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Investing long-run relationships in the stock market

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Abstract

This thesis examines the inflation hedging ability of U.S. individual stocks. We use daily U.S. CPI and stock prices from S&P 500 benchmark index for the period August 2008 to August 2015. We construct portfolios based on long-run (Q1 and Q2) and short-run (Q3 and Q4) relationships of stock prices with respect to the US consumer prices and examine their inflation hedging ability. The empirical results suggest that portfolios with stocks which have shown a significant cointegration relationship have better inflation hedging abilities. Furthermore, the four factor model of Fama and French shows that the best inflation hedgers tend to be growth stocks. Sectoral analysis of the S&P 500 index reveals that stocks which outperform inflation tend to be drawn from Industrial sector.

Keywords: Stock prices, Nonstationary time series, cointegration, hedging inflation, generalized Fisher effect, inflation, portfolio, diversification.

1. Introduction

Inflation is defined as a rise in the general price level. The global economy has experienced high discrepancies in the level of inflation since 2008. Since they, the U.S. inflation declined steadily, while reached negative values after twenty years of inflation stability. The increase in government deficits and debt levels, dollar weakness, expansive monetary policies, and rising commodity prices as a result of emerging market demand suggest an increased probability of a potential inflation surge. A rise in unexpected inflation would cause a decrease in real returns of securities according to Fisher hypothesis. In this respect, investors may wish to secure the value of their investment by diversifying their assets, by purchasing stocks which possess good inflation hedge abilities.

The basic theoretical concept of our analysis is attributed to Irving Fisher (1930) who posited that the nominal interest rate fully reflects the available information concerning the possible future values of the rate of inflation. This hypothesis, known as the "Fisher effect", postulates that a nominal interest rate in any period equal to the sum of the real interest rate and the expected rate of inflation. It has received wide acceptance among economists and has played an important role in monetary theory, finance, and in many empirical studies. The "Fisher effect" can generalized to all assets in efficient markets (Bodie, 1976). It is therefore of importance, to examine whether inflation risk can be easily hedged in financial markets and more specifically in the U.S. financial market.

Many investors prefer stock investments in order to diversify their portfolios and protect their wealth against inflation. Unlike other real assets, stock investments are characterized by high liquidity and transparency, and generally provide good inflation hedging properties. Many empirical studies establish that inflation has a negative short run effect on stock returns but on the long-run they report a positive, Fisher effect. The long-run Fisher hypothesis into stock markets implies a positive, one-to-one relationship between stock returns and inflation (Anari and Kolari, 2001). Thus, in a competitive market stock returns may serve as a hedge against inflation.

There are too many types of asset classes which can provide an inflation protection in financial markets. We briefly outline the major asset classes and the key theories proposed to explain their relationship with inflation.

One branch of literature studies the role of cash as hedge. Irving Fisher's theory of interest rates, in its purest form, assumes that the real interest rate is independent of expected inflation and constant over time. If this hypothesis holds, would mean that short term debt instruments such as treasury bills, called cash, have a perfect hedging ability against inflation in the absence of inflationary shocks. This relationship is more likely to hold over the long run period. However, is often used to describe the behavior of short-term interest rates. Attie and Roach (2009) find that the coefficient on the level of inflation is lower than unity while the coefficient on the change of inflation is negative and statistically significant. This suggests that, following an increase in the rate of inflation, the 12-month return on short-term cash instruments declines. Furthermore, for the long-term they claimed that cash returns do increase in response to an inflation shock, but the response is gradual and less than full. However, cash returns are to a large extent determined by monetary policy and the real interest rate targeted by policymakers.

Another branch of literature studies bonds hedging ability. There is a strong relationship between the price and expected return on bonds, short-term interest rates, and inflation. Fisher's hypothesis predicts a direct link between expected inflation and bond prices. Bonds that pay nominal coupons and principal repayments should be negatively related to expected inflation over the mature the bond. Attie and Roach (2009) confirm the above theory for bonds and postulate that returns are negatively affected by an increase in the rate of inflation since 1973. For a 1 percent increase in the rate of inflation over a one-year period, the nominal annual return on bonds declines by about 1⅓ percent on a broad U.S. Treasury Bill. Long-term Treasury bonds are found to be the worst performing asset class in the immediate aftermath of an inflation shock as yields increase. Briere and Signori (2013) find that the inflation linked bonds are the most preferable assets to hedge against inflation. Inflation linked bonds typically issued with long maturities in excess of 5 years, while provide investors an asset with a fixed long-term real yield that is free from higher than anticipated inflation. In the same study, nominal bond returns are negatively correlated with inflation, especially in the short run.

There are also alternative asset classes that can be considered as inflation hedgers. One asset class is the real estate, which may rely on the same category with equities and bonds, by discounting the expected future stream of cash flows, using a required rate of return. Because real estate represent claims to real assets, should

provide an effective hedge against inflation. The other alternative category is the commodities. The volatility in commodity prices has triggered researcher's attention, in the analysis of inflation-hedging properties of this category. Overall, the research provides quite strong evidence that commodities provide effective protection against inflation. Briere and Signori (2012) find that real estate, during the period 1973 to 1990, is negative correlated with inflation both in short and long term horizon and commodities are positive correlated with inflation in both the periods. On the other hand, in the second sample period (1991-2010) both real estate and commodities have correlation close to zero with inflation, while in the long term real estate has positive correlation in contrast to commodities which are negatively correlated with inflation.

