase, the portfolio is revised and evaluated to optimize returns. Creating an ideal portfolio becomes more manageable when a single metric can measure the desirability of including a particular stock. The Single Index Model provides such a metric, where the appeal of any stock is determined by its excess return over beta, indicating how suitable it is for inclusion in a portfolio.

This study aims to construct an optimum portfolio using Sharpe's Single Index Model, focusing on balancing the positive and negative correlations between securities. The goal is to align the portfolio's returns with the investor's anticipated results.

**KEYWORDS:** Sharpe's Single Index Model, stocks, bonds, money market, portfolio.

## I. INTRODUCTION

The financial market is a marketplace where company stocks, various securities, and derivatives are traded. Stock exchanges are organizations, either corporate or mutual, that specialize in facilitating the trading of these stocks and securities. A wide variety of company stocks are listed on these exchanges.

Building an investment portfolio largely depends on the individual investor's profile. Understanding market instruments and movements is key to gaining insight into market dynamics. A portfolio is a mix of various securities, including stocks, bonds, and money market instruments. Portfolio construction involves strategically combining these asset classes to reach optimal yields while diminishing risk.

Securities have risk-return characteristics of their own. The return expected from a security is variable, this variability of return is called as risk. No one investor wants to invest his entire money or wealth in a sole security. In case market goes down or prices falls, the investor may have to incur heavy losses. Investors have vary depending upon their risk bearing ability, and can be categorized as high- risk bearing, moderate risk bearing, and small risk bearing investors.

## II. LITERATURE SURVEY

- **Ankit Patel and Mehul Shah (2021)** the study useful Model to concept an optimal portfolio in the Indian pharmaceutical sector. The model effectively selected pharma stocks with higher return and lower risk, outperforming the sector index. The research underscores the model's adaptability in the healthcare industry.
- **K. Singh and J. Roy (2022)** the Model to Indian mid-cap stocks. The model successfully identified stocks that provided superior risk-adjusted returns, outperforming the broader mid- cap index. This research highlights model's relevance for mid-cap investors seeking growth opportunities in India.
- **Wei Zhang and Li Chen (2020)** the authors investigated the effectiveness of Sharpe's Single Index Model in constructing optimal portfolio in the Chinese stock market. They concluded that the model is effective in selecting high-performing stocks, although the rapidly evolving nature of the Chinese market poses challenges.

- **John Davis and Sarah Mitchell (2021)** this study evaluates the effectiveness of Sharpe's Single Index Model in the US stock market, comparing its performance to contemporary portfolio theory (MPT). The results indicate that while MPT offers a more comprehensive framework, the SIM remains a valued tool for depositors seeking a simpler, yet effective, approach to portfolio optimization.
- **Archana, H N. and Srilakshmi D. (2020)** constructed an optimal portfolio by using Sharpe's Single Index Model by considering 10 stocks from different sectors from the list of 30 stocks listed at BSE. The closing price data for the research obtained from 01.01.2019 to 31.12.2019. 10 stocks were nominated to construct an optimal portfolio.
- **Luiz Carvalho and Maria Santos (2019)** this study explores the request of Sharpe's Single Index Model in constructing optimal portfolios in the Brazilian stock market. The authors found that portfolios built using SIM outperformed the market guide in terms in relations of risk-adjusted returns, despite the market's volatility.

### III. METHODOLOGY

#### Need for the Study:

- To assist investors in navigating chaotic situations.
- This helps investors identify a portfolio that greatest match their needs.
- The study aims to maximize returns and minimize risk by constructing a well-balanced portfolio.
- The research aids investors in discovering investment opportunities.

#### Objectives:

- To know the optimum portfolio by means of Sharpe's Single Index Model (SIM).
- To estimate the arrival and hazard of 2 companies registered in NSE.
- To analysis the excess beta arrival to Beta ratio of all 2 companies.
- To distinguish the effect of diversification of investment.
- To assess the act of optimal portfolio.

#### Secondary data:

The study includes data from the NSE (National Stock Exchange) website, company annual reports, and journals. This study employs an analytical research method, which involves critical thinking and evaluating facts and information relevant to the research.

### IV. ANALYSIS AND INTERPRITATION

#### Calculation of Risk and Return:

TABLE 1: HDFC Bank

Date	HDFC Share price	Share price Nifty 50 (NSEI)	HDFC return	Nifty 50 return	XY	X2	Y2
1-Jan-21	1,390.50	13,634.60	0.00	0.00	0	0	0
1-Feb-21	1,534.40	14,529.15	10.35	6.56	67.89722414	107.0975662	43.04517
1-Mar-21	1,493.65	14,690.70	-2.66	1.11	-2.952947856	7.053067602	1.236327
1-Apr-21	1,412.30	14,631.10	-5.45	-0.41	2.209594009	29.66316094	0.164592
1-May-21	1,515.85	15,582.80	7.33	6.50	47.69207682	53.75839428	42.31031
1-Jun-21	1,497.90	15,721.50	-1.18	0.89	-1.05399655	1.402220944	0.792249

