

**HEDGING HEALTHCARE LIABILITIES USING A MEDICAL CPI WEIGHTED
PORTFOLIO OF HEALTHCARE STOCKS**

by

Khashayar Noroozadeh Rahimi
BSc, The University of British Columbia, 2018

and

Yashojjwal Mahendra
BE, R.V College of Engineering, 2016

PROJECT SUBMITTED IN PARTIAL FULFILLMENT OF
THE REQUIREMENTS FOR THE DEGREE OF
MASTER OF SCIENCE IN FINANCE

In the Master of Science in Finance Program
of the
Faculty
of
Business Administration

© Khashayar Noroozadeh, Yashojjwal Mahendra, 2019

SIMON FRASER UNIVERSITY

Fall 2019

All rights reserved. However, in accordance with the *Copyright Act of Canada*, this work may be reproduced, without authorization, under the conditions for *Fair Dealing*. Therefore, limited reproduction of this work for the purposes of private study, research, criticism, review and news reporting is likely to be in accordance with the law, particularly if cited appropriately.

Approval

Name: **Khashayar Noroozzadeh, Yashojjwal Mahendra**

Degree: **Master of Science in Finance**

Title of Project: **HEDGING HEALTHCARE LIABILITIES USING
A MEDICAL CPI WEIGHTED PORTFOLIO OF
HEALTHCARE STOCKS**

Supervisory Committee:

Dr. Peter Klein
Senior Supervisor
Professor

Dr. Victor Song
Second Reader
Lecturer

Date Approved: _____

Abstract

The purpose of this paper is to find a suitable investment strategy to hedge against anticipated and unanticipated changes in medical inflation. These changes pose a challenge to individuals and businesses where medical liabilities play a significant role in an entity's life. There have been many attempts to create a suitable investment strategy to hedge the surprise changes such as: shorting AAA Corporate bonds and investing in health care mutual funds. However, none have been successful in creating a suitable and successful hedge. In this paper, we are exploring the possibilities of creating a value-based portfolio weighted according to Medical Care Index components to hedge against anticipated and unanticipated changes. After running the regression, we are confident that our portfolio and individual ETFs have no significant correlation with Medical Care Index as well as the Consumer Price Index (CPI). Therefore, using the common stock as a hedging tool is not efficient. For future studies, one can create a balanced portfolio of equities, fixed income, and alternative investment to try to hedge against Medical CPI.

Keywords: Health Care, Hedge, Liabilities, Portfolio, Adaptive expectation, Regression analysis, Factor model.

Acknowledgments

We want to express our most profound appreciation to Dr. Peter Klein, who generously contributed his valuable time to help us throughout our journey. Dr. Klein taught us valuable lessons both inside and outside the classroom. We forever appreciate his guidance, which made it possible to finish this dissertation. We also would like to thank Dr. Victor Song for taking time out of his busy schedule to be the second reader and attend our presentation.

Table of Contents

Approval.....	ii
Abstract	iii
Acknowledgments	iv
Table of Contents	v
List of Tables.....	vi
List of Figures	vii
1: Introduction.....	1
1.1 Hedging Medical Liabilities.....	1
1.2 Inflation.....	3
1.3 Inflation Hedge.....	3
1.4 Why Medical Inflation	3
2: Literature Review	5
3: Hypothesis Development	8
4: Data	9
5: Method	13
5.1 Portfolio Construction	13
5.2 Estimation.....	14
6: Results	17
7: Discussion.....	27
8: Conclusion.....	28
Appendices	29
8: References.....	34

List of Tables

Table 1. Definitions of published medical care indexes and relative importance as of December 2018	11
Table 2 Medical CPI Weighted Portfolio (as of January 2009)	17
Table 3. Regression of The Real Return on Securities on the Anticipated Change in Medical CPI	20
Table 4. Regression of The Real Return on Securities on the Unanticipated Change in Medical CPI.	21
Table 5. Regression of Real Return on Equity on the Anticipated Changes in Medical CPI for different Updating Factor Θ	22
Table 6. Regression of Real Return on Equity on the Unanticipated Changes in Medical CPI for different Updating Factor Θ	23
Table 7. Regression of Nominal Return of Portfolio on CPI	24
Table 8. Regression of Real Return of Portfolio with Anticipated changes in CPI	24
Table 9. Regression of Real Return of Portfolio with Unanticipated Changes in CPI.....	25
Table 10. Health Care Services	29
Table 11. Health Care Facilities	30
Table 12. Managed Health Care	30
Table 13. Health Care Technology.....	31
Table 14. Health Care Equipment & Supply	31
Table 15. Biotechnology	32
Table 16. Pharmaceuticals.....	32
Table 17. Life Sciences and Services	33

List of Figures

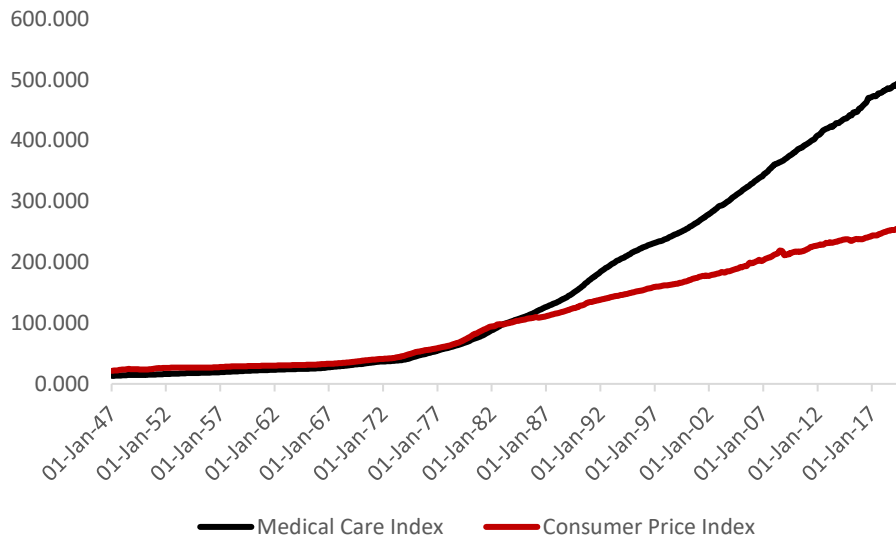
Figure 1. Medical Care Index vs. Consumer Price Index.....	1
--	---

1: Introduction

1.1 Hedging Medical Liabilities

Health care costs are overgrowing in the United States, and this poses a challenge to businesses and consumer expenditures. According to the National Health Expenditure, health spending is projected to grow at an average rate of 5.5% per year from 2018-2027 and to reach \$6.0 trillion by 2027. In 2017, the US spent \$3.5 trillion on health care, which represented 17.9% of the US GDP, and by 2027, it will be 19.4% of GDP. Therefore, medical inflation is growing faster, and it is currently higher than overall inflation; more precisely, it is projected to grow 0.8% faster than Gross Domestic Product (GDP).