Plenty of studies have examined the inflation hedging abilities of diversified portfolios. Diversified portfolios can be a mix of cash, bonds, real estate, commodities and equities which can be from different countries or can be from domestic market. Furthermore, the percentage of each asset in every portfolio can vary when the investor's target or inflation change.

Last but not least of the asset classes are equities. Conventional finance theory holds that equities should provide an effective hedge against inflation. There have been many empirical and theoretical studies on the relationship between inflation and the return of risky assets. Thus far, the role of equities as an inflation hedge may not be answered concisely. During periods with high inflation, real returns from stocks are greater than those of other asset classes but, the empirical evidence on the inflation hedging ability of stocks is limited.

Despite the overall stock market may be a poor inflation hedge, companies in certain sectors or with certain characteristics may have better inflation hedging properties than other companies. Many studies focused on whether portfolios of individual stocks that have certain characteristics can adequately hedge inflation risk. Portfolios of stocks whose returns covary strongly with inflation can provide a much better inflation hedge than the aggregate market. Ang, Briere and Signori (2012) analysis focuses on the construction of portfolios of individual stocks with hedging abilities. To measure the inflation hedging ability, they compute stock-level inflation betas and allocate stocks into portfolios on the basis of inflation betas over the full sample. They use the beta of a stock return with respect to inflation as a measure of individual securities inflation hedging abilities.

Different kind of equities could offer contrasted inflation hedging abilities. The majority of analyzes has been focused on stock market indexes and their relationship with inflation. The overall market assumed to be a poor inflation hedge, but on the other hand companies from specific industry sectors and with some special characteristics may provide stronger long run hedging properties. Some of the sectors, from which equities that outperform inflation are derived, tend to be the energy and the industrial sectors (Bampinas and Panagiotidis, 2015)

The empirical literature reports two alternatives methodologies that have been used in order to examine the inflation hedging abilities of common stocks, from a long term perspective. First, the regressions of long holding period stock returns on inflation using long span data (Boudoukh and Richardson, 1993) and second, the cointegration of stock prices and consumer prices (Anari and Kolari, 2001; Alagidede and Panagiotidis, 2010). Both of the methodologies are shown to derive results that provide a positive long run relationship between stock prices and consumer prices (inflation) with estimated coefficients that are in line with the "Generalized Fisher effect".

The starting point for portfolio risk management in practice focus on the correlation analysis of returns of individual stocks or indexes. The use of returns in correlation analysis, requires the differentiation of the price levels, thus any long-term trends in the price data is excluded in standard risk return model. Correlation reflects comovements in returns, which are liable to great instabilities over time so, it is considered as a short term measure (Alexander, 1999). On the other hand, cointegration has emerged as a powerful technique for investigating common trends in multivariate time series and for testing both short-run and long-run dynamics in a system. Within the Generalized Fisher effect framework, we investigate the hedging ability of common stocks that have shown significant cointegration relationship with consumer price index. Cointegration measures long-run commovements in prices which may occur even through periods. Methodologies which are based on cointegration may be more efficient in the long term. As a long term horizon is considered a period over 5 years at least.

In several empirical studies at the short term horizon there is a negative relation between inflation and common stocks returns. As a result, the literature has moved into investigating the long term horizon hedging abilities of common stocks. In addition, we should be aware of the fact that many investors have long term

horizons. For these investors, the question of inflation protection via stock investments is less about annual correlation and performance and more about the fundamental assurance that, over the long term, these investments earn returns that exceed the inflation rate and, thus, protect their purchasing power.

In this thesis, we focus on the inflation hedging abilities of asset classes and especially on the common stock hedging abilities for short and long-term horizons. We follow the "Generalized Fisher effect" hypothesis, and we analyze common stocks with or without a cointegration relationship with consumer price index and examine their hedging abilities. We use the Engle-Granger cointegration procedure for its simplicity and its efficacy for a seven year period from 2008 to 2015. We construct four in-sample portfolios which include individual common stocks classified according to their cointegration abilities and their inflation betas over short and long-run horizons. Furthermore, we construct ten (10) sectoral portfolios, one for every sector, and we analyze which sectors provide a strong comovement with consumer prices (inflation).

Our analysis postulates that there is a positive relationship between common stocks and consumer prices in short and long run horizons. The inflation hedging abilities of every from the four (Q1, Q2, Q3, Q4) portfolios varies but none of them exceeds unity. This indicates that the portfolios are partial inflation hedgers in the short and long term. The portfolio which consist of individual common stocks which exhibit a cointegration relationship with consumer price index (Q1), has positive long run inflation betas. Q1 has inflation beta of 0.26 the biggest from all other portfolios with the lowest price of near to zero (0.04) estimated for Q2, the portfolio which includes common stocks with no cointegration relationship with CPI. The benchmark S&P 500 index presents the lowest inflation beta and it is close to zero (0.02). In addition, classification of common stocks into sectoral portfolios indicate that the Industrial sector has the highest inflation beta (0.32), closely followed by Utilities with a beta coefficient estimate of (0.31).