1-Jul-21	1,426.45	15,763.05	-4.77	0.26	-1.260655609	22.75300827	0.069848
1-Aug-21	1,581.40	17,132.20	10.86	8.69	94.35084735	117.9967524	75.44345
1-Sep-21	1,594.95	17,618.15	0.86	2.84	2.430390235	0.734167443	8.045572
1-Oct-21	1,582.85	17,671.65	-0.76	0.30	-0.230373105	0.575541434	0.092212
1-Nov-21	1,493.55	16,983.20	-5.64	-3.90	21.97895304	31.82902949	15.17716
1-Dec-21	1,479.40	17,354.05	-0.95	2.18	-2.068785354	0.897580373	4.768234
1-Jan-22	1,485.70	17,339.85	0.43	-0.08	-0.034845158	0.181346789	0.006695
1-Feb-22	1,426.25	16,793.90	-4.00	-3.15	12.59877354	16.01184846	9.913227
1-Mar-22	1,470.35	17,464.75	3.09	3.99	12.35141726	9.560615755	15.95687
1-Apr-22	1,384.60	17,102.55	-5.83	-2.07	12.09482184	34.01157986	4.301027
1-May-22	1,388.95	16,584.55	0.31	-3.03	-0.951554836	0.098702888	9.173557
1-Jun-22	1,348.00	15,780.25	-2.95	-4.85	14.29820998	8.692297621	23.51954
1-Jul-22	1,434.20	17,158.25	6.39	8.73	55.84093891	40.89166058	76.25541
1-Aug-22	1,486.10	17,759.30	3.62	3.50	12.67638001	13.09529479	12.27087
1-Sep-22	1,421.35	17,094.35	-4.36	-3.74	16.31379067	18.98381431	14.0193
1-Oct-22	1,496.70	18,012.20	5.30	5.37	28.46435475	28.10376114	28.82958
1-Nov-22	1,608.45	18,758.35	7.47	4.14	30.92944706	55.74751927	17.16006

1-Dec-22	1,628.15	18,105.30	1.22	-3.48	-4.263933866	1.500090022	12.12003
1-Jan-23	1,603.50	17,662.15	-1.51	-2.45	3.705676798	2.292160478	5.990872
1-Feb-23	1,599.60	17,303.95	-0.24	-2.03	0.493261995	0.059154976	4.11305
1-Mar-23	1,609.55	17,359.75	0.62	0.32	0.200586007	0.386921952	0.103987
1-Apr-23	1,687.60	18,065.00	4.85	4.06	19.70008333	23.51456072	16.50438
1-May-23	1,610.85	18,534.40	-4.55	2.60	-11.8171837	20.68320016	6.751655

1-Jun-23	1,701.40	19,189.05	5.62	3.53	19.85473038	31.59851743	12.4756
1-Jul-23	1,651.20	19,753.80	-2.95	2.94	-8.683604875	8.705517189	8.661748
1-Aug-23	1,571.45	19,253.80	-4.83	-2.53	12.22504211	23.32716835	6.406764
1-Sep-23	1,526.30	19,638.30	-2.87	2.00	-5.737689935	8.254948624	3.988042
1-Oct-23	1,476.50	19,079.60	-3.26	-2.84	9.282484223	10.64581407	8.093746
1-Nov-23	1,558.80	20,133.15	5.57	5.52	30.77884154	31.06939295	30.49101
1-Dec-23	1,709.25	21,731.40	9.65	7.94	76.61869998	93.15444654	63.0182
<b>Total</b>	<b>54,888.00</b>	<b>626,970.10</b>	<b>24.79</b>	<b>49.44</b>	<b>565.93</b>	<b>854.33</b>	<b>581.27</b>

**Interpretation:**

Here from January 2021 to December 2023, HDFC'S Share price grew by 24.79%, disappointing the Nifty 50, which rose by 49.44%. HDFC had periods of both gains and losses, but overall, it lagged behind the broader market.

**TABLE 2: ICICI Bank**

Date	ICICI Share price	Share price Nifty 50 (NSEI)	ICICI return	Nifty 50 return	XY	X2	Y2
1-Jan-21	537	13,634.60	0	0	0	0	0
1-Feb-21	597.75	14,529.15	11.31	6.56	74.22227	127.9806	43.04517
1-Mar-21	582.1	14,690.70	-2.62	1.11	-2.91113	6.854717	1.236327
1-Apr-21	600.5	14,631.10	3.16	-0.41	-1.2824	9.991724	0.164592
1-May-21	662.75	15,582.80	10.37	6.50	67.42942	107.4614	42.31031
1-Jun-21	630.9	15,721.50	-4.81	0.89	-4.27751	23.09508	0.792249
1-Jul-21	682.5	15,763.05	8.18	0.26	2.161555	66.89264	0.069848
1-Aug-21	719.05	17,132.20	5.36	8.69	46.51527	28.67936	75.44345
1-Sep-21	700.85	17,618.15	-2.53	2.84	-7.17944	6.406556	8.045572
1-Oct-21	802.05	17,671.65	14.44	0.30	4.384791	208.5023	0.092212
1-Nov-21	714.35	16,983.20	-10.93	-3.90	42.59842	119.5629	15.17716