Figure 1. Medical Care Index vs. Consumer Price Index



Individuals and institutions need to be able to hedge themselves against medical inflation. In a study done by Himmelstein et al. (2009) showed that health care cost could have a detrimental effect on individuals, 62% of personal bankruptcy filed in 2007 were linked to medical expenses. The explanation for a natural hedge is straightforward; for example, if an aerospace company is concerned about rising in gasoline price, they can invest in oil and gas companies to protect themselves. Therefore, it is reasonable to assume that investment in health care companies would hedge individuals and companies against the anticipated and unanticipated changes in medical inflation. Companies in different sectors might exhibit a particular characteristic, which makes them better inflation-hedging security. Blanchard (1982) found that the price of raw material in early-stage production, such as gasoline are more flexible than later-stage products such as services. This finding would make it harder for services companies to be a hedge against the erosion of dollar value. However, Sadorsky (2001) concluded that natural-resources stocks are not an effective hedge even though many practitioners include them in their portfolios. Moreover, Jennings et al. showed that health care mutual funds could not be used to hedge health care costs, which have outpaced general inflation since the mid-1980s.

The purpose of this study is to create a portfolio of health-care stocks that closely tracks the composition of Medical CPI and determines whether it could be used to hedge against unanticipated medical inflation growth. The investment problem motivated the goal that companies must pay future claims for the employee's insurances. This study aims to create an inflation hedge portfolio of healthcare stocks against unexpected changes in Medical CPI.

1.2 Inflation

Inflation is defined as the rise in the general price level or a general decrease in the value of the dollar. In other words, when inflation is rising, the dollars have less value in terms of purchasing power. Given that in developed countries, inflation is on an upward trend, investors must pay attention to their investment decisions to hedge themselves against a loss in general purchasing power.

1.3 Inflation Hedge

For many decades economist theorist have long regarded common stocks as a good inflation hedge, citing that common stock represents the ownership of physical capital whose value is independent of the rate of inflation (Lintner 1973)

There are multiple definitions of inflation hedge security. The first definition is given by Reilly, Johnson, and Smith (1970) indicates that for a security to be an inflation hedge it has to offer “protection” against inflation, meaning it must eliminate or reduce the possibility of the real rate of return on the security to fall below some specified floor. The second definition is that security is an inflation hedge if and only if its real rate of return is independent of the rate of inflation (Branch, 1974). Inflation Betas, on the other hand, states that inflation hedging is how strongly a normal rate of return on security covaries with inflation (Bekaert & Wand, 2010)

1.4 Why Medical Inflation

The medical cost affects individuals and firms in a significant way. Health Insurance is an essential component of employee compensation that offers excellent

value to the employees. According to 2019 Employer Health Benefits Survey employee-sponsored, insurance covers approximately 153 million nonelderly people in total with average annual premiums \$7,188 for single coverage and \$20,576 for family coverage. Health care compensation is an attractive component for the labour market, and companies have limited ability to discontinue providing them. With a decreasing rate of unemployment, this trend will stay relatively constant or will increase. Thus, medical care costs represent an impotent candidate as a systematic risk to firms and individuals.

2: Literature Review

Jennings et al. used monthly returns (October 1987 through May 2006) of two health-care oriented mutual funds to run a regression analysis against medical care inflation, and concluded that there is no correlation (Jennings, Fraser, & Payne, 2009). However, there are limitations to this study, the two mutual funds (Vanguard health care & Fidelity Select Health Care) used in this study are heavily focused on health care equipment, Biotechnology, and pharmaceuticals. As discussed above in the introduction, most of the Medical care index is made up of medical care services. Jennings et al. also created a “Hedged health care index” and regressed it against medical inflation. The results showed no correlation. The “Hedged health care index” was created by subtracting the beta-adjusted S&P 500 returns from the returns of two mutual funds. The authors focused on the existing investable health care vehicles and suggested creating a portfolio that closely reflects the inflation weightings (Jennings, Fraser, & Payne, 2009). Jennings et al. mention TIPS as a better hedging instrument for health care inflation since there is a high correlation between health care inflation and ordinary CPI (Jennings, Fraser, & Payne, 2009).

Multiple studies have been conducted to evaluate the effectiveness of common stocks as a hedge against inflation. Among popular studies, Bodie (1976) stands out with a surprising conclusion. He studied the effectiveness of a well-diversified portfolio of common stocks against both anticipated and unanticipated inflation (Bodie, 1976). Using annual, quarterly and monthly data from 1953-1972, Bodie showed that contrary to a commonly held belief among economists, the real return of the common stocks is negatively correlated with anticipated and unanticipated inflation. Therefore, in order to

use common stocks as a hedging tool, one must sell them short (Bodie, 1976). However, the paper regressed common equity against general inflation, which grows at a slower rate compared to medical inflation.

From a different perspective, a paper was done by Payne (2010) investigated the impact of health care costs on asset prices in the US market and the degree to which medical costs are a priced risk in the US economy. He concluded that unexpected changes in medical inflation are priced in the market, and, are non-diversifiable (Payne, 2010). In the second part of his paper, Payne (2010) created a generic algorithm for hedging health care costs. His research demonstrated the ability of a genetic algorithm (GA) to form a portfolio of assets that offsets the risk posed by monthly medical inflation (Payne, 2010). Using GA, across out-of-sample time period from 2005-2008, 5 asset GA-generated portfolio showed a much better performance compare to existing investable vehicles in managing the risk of escalating health care expenses (Payne, 2010)

In a more recent study done by Lieberthal (2016), conducted research to determine whether unexpected changes in medical spending could be hedge by stocks or bonds. Lieberthal (2016) proposed three questions; first, do hedge instruments for medical inflation exist? Second, what would the instrument be? Third, what is the strategy, i.e. long or short, the assets? Lieberthal (2016) used an adaptive expectations model in order to determine the deviations from the medical spending trend. Data on medical spending growth was gathered from The Centres for Medicare and Medicaid Services (CMS), and the medical spending growth was defined in terms of spending on private insurance plan enrollees. (Lieberthal, 2016). Fama-French return factors were used to determine the stock returns and risk-free rate. Three asset classes used in this

study were; 10-year government bond, Moody's index of AAA-rated corporate bonds, and health care stocks. Lieberthal (2016) concluded that the bonds are inversely related to unexpected changes in medical spending growth rates. He also states that the return of health care stocks, such as those for health care insurance companies, hospitals, biopharmaceuticals, and other healthcare-related sectors are not correlated with unexpected changes in medical spending (Lieberthal, 2016). In order to hedge against medical care spending, insurance companies must short corporate bonds (Lieberthal, 2016).