This thesis is structured in the following way. The literature is reviewed in Section 2. The next Section will discusses the data, stationarity tests and the cointegration procedure. Section 4 describes the empirical model and the portfolio construction. The empirical results are presented in Section 5. We provided conclusions and final remarks in Section 6.

2. Literature review

Since Irving Fisher (1930) hypothesis there are several empirical studies which examines the relationship between inflation and stock returns and they document a positive relation in various time periods and in different financial markets. In this section we make an overview of the most important research which take place over this time period and we analyze their results.

A branch of the literature argues that the Fisher hypothesis is an equilibrium hypothesis expected to hold in the long-run. Boudoukh and Richardson (1993) uses, long spam annual data for their empirical analysis on inflation, stock returns, and short-term and long-term interest rates. Their sample period extends from 1802 to 1990, about 180 years. They focus their analysis on the different empirical implications over short and long horizons.

In their ex-post analysis about the relationship between stock returns and inflation, they regress one-year stock returns on one-year inflation and five-year stock returns on five-year inflation. They used ordinary least squares (O.L.S) to estimate each equation and then using the variance-covariance matrix for the normal equations, calculate the correlation between the estimators. They separate the data in three sample periods which are: i) 1802-1990 and two sub periods ii) 1870-1990 and iii)1914-1990. For the overall sample i), the regression coefficient of five-year stock returns on the contemporaneous five-year inflation rate is significantly positive and is equal to 0.52, with a standard error 0.17. On the other hand the regression coefficient of one-year stock returns on one-year inflation rate is positive but close to zero and equals to 0.07. For the two sub periods (ii) and (iii) the short-run coefficient equals to 0.13 and 0.09, respectively. In contrast, over long holding periods, stocks appear to have a more positive relation with inflation. The long-run coefficient equals to 0.46 and 0.43, respectively. The standard errors of the estimates, however, tend to be larger for the ii) 1870-1990 sub period but not for the iii) 1914-1990. The coefficients on both short and long term inflation in ex post analysis are significantly different than one. All results of their ex-post analysis for the three sample periods show that, in contrast to the short-horizon results, stocks seem to compensate for inflation in the long run. This analysis provides strong support for a positive relation between nominal stock returns and inflation at long horizons and near to zero relation in short horizons in the US stock market.

Ang, Briere and Signori (2012) examine the inflation hedging capabilities of S&P 500 stocks. They constructed five quintile portfolios Q1 - Q5, from the highest inflation beta to the lowest, weighted at each date by market capitalizations over the entire study period October 1989 to May 2010. The outcome of this analysis is that the portfolio Q1 has the highest inflation beta equal to 1.65 over the entire period. All the other portfolios have negative betas, which take the following values: Q2= -0.34, Q3= -1.12, Q4=-2.48 and Q5=-2.22, compared to the S&P 500's inflation beta of -0.52. They conclude that only a small subset of individual stocks, from portfolio Q1, has covaried positively with inflation. The average common stocks from the other four portfolios, have been a poor inflation hedge with negative covariance with inflation in sample.

Another study that examines the ability of common stocks as a hedge against inflation is the paper of Bodie (1976). The latter defines the difference between the mean real return on a nominal bond and the mean real return on the minimum variance portfolio as the "cost" of hedging against inflation. As inflation hedging property is defined the proportion of variance of real returns of a bond portfolio that can be reduced by using an equity portfolio. The author employs annual, quarterly and monthly data for the twenty year period from January 1953 to December 1972. These para meters were estimated under a number of different assumptions about the stochastic process generating the data. The regression results of Bodie's (1976) analysis indicate that, contrary to a commonly held belief among economists, the real return on equity is negatively related to both anticipated and unanticipated inflation, at least in the short run. This negative correlation leads to the conclusion that in order to use common stocks as a hedge against inflation one must purchase them in the short term.

In contrast to the Fisher hypothesis, or "Fisher effect", many empirical studies have shown a negative relation between inflation and common stocks returns in the US and other countries around the world (Jaffe and Mandelker, 1976). In their analysis Jaffe and Mandelker (1976) measure the return on the market as a whole by employing the Lawrence Fisher Index, which is an equally-weighted portfolio of all securities listed on the New York Stock Exchange and the Consumer Price Index (CPI) as a measure of the price level. They used monthly data from January 1953 to December 1971 and annual data for the period 1876 to 1970.

The results of the analysis from monthly data have shown that, there is a significant negative relationship between the return of the market portfolio (the Fisher index) and the rate of inflation. This suggests that the stock market is hardly a partial[1] hedge against inflation. Investors whose real wealth is diminished by high inflation can expect a lower than average return on the stock market. When the data are separated in three subperiods, the results indicate that the negative relationship holds for two of the three subperiods. Annual data analysis shows that, the coefficient of inflation is positive but lower than 1.0, suggesting that the stock market is a partial inflation hedge. Moreover, they analyze the effects of anticipated and unanticipated inflation and stock returns and conclude in favor of a negative relationship between the returns and rates of inflation over the twenty years horizon, while they find a positive relationship between the two variables over a much longer period of time.