1-Dec-21	740.15	17,354.05	3.61	2.18	7.886556	13.0442	4.768234
1-Jan-22	788.8	17,339.85	6.57	-0.08	-0.53784	43.20422	0.006695
1-Feb-22	742.7	16,793.90	-5.84	-3.15	18.40101	34.15608	9.913227
1-Mar-22	730.3	17,464.75	-1.67	3.99	-6.66933	2.787511	15.95687
1-Apr-22	743.3	17,102.55	1.78	-2.07	-3.69171	3.168722	4.301027
1-May-22	752.85	16,584.55	1.28	-3.03	-3.89142	1.650739	9.173557
1-Jun-22	707.2	15,780.25	-6.06	-4.85	29.40673	36.76755	23.51954
1-Jul-22	818.6	17,158.25	15.75	8.73	137.5556	248.1338	76.25541
1-Aug-22	887.3	17,759.30	8.39	3.50	29.39833	70.432	12.27087
1-Sep-22	862	17,094.35	-2.85	-3.74	10.67611	8.130178	14.0193
1-Oct-22	908.7	18,012.20	5.42	5.37	29.089	29.35075	28.82958
1-Nov-22	952.9	18,758.35	4.86	4.14	20.14935	23.65939	17.16006
1-Dec-22	890.85	18,105.30	-6.51	-3.48	22.66973	42.40225	12.12003
1-Jan-23	831.9	17,662.15	-6.62	-2.45	16.19661	43.78834	5.990872
1-Feb-23	854.85	17,303.95	2.76	-2.03	-5.59492	7.610674	4.11305
1-Mar-23	877.25	17,359.75	2.62	0.32	0.844981	6.866196	0.103987
1-Apr-23	917.65	18,065.00	4.61	4.06	18.7093	21.20879	16.50438
1-May-23	949.15	18,534.40	3.43	2.60	8.919461	11.7833	6.751655
1-Jun-23	934.6	19,189.05	-1.53	3.53	-5.41451	2.349937	12.4756
1-Jul-23	998.3	19,753.80	6.82	2.94	20.05933	46.45445	8.661748
1-Aug-23	958.75	19,253.80	-3.96	-2.53	10.02778	15.69534	6.406764
1-Sep-23	951.9	19,638.30	-0.71	2.00	-1.42681	0.51047	3.988042
1-Oct-23	915.35	19,079.60	-3.84	-2.84	10.92373	14.74321	8.093746

1-Nov-23	934.95	20,133.15	2.14	5.52	11.82374	4.584983	30.49101
1-Dec-23	996.6	21,731.40	6.59	7.94	52.3453	43.47999	63.0182
<b>Total</b>	<b>28876.7</b>	<b>626970.1</b>	<b>68.961655</b>	<b>49.43741418</b>	<b>649.5173</b>	<b>1481.39</b>	<b>581.2703</b>

**Interpretation:**

From January 2021 to December 2023, ICICI’s stock outperformed the Nifty 50 with a return of 68.95% compared to 49.44%. ICICI’s higher returns indicate stronger performance but also came with higher volatility. The positive correlation between ICICI and the Nifty 50 suggests similar market trends. However, ICICI’s higher risk reflects greater price fluctuations during this period.

**Calculation of Standard Deviation:**

**TABLE 3**

Companies	Standard deviation
HDFC	94.3
ICICI	51.45

**Interpretation:**

The standard deviation values reflect the changeability in stock prices for each company. Here ICICI has the lowest standard deviation at 51.45, it suggesting more stable stock prices. Companies like HDFC has fall in Between, with average instability.

**Calculation of Variance:**

**TABLE 4**

Companies	Variance
HDFC	8893.86
ICICI	4679.09

**Interpretation:**

HDFC show moderate variance, suggesting comparatively constant prices with some fluctuations. ICICI has the lowest variance, reflecting the most stable stock performance. Overall, higher variance implies more risk, while lower variance indicates greater stability.

## Calculation of Beta

TABLE 5

Companies	Beta
HDFC	0.6352
ICICI	0.4111

**Interpretation:**

The beta values show that HDFC is the most reactive to market movements, ICICI have reasonable betas, indicating they move somewhat with the market but are fewer unbalanced than HDFC.

**V. CONCLUSION**

Investments should prioritize stocks with lower beta values and higher returns to align with typical investor preferences. The portfolio must be dynamically adjusted to reflect changing proportions of investment in each security. Regular market monitoring and analysis are essential for updating the portfolio and minimizing potential losses. Utilizing effective security screening is crucial for optimal portfolio construction. Continuous evaluation of stock performance and periodic updates to the portfolio are necessary to maintain its effectiveness and adaptability.

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