Lastly, Ang, Briere, and Signori (2012) performed a regression analysis on a portfolio of stocks vs Consumer Price Index and found and surprisingly concluded that certain individual stocks could be a good inflation hedge. This paper starts by taking the S&P 500 stocks monthly closing total return from October 1980-May, 2010 and their respective market capitalization. Then, for portfolio construction, they sorted the companies into quintile based on their inflation betas. Inflation beta is defined as how strongly a security's normal rate of return covaries with inflation following this formula

$$R_{it} = \alpha + \beta\pi_t + \varepsilon_t$$

Where R_{it} is the monthly nominal return of stock I, and beta is the monthly rate of inflation. After forming the portfolios, the securities are weighted according to their respective market caps and ranked based on their inflation beta. They created a self-financed, dollar-natural Q1-Q5, which they bought the Q1 and shorted the Q5. Our paper has similarities in terms of portfolio construction. However, the method of creation is different. Our portfolio is a value-based portfolio weighted according to the Medical Care Index.

3: Hypothesis Development

After studying many papers on the effectiveness of common stocks as an inflation hedge security, we decided to follow the recommendations of Jennings, Peter, and Payne (2009). The paper recommended forming a portfolio of medical CPI weighted, which closely tracks the movement of the Medical Care Index. For many public and private companies which offer health insurance as a part of their compensation packages ability to hedge themselves against unexpected changes in Medical CPI is essential. For instance, higher than expected, medical CPI affects companies' ability to pay insurance premiums, which in turn affects the attractiveness of the company and the job market.

Primarily, this study takes into consideration the devastating effect of medical care costs that have on individuals and the U.S economy. Any firm which has human capital involved in their operation is exposed to the medical care costs, which in turn affects the riskiness and cash flow of the company. These medical care costs are a source of systematic risk. Thus, we are trying to form a portfolio that covaries positively with the unexpected changes in medical inflation in order to create a hedge to reduce the cost.

4: Data

Our sample consisted of all companies that constituted of four iShares Health-Care ETF over January 2009-January 2019. For all stocks in the four ETFs each month, we gathered the monthly cumulative total return, Price to book ratio, Price to earnings ratio, Debt to Equity Ratio, Free Cash Flow Yield, EV to EBITDA Multiple from Bloomberg Terminal.

We focused on the available healthcare ETFs because the previous study done by Jennings et al. selected Mutual funds that have a high concentration in Biotech and Pharmaceutical stocks. We choose ETFs due to low management and commission fees, and they are easily accessible, investable, and liquid assets.

We used the U.S. Consumer Price Index from Bloomberg Terminal from January 2009- January 2019. The CPI data from this period shows that overall inflation was moderate, with an average of 1.6% and a volatility of 1.15%. Inflation was peaked at 3.9% in September 2011, reflecting the rise in commodity prices.

We used the Bureau of Labor and Statistics to obtain monthly data on Medical CPI from January 2009 - January 2019. The medical CPI index is one of the eight components of the Consumer Price Index (CPI). Medical Care index is divided into two main categories: Medical Care Services and Medical Care commodities. The two main categories are made up of sub-categories. The weight of each category is determined using the Consumer Expenditure Survey, which tracks consumer out-of-pocket spending on medical care and attributes most weight to the items that consumers spend the most.

Consumer Expenditure survey defines out-of-pocket spending as:

- Out-of-pocket spending by consumers to retail establishments for medical services
- Out-of-pocket spending on premiums, including Medicare part B
- Deductible health insurance premiums from employee paychecks

Table 1. below is obtained from the CE survey, which shows the relative importance of each category and sub-categories in the Medical CPI index. Our portfolio follows the following weights in its construction.

Table 1. Definitions of published medical care indexes and relative importance as of December 2018

Item	Relative importance (percent)	Percentage of the Medical Care Index
Medical care	8.682	100%
A. Medical care commodities	1.707	20%
1. Medicinal drugs	1.65	19%
a. Prescription drugs	1.308	15%
b. Non-prescription drugs	0.342	4%
2. Medical equipment and supplies	0.057	1%
B. Medical care services	6.974	80%
1. Professional services	3.255	37%
a. Physicians' services	1.732	20%
b. Dental services	0.785	9%
c. Eyeglasses and eye care	0.319	4%
d. Services by other medical professionals	0.419	5%
2. Hospital and related services	2.621	30%
a. Hospital services	2.34	27%
i. Inpatient hospital services (1)	N/A	
ii. Outpatient hospital services (1)	N/A	
b. Nursing home and adult day care services	0.193	2%
c. Care of invalids, elderly and convalescents in the home	0.088	1%
3. Health Insurance	1.099	13%

The four ETF from the iShares ETFs were used to track the companies in the Medical care sector Blackrock's iShares website provides the data for the following ETFs:

- iShares U.S. Medical Devices ETF (IHI): This ETF seeks to track the investment results of an index composed of U.S equities in the medical devices sector. It gives exposure to the U.S. companies in the manufacturing and distribution of medical devices
- iShares U.S. Healthcare Providers ETF (IHF): This ETF tracks the investment results of an index composed of U.S. equities in the health care providers sector. It gives exposure to U.S. companies that provide health insurance, diagnostics, and specialized treatment.
- iShares NASDAQ Biotechnology ETF (IBB): This ETF tracks the investment result of an index composed of biotechnology (80.7%), life sciences tools and services sector (9.88%), and pharmaceutical equities (8.5%) listed on NASDAQ.
- iShares U.S Pharmaceuticals ETF (IHE): This ETF tracks the investment results of an index composed of U.S Equities in the pharmaceuticals sector (96.47%) and Biotechnology sector (3.2%). It gives an exposure to the manufacturers of prescription or over the counter drugs or vaccines.

5: Method

5.1 Portfolio Construction

To construct a portfolio of securities that acts as a hedge against medical inflation, we used the factor model to rank securities in each ETF based on the Z-Scores of each factor chosen. Historically, factor investing has been identified as a critical driver of portfolio risk/return and it can be used to inform the investment process better. This method is used to construct a portfolio where investors can meet their objectives such as: increasing the return, reducing the risk and diversification. According to MSCI, the factor groups are Value, Low size (small cap), Momentum, Low volatility, Dividend yield, and Quality. We have decided to follow this method of construction to create a value/quality-based portfolio of healthcare stocks. We selected value metrics to capture excess returns of stocks that have a low price relative to their fundamental values, and quality metrics to capture stocks with low debt and stable earnings growth. This method of portfolio construction was used by Bonne et al. (June 2018) and is becoming increasingly popular in an institutional setting. The portfolio constructed showed superior returns, beating the S&P 500 and S&P 500 healthcare Index. The factors we chose were value and quality-based, which are, Price to book ratio, Price to earnings ratio, Debt to Equity Ratio, Free Cash Flow Yield, EV to EBITDA Multiple.