Anari and Kolari (2001) use monthly time series of stock price indexes and goods price indexes for six industrialized countries (United States, Canada, United Kingdom, France, Germany, and Japan) from 1953 to 1998 and examine these data with cointegration methods. They use levels of stock prices and goods prices, rather than stock returns and inflation rates which eliminates crusial long-run information. Their estimates of the long-run elasticities of stock prices with respect to inflation generally exceed 1 and range from 1.04 to 1.65 for France and Japan respectively. Since the variables are in log terms, the coefficient of the natural logarithm of a goods price index (CPI) in this equation is the elasticity of stock prices with respect to goods prices. Furthermore, since stock prices and goods prices have an infinitely long memory, they also estimate the response of stock prices to a shock in goods prices over a forecast horizon of twenty years. The initial responses of stock prices in all six countries are negative and thereafter become positive and permanent. These results are consistent with many empirical studies that document negative short run but positive long run inflation hedging abilities on stock returns. Finally, they conclude

[1] If the coefficient of inflation in the regression is over 1 then we can claim that the common stock is a complete inflation hedge. If the coefficient is 0<coefficient<1 then the common stock is a partial inflation hedge. If the common stock is negative related with inflation then it has not inflation hedging ability. (Johnson, Reilly and Smith, 1971)

that the stock prices have a long memory with respect to shocks in goods prices, which implies investors should expect stocks to be a good inflation hedge over a long holding period.

Alagidede and Panagiotidis (2010) use a data set which consists of monthly stock price indices and consumer price indices (CPI) from 6 African countries: South Africa, Nigeria, Kenya, Morocco, Tunisia and Egypt, for a period from 10 years to a max of 27 years using cointegration. First, they regress stock returns on inflation to, analyze the short run relationship, and from six countries in sample, only Egypt has negative estimation. This result is in contrast with worldwide evidence of a negative relationship between stock returns and inflation. Then, they use the levels of the consumer price (CPI) and stock price indices to analyze the long run relationships. The estimated coefficients range from 0.015 to 2.264 for Tunisia and South Africa respectively. In all countries, the estimated coefficients are positive and statistically significant with the exception of Kenya and Tunisia. Since the variables are expressed in logs, the estimated coefficient in each equation shows the elasticity of changes in stock prices with respect to changes in consumer prices, or the long run generalized Fisher elasticities. This indicates a positive relationship between stock prices and consumer prices. Furthermore, they find that the time path of the response of stock prices to a shock in consumer prices exhibits a negative response at first in Egypt and South Africa, which turns positive over the long-run. These results are consistent with previous analyses of positive long run relationship between consumer and stock prices in other markets. (see e.g. Anari and Kolari, 2001).

Some studies have examined the relationships between common stocks return and the inflation for countries with different economic level. For example, they examine the emerging economies and how they react in an inflationary shock, in which is more likely to happen compared to developed countries. These economies are subject to much sharper bouts of inflation, often caused by a crisis affecting their currency or their government debt. Emerging country investors generally have a narrower range of domestic assets to choose compared to investors in developed countries. Bekaert and Wang (2010) have shown that the inflation betas from emerging economies are higher than the inflation beta of developed economies. These positive coefficients for emerging economies observed due to the Latin American countries which have experienced high inflation shocks. Briere and Signori (2013) examine the market of Brazil, using monthly returns over the time period from

January 2002 to February 2011 and document that unlike developed countries, nominal bonds and equities are good for hedging inflation and are important asset classes for the portfolio. Their work also shows that domestic assets alone are not enough to reduce the volatility of the portfolio's real return to a minimum. A total of 30% should be invested in foreign currencies, especially the US dollar and the euro, which display excellent inflation hedging qualities during bouts of inflation.

Last but not least, is a sectoral analysis from Johnson, Reilly and Smith, (1971) which use the thirty stocks of the Dow-Jones Industrial Average from 1949 to 1968. They divided the data to three inflationary periods: 1949 to 1951 (5.8% annual rate of inflation), 1955 to 1957 (3.0%), and 1965 to 1968 (3.7%). They noted that none of the common stocks has been a complete inflation hedge during all three inflationary periods tested. In general, it is argued that is quite difficult for investors to select stocks or sectors that have a good hedging ability against inflation.

3. Data

3.1 Stock prices and data

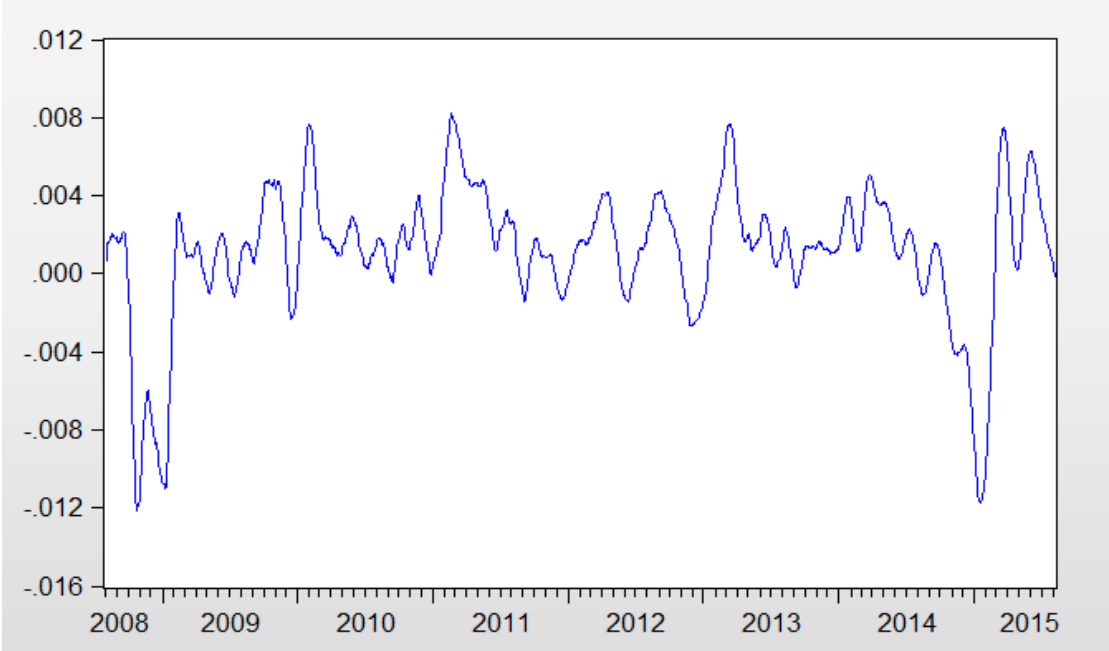
In our analysis, we use stock prices from all the companies included continuously in S&P 500 index from August 2008 to August 2015. The S&P 500 index traded on U.S. stock exchange, and covers about 75 percent of the U.S. equity market capitalization. It is one of the most commonly used equity indices, and many consider it as the benchmark index of the U.S. stock market, and a barometer for the U.S. economy. We exclude common stocks that have partial appearance in S&P 500 index. For all the individual common stocks, we obtain the daily adjusted closing prices and the market capitalization from Yahoo Finance[2]. We use, after the unit root tests, 462 individual stocks from the 511 that include in the S&P 500 index. In line with many previous studies, we use the Consumer Price Index (CPI) as our measure of the price level. Indices for consumer prices are the most frequently used indicators of inflation and reflect changes in the cost of acquiring a fixed basket of goods and services by the average consumer. On the other hand, the majority of past studies have used monthly CPI index in their analysis, we use U.S. CPI index with daily frequency, downloaded from the Billion Prices Project @ MIT[3]. To construct the daily CPI index used, prices were collected from hundreds of online retailers with large market shares, in relevant cities, that sell both offline and online in U.S. on daily basis. The data covers key economic sectors such as: food, furnishing and household products, recreation, clothing, housing, electricity, fuel and health.

Figure 1 depicts daily inflation series for the full sample period.

[2]Available at: http://finance.yahoo.com/

[3]Available at: http://bpp.mit.edu/usa/

Figure 1. *U.S. Headline daily Inflation, August 2008- August 2015*



3.2 Unit roots and stationarity tests

In order to examine for cointegration between two (or more) time series, they should be non-stationary. The relationship between stock prices and consumer prices (CPI) depends on the integration and stationarity properties of the two series. Therefore, it is necessary to present the stationarity tests, which can be done with unit root tests that are considered quite powerful and effective. Subsequently, we use the following unit root tests: i) the Augmented Dickey-Fuller (ADF) and ii) Phillips Perron (PP). We use these tests for our CPI Series and all the individual stocks.

The Augmented Dickey-Fuller (ADF) and Phillips Perron (PP) tests the null hypothesis of unit root. Tests have taken place for two cases: trend and no trend. We test both levels and first differences of individual stock prices and consumer prices (CPI). The results show that, we cannot reject the null hypothesis of a unit root for the levels of both consumer prices (CPI) and the vast majority of stock prices but on the other hand, in the first differences we can reject the null hypothesis of a unit root. Thus, the tests for stationarity and the results for unit roots have been done for 476 individual stocks of which only 14 has failed the tests. So we lead to the conclusion that consumer price (CPI) and 462 stock prices have at least one unit root (all I(1)). The unit root test results for individual stocks, CPI and S&P 500 index are given in the *Appendix* (*Figure 10).*

3.3 Cointegration

Having established the order of integration, we proceed to apply the Engle - Granger (1987) cointegration test. The concept of cointegration is directly linked to the concept of long-run equilibrium relationship between non-stationary time series. The "synchronization" of non-stationary time series is the basic idea behind the concept of the cointegration. When two or more variables move in the same direction then may exists a long-term relationship between the variables but not necessarily the same holds true in the short term. Two or more non-stationary time series is said to be cointegrated, if there is at least one linear combination of the time series, which is stationary.