Factors like price to book and price to earnings were inverted, and their sector-neutral scores for each security were computed in order to exclude overvalued securities. Other factors like the Debt to Equity Ratio, Free Cash Flow Yield, EV to EBITDA were also incorporated as we wanted to include companies with good quality earnings. The earnings of these companies are providing the hedge against inflation.

A total value score was generated by giving equal weightings to sector-neutral scores of each factor. A sector-neutral ranking was created for each security. For the selection of the constituents of the portfolio, an elimination process was adopted wherein any security which had a zero value for any factor was eliminated from the selection process. Only the top 10% ranking securities in each sector were included in the portfolio.

With securities selected, portfolio weights of each security were given such that securities from the Medical care services sector comprised 80% of the total portfolio weight and rest 20% with a value tilt to their original Market Value Weighted weights. This portfolio was uploaded into the Bloomberg Terminal and was analyzed in the Bloomberg Portfolio Module. The monthly returns of the portfolio were generated through the terminal.

5.2 Estimation

Bodie (1976) emphasized that if an investment is to hedge against inflation, it must be reactive to the unanticipated changes in inflation. He modelled the anticipated changes in inflation using the adaptive expectation model. In this study, we used the same adaptive expectation model to determine unanticipated changes in medical CPI tend. The expected change in the growth of medical CPI in the current period is equal to the expected change in the last period adjusted to reflect the difference between the experienced growth in the last period and the expected growth in the last period. The updating equation is given by equation 1 (Lieberthal 2016) (Jennings, Peter and Payne 2009):

$$\bar{D}(t) = \bar{D}(t - 1) + \theta(D(t - 1) - \bar{D}(t - 1)) \quad (1)$$

Where

$\bar{D}(t)$ is the expected rate of growth at time t

$D(t)$ is the experienced rate of growth at time t

This model for anticipated inflation was first emphasized by Bodie, 1976, that if an investment is to be used as a hedge against inflation, it must be responsive to unanticipated inflation (Bodie 1976). The updating factor Θ for the adjustment ranges from 0.1, 0.2, 0.3, 0.4, 0.5, 0.6, 0.7, 0.8, 0.9, and 1 and decides the time series deviations from the long-term growth in the model. Estimates of expected long term growth are calculated over a range of values of Θ . The unanticipated deviations that resulted and differed by choice of Θ are calculated as the difference between the experienced growth and anticipated growth. We gave $\bar{D}(t) = D(t)$ for the starting month of our holding period, which was consistent with the model used by Bodie (Bodie 1976)

Next, the excess rate of return on the assets was calculated using the anticipated growth in inflation. The return on an asset was not fit to a model to generate unanticipated returns, reflecting an efficient market hypothesis for asset returns (Lieberthal 2016)

Equation 2:

Excess returns on assets:

$$Re(t) = R(t) - \bar{D}(t) \quad (2)$$

The relationship between excess returns of the portfolio and unanticipated growth was analyzed to determine whether the portfolio hedged the spending growth. If the regression coefficient β_1 in Equation 3 is significant, then the portfolio will be a good hedge. The sign of coefficient indicates whether the portfolio is short or long.

Equation 3:

Regression of excess returns on deviations

$$1 + Re(t) = \alpha_1 + \beta_1 d(t) \quad (3)$$

6: Results

The following tables show the holdings of the portfolio. In Table 2., we can observe that the date at which we start holding this portfolio is January 1, 2009. We can also observe that the Medical Commodities Sector has a total weight of 20%, with each holding having a maximum weight of 0.01% and a maximum weight of 1%. The Medical Health Care Service Provider Sector has a total weight of 80%, with each holding having a minimum weight of 3% and a maximum weight of 6%. The primary market-cap-weighted weights are then weather multiplied by value-based multiple, which tilts the original weight towards the value score and give the total portfolio weight equal to 100%. After analyzing the portfolio on Bloomberg Terminal, we observe that our portfolio had outperformed the S&P500 and the S&P benchmark for the healthcare sector by 150% during the holding period.

Table 2 Medical CPI Weighted Portfolio (as of January 2009)

Ticker	Company Name	Weight (%)	Total Score	Value weight (%)
NTUS US Equity	NATUS MEDICAL INC	0.09%	1.67	0.02%
ITGR US Equity	INTEGER HOLDINGS CORP	0.2%	1.24	0.1%
HRC US Equity	HILL ROM HOLDINGS INC	0.6%	0.97	0.3%
BDX US Equity	BECTON DICKINSON	5.6%	0.84	1.0%
ZBH US Equity	ZIMMER BIOMET HOLDINGS INC	2.5%	0.78	1.0%
HOLX US Equity	HOLOGIC INC	1.0%	0.68	0.7%
IART US Equity	INTEGRA LIFESCIENCES HOLDINGS CORP	0.4%	0.55	0.3%
PODD US Equity	INSULET CORP	0.9%	0.53	0.7%
MDT US Equity	MEDTRONIC PLC	12.2%	0.50	1.0%
SYK US Equity	STRYKER CORP	6.3%	0.21	1.0%
DHR US Equity	DANAHER CORP	8.1%	0.11	1.0%
BAX US Equity	BAXTER INTERNATIONAL INC	3.4%	0.05	1.0%

STE US Equity	STERIS	1.0%	0.01	1.0%
STAA US Equity	STAAR SURGICAL	0.1%	0.26	0.1%
PDLI US Equity	PDL BIOPHARMA INC	0.0%	1.20	0.0%
ARNA US Equity	ARENA PHARMACEUTICALS INC	0.2%	0.88	0.1%
CELG US Equity	CELGENE CORP	6.5%	0.24	1.0%
GILD US Equity	GILEAD SCIENCES INC	6.7%	0.06	1.0%
AMGN US Equity	AMGEN INC	10.8%	0.04	1.0%
BIIB US Equity	BIOGEN INC	4.1%	0.02	1.0%
PBH US Equity	PRESTIGE CONSUMER HEALTHCARE INC	0.2%	1.66	0.0%
INVA US Equity	INNOVIVA INC	0.1%	1.13	0.1%
MYL US Equity	MYLAN NV	0.7%	0.80	0.5%
ZTS US Equity	ZOETIS INC CLASS A	4.6%	0.52	1.0%
JAZZ US Equity	JAZZ PHARMACEUTICALS PLC	0.6%	0.23	0.6%
PRGO US Equity	PERRIGO PLC	0.5%	0.18	0.5%
SUPN US Equity	SUPERNUS PHARMACEUTICALS INC	0.1%	0.14	0.1%
AMPH US Equity	AMPHASTAR PHARMACEUTICALS INC	0.1%	0.08	0.1%
LLY US Equity	ELI LILLY	8.9%	0.03	1.0%
SYNH US Equity	SYNEOS HEALTH INC CLASS A	0.4%	2.20	0.0%
BIO US Equity	BIO RAD LABORATORIES INC CLASS A	0.9%	1.61	0.2%
TMO US Equity	THERMO FISHER SCIENTIFIC INC	10.0%	0.55	1.0%
MEDP US Equity	MEDPACE HOLDINGS INC	0.2%	0.54	0.2%
PRAH US Equity	PRA HEALTH SCIENCES INC	0.6%	0.50	0.4%
WAT US Equity	WATER CORP	1.1%	0.23	1.0%