There are good reasons to select Engle – Granger procedure as the preferred methodology in financial applications of cointegration. At first, it is straightforward to implement, secondly in risk management applications it is generally used the Engle - Granger criterion of minimum variance and thirdly there is a choice of depended variable in the cointegrating regressions. In Engle - Granger (1987) cointegration test we check every time for the existence of a cointegrating vector between the two variables. The method of Engle - Granger (1987) also called the method of cointegration on the basis of residuals, since they check the stationarity of the residuals of the cointegrating equation.

The Engle – Granger procedure includes the following four steps:

- We find the integration order of the two variables.
- If the integration order of the two variables is the same then we continue to the process of cointegration.
- If the two variables are integrated in the same range, estimate with the least square method the equation (cointegration equation) for the long term equilibrium relationship and take residuals.
- Apply the methodology of unit roots to test for the stationarity of the estimated residuals.

We test the cointegration relationship of individual stocks with the consumer prices (CPI). All the variables are expressed in logs and we have considered a significance level of 10%.

4. Methodology

4.1 Long-run and Short-run regression analysis

Many studies have analyzed the issue of cointegration and asset prices. As mentioned above we used the Engle - Granger (1987) procedure to test for cointegration because of its intuitive and straightforward implementation.

In our analysis, we use a simply concept of inflation hedging, the long-run inflation beta. This concept of long-run inflation hedging defined as how strongly a security's nominal price covaries with consumer prices (CPI) in the following time-series regression:

$$S_{it}=\alpha + \beta_1 CPI_t + \varepsilon_t \qquad (1)$$

where S_{it} is the daily log nominal price of a stock i, CPI_t the daily consumer price level, and ε_t the error of the regression. We use the levels of the consumer price (CPI) and stock prices to analyze the long-run relationships. In addition, we use the beta of a stock price with respect to consumer price index (CPI) as a measure of the ability that has the individual securities to hedge the inflation in long-run horizons. If β_1= 1, we can claim that the stock is a perfect hedge against inflation and we have one-to-one relationship, if β_1>0 then we have partial long-run inflation hedge and if β_1>1 stock performance superior. A negative long-run inflation beta (β_1<0) implies that an individual stock price moves to the opposite direction in the long-run when we have a price level (CPI) increase. We construct portfolio classified by long-run inflation betas and the cointegration ability of each individual stock.

Furthermore, for the portfolios constructed on the basis of their betas and cointegration relationship with CPI, we use a simple concept of portfolios hedging ability which named inflation beta. Following Ang, Briere and Signori (2012) and Bekaert and Wang (2010), we defined inflation hedging as how strongly the portfolios returns covary with actual inflation in the following time-series regression:

$$\Delta S_{pt}=\alpha + \beta_2 \Delta CPI_t + e_t \qquad (2)$$

where ΔS_{pt} is the portfolio monthly nominal return, ΔCPI_t is the monthly rate of inflation, and e_t is the residual of the regression that measures the part of the nominal

return that is not explained by inflation. Since the variables are expressed in logs and we used portfolio monthly nominal return and the monthly rate of inflation, β_2 coefficient is the short-run elasticity of portfolio returns with respect to inflation.

4.2 Portfolio construction

To construct inflation hedging portfolios, we sorted companies on the basis of their inflation betas and cointegration relationship with the consumer prices (CPI). We construct four (4) equally weighted portfolios. We select individual stocks that have a significant cointegration relationship with consumer price index (CPI) over the whole sample period to construct the first portfolio Q1. We estimated the equation (1) with OLS for the daily log nominal prices of stocks and the daily consumer prices (CPI). Portfolio Q1 consists by individual stocks that have shown a cointegration relationship and have positive long run inflation betas. On the other hand, Q2 portfolio consists by individual stocks that have shown no cointegration relationship with consumer prices index(CPI). From our long-run analysis in portfolios Q1 and Q2, we exclude individual stocks that have negative LR betas. In addition, for the short-run analysis, for the Q3 and Q4 portfolios we estimated the equation (1) with OLS but we used the daily nominal returns of individual stocks and the daily inflation rate. Using stock returns and inflation tell us only about the short-run solution. Thus, we sorted the short-run portfolios Q3 and Q4 with respect to SR inflation betas. Portfolio Q3 contains individual stocks with positive short-run inflation betas and portfolio Q4 individual stocks with negative short-run inflation betas.

We used daily data from August 2008 to August 2015, 1831 observations for each of 462 individual stocks, to construct our portfolios. For the regression analysis, we employ a robust HAC (Newey-West) covariance matrix estimator (Newey and West, 1987). Then, we calculate the monthly returns from all four portfolios as well as the portfolios inflation betas using equation (2) with monthly portfolios nominal returns and monthly inflation rates.

Furthermore, in our analysis we examine whether the inflation hedging portfolios excess returns can be described by an asset pricing model. Fama and French (1993) with their three-factor model assume that expected returns can be explained by the excess market return, a firm size factor and a value factor. The factor functions as a portfolio that designed to have a unit exposure to the factor concerned and zero exposure to all other factors. After constructing our portfolios, we then run regression

tests on portfolios sorted by inflation betas to check their Fama and French (1993) (FFC) three factor loadings and, following Carhart (1997), he also include the momentum loading in the following regression:

$$R_{pt} = \alpha_p + \beta_p MKT_t + \gamma_p SMB_t + \delta_p HML_t + \eta_p MOM_t + \varepsilon_t \quad (3)$$

where R_{pt} is the monthly excess-return of portfolio *p* over risk free rate. We used the returns of usual Fama and French (1993) (FFC) factors which include MKT_t (market excess return), SMB_t (small-minus-big firm returns), HML_t (high-minus-low book to market returns), MOM_t (winners-minus-losers returns) and monthly risk-free rates (one month Treasury bills). We obtain the data from Kenneth French's online data library[4]. We estimate standard errors and t-statistics by using the estimator in Newey and West (1987), with the number of lags equal to the recommendation in Newey and West (1994).

5. Empirical results

5.1 Portfolio analysis

In this section, we first examine how the individual stocks covary with the consumer prices (CPI) and if they have a strong relationship. This analysis reveals which stocks have provided the best long-run and short-run inflation hedges over the seven (7) years of our sample period. In our analysis, there are a few individual stocks that have been a perfect inflation hedger in long-run horizon and none of these in short-run, but on the other hand there are many of individual stocks that represented to be partial inflation hedgers both on short and long run horizons. The top perfect long-run inflation hedging stocks are the Regeneron Pharmaceuticals Inc (REGN) from Health Care sector with a beta of 1.31 followed by Broadcom Limited (AVGO) from Information Technology sector with beta of 1.22. In addition, top short-run inflation hedgers individual stocks are not perfect hedgers because they have inflation

[4] Available at: http://mba.tuck.dartmouth.edu/pages/faculty/ken.french/data_library.html

betas below 1, thus they are partial inflation hedgers. The top is General Growth Properties, Inc (GGP) from Financials sector with a beta of 0.96 followed by Tenet Healthcare Corp. (THC) from Health Care sector with a beta 0.59. We document that the Health Care sector has in both short and long run good inflation hedging abilities.

Furthermore, the best represented sectors in the long-run analysis and more specific, in portfolio Q1 with individual stocks with significant cointegration relationship, are the Financials and Industrials sectors followed by the Consumer Discretionary sector , as we observe in *Figure 2.* A market map from all the inflation hedging stocks for each sector is presented in *Figure 6* in the *Appendix* for portfolio Q1. Larger surface areas correspond to the best represented sectors and the (green) color of the rectangles denotes the best LR inflation betas. We observe that the best represented sectors are the Financials and Industrials sectors and the best long-run inflation betas are derived for the Consumer Discretionary and Utilities sectors. In Q2 portfolio with individual stocks with no cointegration relationship the sectors with the most stocks are Consumer Discretionary and Information Technologies sectors as presented in *Figure 3* and *Figure 7*.

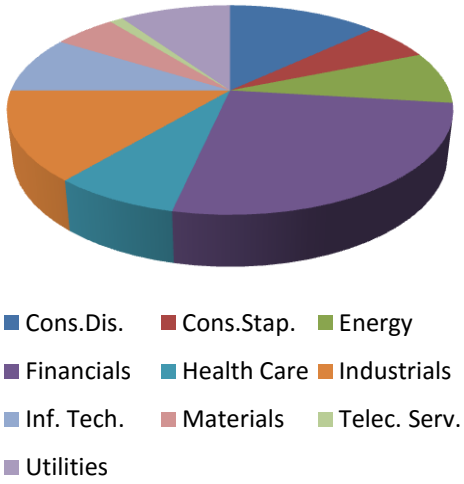


Figure 2. Q1 portfolio represented sectors.

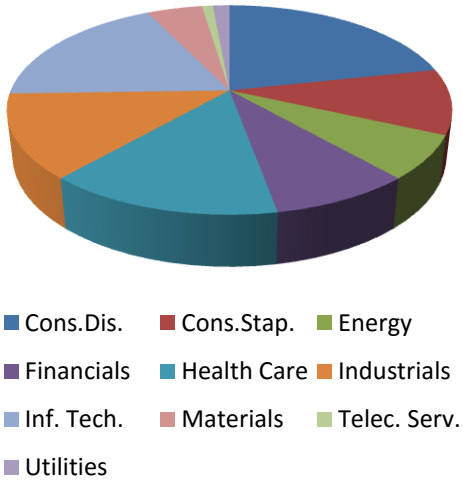


Figure 3. Q2 portfolio represented sectors.

In the short-run analysis and specifically in Q3 portfolio with positive SR inflation betas, best represented sectors are the Financials and the Consumer Discretionary sector as we see in *Figures 4*. In addition, *Figure 8* presents that the sectors with the most individual stocks are the Financials and the Consumer Discretionary and that the Materials sector with the Information Technologies and Industrials have the best short-run (SR) inflation betas in this portfolio. Last,

portfolio Q4 with negative SR inflation betas, includes individual stocks from Information Technologies, Industrials and Health Care sectors in more than 50 percentage points (%), see *Figure 5*. *Figure 9* table agrees with this finds and moreover presents that the best negative SR inflation betas comes from Utilities and Materials sectors.