DPLO US Equity	Diplomat Pharmacy Inc	0.1%	1.14	3.0%
MD US Equity	MEDNAX Inc	0.6%	0.85	3.0%
BIOS US Equity	Option Care Health Inc	0.6%	0.76	3.0%
CVS US Equity	CVS Health Corp	25.1%	0.72	6.0%
DVA US Equity	DaVita Inc	2.4%	0.29	4.3%
CI US Equity	Cigna Corp	18.8%	0.29	6.0%
TVTY US Equity	Tivity Health Inc	0.3%	0.17	3.0%
RCM US Equity	R1 RCM Inc	0.4%	0.07	3.0%
PINC US Equity	Premier Inc	1.2%	0.05	3.0%
ACHC US Equity	Acadia Healthcare Co Inc	0.7%	1.15	3.0%
THC US Equity	Tenet Healthcare Corp	0.8%	1.10	3.2%
BKD US Equity	Brookdale Senior Living Inc	0.3%	0.43	3.0%
HCA US Equity	HCA Healthcare Inc	12.1%	0.19	6.0%
UHS US Equity	Universal Health Services Inc	3.3%	0.01	3.4%
MGLN US Equity	Magellan Health Inc	0.5%	0.30	3.0%
HQY US Equity	HealthEquity Inc	1.2%	0.15	3.0%
HUM US Equity	Humana Inc	11.1%	0.03	6.0%
ANTM US Equity	Anthem Inc	18.9%	0.01	6.0%
HMSY US Equity	HMS Holdings Corp	0.6%	1.39	3.1%
CHNG US Equity	Change Healthcare Inc	0.5%	0.56	3.0%
INOV US Equity	Inovalon Holdings Inc	0.7%	0.45	3.0%

Table 2. shows the composition of each holding in our portfolio. It outlines each security ticker, its name, total value score, and its value tilted weights, along with its holding start date. We have 55 securities in our portfolio. Each security is weighted such that it closely tracks the medical CPI composition.

Table 3. Regression of The Real Return on Securities on the Anticipated Change in Medical CPI

Security	Coefficients		Number of observations	R ²	Standard Error of Regression
	(Standard error of coefficient)	<i>t</i> statistics			
	α_1	β_1			
Portfolio	0.015398 (0.009679)	-0.99637 (3.48946)	126	0.000657	0.044981
IHI	0.013146 (0.009501)	-0.28554 1.391913 (3.42547)	126	0.00133	0.044156
IHF	0.017999 (0.010029)	0.406342 -1.2608 (3.615848)	126	0.00098	0.04661
IHE	0.009311 (0.009562)	-0.34869 0.76553 (3.447315)	126	0.000398	0.044438
IBB	0.011776 (0.013027)	0.222066 1.090742 (4.696468)	126	0.000435	0.06054
		0.232247			

Table 3. shows the regression result of the real return of our portfolio, along with each iShares ETFs against the anticipated changes in the Medical CPI. As shown, the regression results were not significant enough due to low R² value. One thing which can be observed is that the coefficient α_1 is positive for all securities. Our observations were 126. Our portfolio's correlation with the anticipated changes is approximately equal to -1. Hence, it does not act as a good hedge against medical inflation.

Table 4. Regression of The Real Return on Securities on the Unanticipated Change in Medical CPI.

Security	Coefficients		Number of observations	R ²	Standard Error of Regression
	(Standard error of coefficient)	t statistics			
	α_1	β_1			
Portfolio	0.012687 (0.004007)	-1.49564 (1.96666)	126	0.004642	0.044891
IHI	0.016354 (0.003921)	-0.7605 -2.34508 (1.924254)	126	0.011836	0.043923
IHF	0.0147 (0.00416)	-1.2187 -0.88273 (2.04143)	126	0.001506	0.046598
IHE	0.011033 (0.003957)	-0.43241 -1.61169 (1.941793)	126	0.005525	0.044324
IBB	0.014073 (0.005368)	-0.83 -3.49519 (2.634167)	126	0.013999	0.060128
		-1.32687			

Table 4. shows the regression result of the real return of our portfolio along with each iShares ETFs against the unanticipated changes in the Medical CPI. As shown, the regression results were not significant enough due to low R² value. One thing which can be observed is that the coefficient α_1 is positive for all securities. Our observations were 126. Our portfolio's correlation(β_1) with the unanticipated changes is approximately equal to -1.5. Hence, it does not act as a good hedge against medical inflation.

Table 5. Regression of Real Return on Equity on the Anticipated Changes in Medical CPI for different Updating Factor Θ

Θ	Coefficients		Number of observations	R^2	Standard Error of Regression
	(Standard error of coefficient)				
	α_1	β_1			
0.2	0.8811 (0.1176)	0.1391 (0.1252)	126	0.00978	0.04644
		1.1111			
0.4	0.7753 (0.2053)	0.2448 (0.2127)	126	0.01048	0.04642
		1.1510			
0.6	1.2691 (0.4188)	-0.2527 (0.4112)	126	0.00301	0.04660
		-0.6145			
0.8	1.0619 (0.0521)	-0.0427 (0.0441)	126	0.00741	0.04649
		-0.9666			
1	1.0193 (0.0076)	-0.0019 (0.0016)	126	0.01089	0.04641
		-1.1735			

Table 5. shows the regression result of the real return of our portfolio against the anticipated changes in the Medical CPI for different values of updating factor Θ . As shown, the regression results were not significant enough due to low R^2 value. One thing which can be observed is that the coefficient α_1 is positive for all securities. Our observations were 126. Our portfolio's correlation (β_1) with the anticipated changes ranges from approximately equal to 0.14 for $\Theta = 0.2$ to -0.0019 for $\Theta = 1$.

Table 6. Regression of Real Return on Equity on the Unanticipated Changes in Medical CPI for different Updating Factor Θ

Θ	Coefficients		Number of observations	R^2	Standard Error of Regression
	(Standard error of coefficient)	t statistics			
	α_1	β_1			
0.2	1.0204 (0.0093)	0.1052 (0.1007) 1.0451	126	0.00866	0.04646
0.4	1.0203 (0.0092)	0.0785 (0.0753) 1.0427	126	0.00862	0.04647
0.6	1.0201 (0.0091)	0.0518 (0.0500) 1.0371	126	0.00853	0.04647
0.8	1.0198 (0.0089)	0.0251 (0.0247) 1.0167	126	0.00820	0.04648
1	1.0175 (0.0064)	0.0018 (0.0015) 1.1722	126	0.01087	0.04641

Table 6. shows the regression result of the real return of our portfolio against the unanticipated changes in the Medical CPI for different values of updating factor Θ . As shown, the regression results were not significant enough due to low R^2 value. One thing which can be observed is that the coefficient α_1 is positive for all securities. Our observations were 126. Our portfolio's correlation (β_1) with the anticipated changes ranges from approximately equal to 0.10 for $\Theta = 0.2$ to 0.0018 for $\Theta = 1$. Standard Error has remained constant for all values of Θ .

Table 7. Regression of Nominal Return of Portfolio on CPI

Security	Coefficients		Number of observations	R ²	Standard Error of Regression
	(Standard error of coefficient)				
	<i>t</i> statistics				
α_1	β_1				
Portfolio	0.0091 (0.0051)	1.7243 (2.090) 0.8250	126	0.005416	0.04654

Table 7. shows the regression result of the nominal return of our portfolio against the CPI. As shown, the regression results were not significant enough due to low R² value. One thing which can be observed is that the coefficient α_1 is positive. Our observations were 126 in total. Our portfolio's correlation(β_1) with the unanticipated changes is approximately equal to 1.724. Hence, it does act as a good hedge against inflation.

Table 8. Regression of Real Return of Portfolio with Anticipated changes in CPI

Security	Coefficients		Number of observations	R ²	Standard Error of Regression
	(Standard error of coefficient)				
	<i>t</i> statistics				
α_1	β_1				
Portfolio	0.0315 (0.017)	-12.088 (10.466) -1.1549	126	0.010729	0.04506

Table 8. shows the regression result of the real return of our portfolio against the anticipated changes in CPI. As shown, the regression results were not significant enough due to low R² value. One thing which can be observed is that the coefficient α_1 is positive.

Our observations were 126 in total. Our portfolio's correlation(β_1) with the anticipated changes is approximately equal to -12.088. Hence, it does not act as a good hedge against the anticipated changes in inflation.

Table 9. Regression of Real Return of Portfolio with Unanticipated Changes in CPI

Security	Coefficients		Number of observations	R ²	Standard Error of Regression
	(Standard error of coefficient)	t statistics			
	α_1	β_1			
Portfolio	0.0127 (0.0039)	4.00009 (2.00009) 1.9994	126	0.03148	0.04458

Table 9. shows the regression result of the real return of our portfolio against the unanticipated CPI. As shown, the regression results were not significant enough due to low R² value. One thing which can be observed is that the coefficient α_1 is positive. Our observations were 126 in total. Our portfolio's correlation(β_1) with the anticipated changes is approximately equal to 4. Hence, it does act as a good hedge against the anticipated changes in inflation. This was one of our motivations to proceed to analyze results for a hedge against unanticipated changes in medical CPI.

Regression results were consistent with the finding of Jennings et al. 2009 Where they analyzed mutual fund returns against medical CPI and concluded that the health care mutual funds are not a good hedge against medical inflation. Our results show the same for our portfolio. We also ran a series of regression against the expected and unexpected changes in medical CPI for different values of updating factor and concluded that the

updating factor has no significant influence on regression results and we can finally conclude that using equities as a hedge against medical inflation is not a good strategy, even if the selected equities follow the breakdown of medical CPI.

7: Discussion

In contrast with our hypothesis that a medical CPI weighted portfolio of stocks is a well-suited inflation hedge, our results show this method to be an imperfect hedge against medical care inflation. A Medical CPI weighted portfolio is no solution to soaring medical care costs. Thus, further studies need to be done in order to find proper inflation hedging security.

While it appears that a Medical CPI weighted portfolio of healthcare stocks is not a good hedge against unexpected changes in health-care related costs, one might wonder whether a balanced portfolio of stocks and bonds would be more appropriate to hedge. According to Jennings et al. (2009), investors can hedge their investment against CPI by allocating TIPS into their portfolios. Moreover, Jennings et al. (2009) showed that TIPS has much higher correlation with medical inflation than health care equities.

For further studies, we will leave it to others to see if a better hedge can be designed by creating a balanced portfolio of equities, fixed income, and alternative investments. We also recommend an alternative portfolio construction method using inflation-adjusted betas (Ang, Brière and Signori 2012). In this method, the inflation betas (Bekaert and Wang 2010) of each security is computed by regressing the cumulative total return of each security against inflation. Then, sorting the securities into quantiles based on the inflation betas. Finally, the investor should take a long position in the top quantile portfolio and a short position in the bottom quantile portfolio.

Finally, the ability to create a medical inflation hedge will be well received by investment managers, public and private companies, as a widespread need to fund rising medical costs.

8: Conclusion

Health care spending plays a significant role in the US economy. From 1980 Medical CPI has been surpassing the general CPI with a projection to grow 0.8% faster than General CPI. This poses a challenge to individuals and corporates who invested in pension liabilities. Many attempts to create a hedging strategy but have not been successful. This motivated us to investigate a new method to combat unexpected changes in medical CPI.

This study attempts to create a value-based portfolio of health-care stocks that closely track the medical CPI to create a hedging investment strategy. We followed the MSCI factor model to select the securities within the four healthcare ETFs. The goal was to select the stocks that are priced low relative to their fundamentals, and they exhibit low debt and stable earnings growth. The main result of this study is that there is no correlation between a Medical CPI weighted portfolio of health-care stocks and anticipated and unanticipated changes in medical CPI. Our results are consistent with the previous studies, such as Jennings et al., in which they tried to invest in mutual funds that invest in health care equities. Their results showed no correlation with medical CPI. Also, we ran a regression analysis of our portfolio vs Consumer Price Index and found no significant correlation.

Appendices

Table 10. Health Care Services

Ticker	Name	B/P Score	E/P Score	Leverage Score	FCF Yield Score	EV/EBITDA Score	Total Score	Rank
DPLO US Equity	Diplomat Pharmacy Inc	0.68	0.00	0.85	4.17	0.00	1.14	1
MD US Equity	MEDNAX Inc	1.42	1.93	-0.23	1.16	0.00	0.85	2
BIOS US Equity	Option Care Health Inc	0.13	0.00	0.00	-1.35	5.01	0.76	3
CVS US Equity	CVS Health Corp	1.36	1.43	0.71	0.68	-0.59	0.72	4
DVA US Equity	DaVita Inc	-0.56	0.67	1.86	0.32	-0.82	0.29	5
CI US Equity	Cigna Corp	1.22	0.26	0.37	0.24	-0.62	0.29	6
TVTY US Equity	Tivity Health Inc	0.93	0.84	-1.08	0.69	-0.53	0.17	7
RCM US Equity	R1 RCM Inc	0.00	0.00	1.34	-0.88	-0.10	0.07	8
PINC US Equity	Premier Inc	0.01	0.00	-1.17	2.16	-0.74	0.05	9
LH US Equity	Laboratory Corp of America Hol	0.32	0.31	0.12	-0.13	-0.62	0.00	10
DGX US Equity	Quest Diagnostics Inc	0.16	0.28	-0.08	-0.09	-0.62	-0.07	11
RDNT US Equity	RadNet Inc	-0.95	-1.30	3.92	-2.33	-0.71	-0.27	12
LHCG US Equity	LHC Group Inc	-0.10	-0.74	-0.95	-0.64	0.00	-0.48	13
PRSC US Equity	Providence Service Corp/The	0.13	-0.74	-1.20	-0.63	-0.07	-0.50	14
ADUS US Equity	Addus HomeCare Corp	-0.06	-0.99	-1.11	-0.86	0.48	-0.51	15
CRVL US Equity	CorVel Corp	-1.06	-0.55	0.00	-0.47	-0.46	-0.51	16
CHE US Equity	Chemed Corp	-1.26	-0.62	-0.97	-0.46	0.09	-0.65	17
AMED US Equity	Amedisys Inc	-1.16	-0.77	-1.18	-0.43	0.29	-0.65	18
GH US Equity	Guardant Health Inc	-1.21	0.00	-1.20	-1.14	0.00	-0.71	19

Table 11. Health Care Facilities

Ticker	Name	B/P Score	E/P Score	Leverage Score	FCF Yield Score	EV/EBITDA Score	Total Score	Rank
ACHC US Equity	Acadia Healthcare Co Inc	2.46	0.47	-0.49	0.51	2.78	1.15	1
THC US Equity	Tenet Healthcare Corp	0.00	0.99	4.18	0.81	-0.49	1.10	2
BKD US Equity	Brookdale Senior Living Inc	0.81	0.00	2.04	-0.11	-0.60	0.43	3
HCA US Equity	HCA Healthcare Inc	0.00	0.82	0.00	0.75	-0.61	0.19	4
UHS US Equity	Universal Health Services Inc	0.01	0.67	-1.00	0.71	-0.35	0.01	5
PNTG US Equity	Pennant Group Inc/The	0.00	0.00	0.00	0.00	0.00	0.00	6
SEM US Equity	Select Medical Holdings Corp	-0.81	0.31	0.01	0.79	-0.39	-0.02	7
NHC US Equity	National HealthCare Corp	0.88	-0.32	-1.51	0.64	-0.37	-0.14	8
EHC US Equity	Encompass Health Corp	-1.27	-0.04	-0.46	0.60	-0.06	-0.25	9
HNGR US Equity	Hanger Inc	0.00	-1.57	0.00	0.59	-0.48	-0.29	10
ENSG US Equity	Ensign Group Inc/The	-0.62	-0.11	-1.27	0.56	-0.36	-0.36	11
USPH US Equity	US Physical Therapy Inc	-1.46	-1.23	-1.51	0.61	0.67	-0.58	12
CYH US Equity	Community Health Systems Inc	0.00	0.00	0.00	-6.47	0.26	-1.24	13

Table 12. Managed Health Care

Ticker	Name	B/P Score	E/P Score	Leverage Score	FCF Yield Score	EV/EBITDA Score	Total Score	Rank
MGLN US Equity	Magellan Health Inc	0.71	-1.96	0.06	2.96	-0.26	0.30	1
HQY US Equity	HealthEquity Inc	-1.03	-1.44	0.00	-0.75	3.96	0.15	2
HUM US Equity	Humana Inc	-0.90	-0.23	0.18	1.53	-0.42	0.03	3
ANTM US Equity	Anthem Inc	-0.39	-0.04	0.43	0.34	-0.31	0.01	4
GTS US Equity	Triple-S Management Corp	4.47	2.83	-2.30	-3.13	-1.87	0.00	5
MOH US Equity	Molina Healthcare Inc	-1.01	1.37	1.35	-0.61	-1.18	-0.02	6
UNH US Equity	UnitedHealth Group Inc	-1.05	-0.27	0.43	0.13	0.32	-0.09	7
CNC US Equity	Centene Corp	-0.05	0.33	0.15	-0.54	-0.32	-0.09	8
WCG US Equity	WellCare Health Plans Inc	-0.76	-0.59	-0.30	0.07	0.09	-0.30	9

Table 13. Health Care Technology

Ticker	Name	B/P Score	E/P Score	Leverage Score	FCF Yield Score	EV/EBITDA Score	Total Score	Rank
HMSY US Equity	HMS Holdings Corp	0.33	3.72	-0.93	4.30	-0.45	1.39	1
CHNG US Equity	Change Healthcare Inc	2.82	0.00	0.00	0.00	0.00	0.56	2
INOV US Equity	Inovalon Holdings Inc	-0.35	-2.95	3.99	0.80	0.76	0.45	3
HSTM US Equity	HealthStream Inc	0.63	-0.77	0.00	2.04	-0.30	0.32	4
TDOC US Equity	Teladoc Health Inc	-1.02	0.00	-0.60	-0.56	0.00	-0.44	5
TRHC US Equity	Tabula Rasa HealthCare Inc	-0.79	0.00	-0.70	-3.08	0.00	-0.91	6
INSP US Equity	Inspire Medical Systems Inc	-1.62	0.00	-1.77	-3.50	0.00	-1.38	7

Table 14. Health Care Equipment & Supply

Ticker	Name	B/P Score	E/P Score	Leverage Score	FCF Yield Score	EV/EBITDA Score	Total Score	Rank
NTUS US Equity	NATUS MEDICAL INC	1.36	1.41	-1.38	1.97	5.00	1.24	1
ITGR US Equity	INTEGER HOLDINGS CORP	2.15	2.36	0.64	1.91	-0.84	0.97	2
HRC US Equity	HILL ROM HOLDINGS INC	0.02	1.05	2.90	1.64	-0.77	0.84	3
BDX US Equity	BECTON DICKINSON	0.80	2.12	0.79	1.22	-0.73	0.78	4
ZBH US Equity	ZIMMER BIOMET HOLDINGS INC	1.60	1.31	0.38	1.19	-0.55	0.68	5
HOLX US Equity	HOLOGIC INC	-0.38	0.63	2.20	1.56	-0.62	0.55	6
IART US Equity	INTEGRA LIFESCIENCES HOLDINGS CORP	0.48	1.25	1.01	0.65	-0.64	0.53	7
PODD US Equity	INSULET CORP	-1.87	-2.48	7.01	-0.82	0.82	0.50	8
MDT US Equity	MEDTRONIC PLC	1.06	1.45	-0.58	1.37	-0.78	0.21	9
SYK US Equity	STRYKER CORP	-0.56	0.99	0.54	0.76	-0.69	0.11	10
DHR US Equity	DANAHER CORP	0.81	0.37	-1.11	1.19	-0.73	0.05	11
BAX US Equity	BAXTER INTERNATIONAL INC	-0.31	1.28	-0.78	0.84	-0.76	0.01	12

Table 15. Biotechnology

Ticker	Name	B/P Score	E/P Score	FCF		EV/EBITDA Score	Total Score	Rank
				Leverage Score	Yield Score			
PDLI US Equity	PDL BIOPHARMA INC	3.44	3.35	-0.48	0.53	-0.86	1.20	1
ARNA US Equity	ARENA PHARMACEUTICALS INC	0.20	4.40	-0.54	1.39	-1.03	0.88	2
CELG US Equity	CELGENE CORP	-0.62	-0.20	2.01	0.94	-0.94	0.24	3
GILD US Equity	GILEAD SCIENCES INC	-0.38	0.23	0.40	0.93	-0.89	0.06	4
AMGN US Equity	AMGEN INC	-0.78	-0.51	1.55	0.85	-0.92	0.04	5
BIIB US Equity	BIOGEN INC	-0.32	0.65	-0.25	0.99	-0.98	0.02	6

Table 16. Pharmaceuticals

Ticker	Name	B/P Score	E/P Score	Leverage Score	FCF Yield Score	EV/EBITDA Score	Total Score	Rank
PBH US Equity	PRESTIGE CONSUMER HEALTHCARE INC	0.56	1.37	0.50	1.14	4.74	1.66	1
INVA US Equity	INNOVIVA INC	-0.69	5.17	1.62	1.65	-2.13	1.13	2
MYL US Equity	MYLAN NV	2.95	1.42	-0.23	1.48	-1.61	0.80	3
ZTS US Equity	ZOETIS INC CLASS A JAZZ	-1.26	-1.42	2.41	0.81	2.06	0.52	4
JAZZ US Equity	PHARMACEUTICALS PLC	-0.05	2.34	-1.05	1.23	-1.34	0.23	5
PRGO US Equity	PERRIGO PLC SUPERNUS	1.57	0.09	-1.06	0.89	-0.57	0.18	6
SUPN US Equity	PHARMACEUTICALS INC	0.23	2.45	-0.83	1.24	-2.38	0.14	7
AMPH US Equity	AMPHASTAR PHARMACEUTICALS INC	0.22	-2.77	-1.70	0.72	3.91	0.08	8
LLY US Equity	ELI LILLY	-1.31	-0.22	-0.19	0.84	1.02	0.03	9

Table 17. Life Sciences and Services

Ticker	Name	B/P Score	E/P Score	Leverage Score	FCF		EV/EBITDA Score	Total Score	Rank
					Yield Score	Score			
SYNH US Equity	SYNEOS HEALTH INC CLASS A	5.35	1.62	2.85	3.59	-2.42	2.20	1	
BIO US Equity	BIO RAD LABORATORIES INC CLASS A	4.29	-3.16	-3.20	2.42	7.70	1.61	2	
TMO US Equity	THERMO FISHER SCIENTIFIC INC	0.27	0.24	0.78	2.99	-1.54	0.55	3	
MEDP US Equity	MEDPACE HOLDINGS INC	0.66	1.44	-3.02	5.71	-2.10	0.54	4	
PRAH US Equity	PRA HEALTH SCIENCES INC	-1.40	1.17	3.12	1.75	-2.13	0.50	5	
WAT US Equity	WATER CORP	-3.65	2.66	1.09	2.97	-1.90	0.23	6	

8: References

- Ang, Andrew, Marie Brière, and Ombretta Signori. 2012. "Inflation and Individual Equities." *Financial Analysts Journal*, Vol. 68, No. 4 36-55.
- Bekaert, Geert, and Xiaozheng Wang. 2010. "Inflation Risk and the Inflation Risk Premium." *Economic Policy*, vol. 25, no. 64 755-806.
- Blanchard, Olivier J. 1982. "Price Desynchronization and Price Level Inertia." *NBER Working Paper* 900.
- Bodie, Z. 1976. "Common Stocks as a Hedge Against Inflation." *Journal of Finance* 459-470.
- Bonne, George, Leon Roisenberg, Roman Kouzmenko, and Peter Zangari. June 2018. *MSCI INTEGRATED FACTOR CROWDING MODEL*. MSCI Inc.
- Boudoukh, Jacob, and Matthew Richardson. 1993. "Stock Returns and Inflation: A Long-Horizon Perspective." *The American Economic Review*, Vol. 83, No. 5 1346-1355.
- Branch, Ben. 1974. "Common Stock Performance and Inflation: An International Comparison." *The Journal of Business*, Vol. 47, No. 1 48-52.
- Fama, Eugene F., and James D. MacBeth. 1974. "Test of the Multiperiod Two-Parameter Model." *Journal of Financial Economics* 1 43-66.
- Jennings, William W., Steve P. Peter, and C. Brian Payne. 2009. "Do Health Care Investments Hedge Health Care Liabilities?" *The Journal Of Investing* 7.
- Lieberthal, Robert D. 2016. "Hedging Medical Spending Growth: An Adaptive Expectation Report." *Appl Finance Account* 15.
- Lintner, John. 1973. "Inflation and Common Stock Prices in a Cyclical Context." *The New Realities of the Business Cycle* 23-36.
- Payne, Brian C. 2010. "TWO ESSAYS ON HEALTH CARE COSTS AND ASSET RETURNS." *Dissertations, Theses, and Student Research from the College of Business* 9.
- Reilly, Frank K., Glenn L. Johnson, and Ralph E. Smith. 1970. "Inflation, Inflation Hedges, and Common Stocks." *Financial Analysts Journal*, Vol. 26, No. 1 104-110.
- Sadorsky, Perry. 2001. "Risk factors in stock returns of Canadian Oil and Gas Companies." *Energy Economics*, vol. 23 17-28.
- Services, Centres for Medicare and Medical. 2019. *National health expenditure data*. Comp. Centers for Medicare and Medical Services.
- Statistics, Bureau of Labor. 2019. *Consumer Price Index: Medical Care*. 24 April.
- Statistics, U.S Bureau of Labor. 2019. *Consumer Price Index for All Urban Consumer: All Items in U.S. City Average*. 11 December.