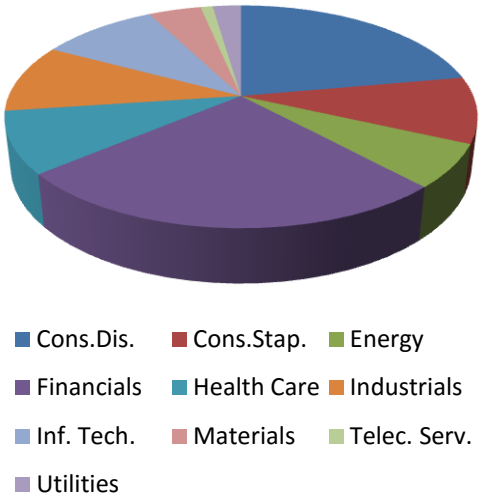


Figure 4. Q3 portfolio represented sectors.

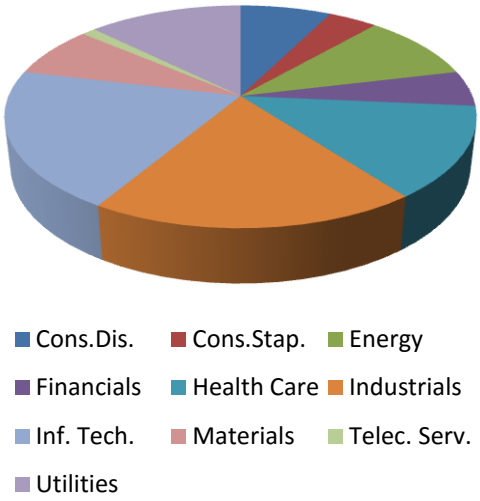


Figure 5. Q4 portfolio represented sectors.

As we can observe from portfolio analysis and *Figures 2,3,4,5* and *Figures 6,7,8,9* in *Appendix*, the main sectors in four portfolios which have the biggest number of individual stocks are the Financials, Consumer Discretionary, Industrials and the Information Technologies sector. A second portfolio analysis have shown that individual stocks with the best long-run and short-run inflation hedging ability tend to be from Materials and Information Technologies sectors followed by Utilities and Health Care sectors. These sectors are given with a (green) color in tables in *Figures 6,7,8,9* in *Appendix*.

Table 1 presents the descriptive statistics for returns of the four (4) portfolios and the S&P 500 index over the entire sample. Real returns for all the four (4) portfolios and for S&P 500 are all negative but not under of 2 percentage points (%).

More specifically, Q1 portfolio stocks, the stocks with a significant cointegration relationship with consumer price (CPI) and positive long-run inflation betas, have shown monthly annualized real return -0.82%, which is close to zero and it is the best annualized return. Q2 portfolio stocks, the stocks with no cointegration relationship with consumer price (CPI), have shown monthly annualized real return -1.06% the second worst return after the Q4 portfolio, which contains individual

stocks with negative short-run inflation betas and monthly annualized real return of -1.30% which is the worst return from the four (4) portfolios. The last portfolio Q3 that sorted with stocks which have shown positive short-run inflation betas, has monthly annualized real return -0.82% the same with portfolio Q1. The S&P 500 index have had the worst monthly annualized real return from all the portfolios and it is equal to -1.51%. Thus, stocks that have been good inflation hedgers in the short and long run have had higher (or less negative) nominal and real returns from the market index.

***Table 1**: Descriptive statistics of portfolios.*

	Q1	Q2	Q3	Q4	S&P 500
Ann.Mean (%)	-0.72	-0.96	-0.72	-1.20	-1.41
Ann.Mean real (%)	-0.82	-1.06	-0.82	-1.30	-1.51
Median (%)	-0.05	-0.13	-0.11	-0.13	-0.18
Max (%)	4.99	4.23	4.92	4.15	5.28
Min (%)	-3.42	-2.85	-3.69	-2.77	-2.85
Std.Dev. (%)	1.36	1.21	1.37	1.14	1.21
Skewness	0.70	0.85	0.70	0.93	1.28
Kurtosis	6.50	5.98	6.24	6.40	8.28
Success rate*(%)	37.65	31.76	35.29	28.24	32.94
#Obs	85	85	85	85	85

*Success rate denotes the percentage of months when nominal returns are higher than inflation.

Note that the portfolios Q1 and Q3 which includes individual stocks with good inflation hedging abilities in long and short terms respectively exhibit higher volatility than the other two (2) portfolios. Q1 and Q3 have volatilities of 1.36% and 1.37% respectively when the Q2 has 1.21%, Q4 has 1.14 the lower and the S&P 500 has volatility of 1.21%. However, the volatilities of all portfolios are, on average, low and they also exhibit low extreme risks. Skewness have had prices from 0.70 to 1.28 for Q1,Q2 and S&P 500 index, respectively, and thus we have shown a positive- right skewed distribution. Kurtosis, which is a feature of risk, ranges between 5.98 and of 6.40 for portfolios and 8.28 for the S&P 500 index, reflecting distribution tails that are fatter than normal. The portfolio's success rates (percentage of months in which a portfolio's nominal return was higher than inflation) range from 28.24% to 37.65%,

with an average of 32.94% for the S&P 500 index. The highest success rates observed in portfolios Q1 and Q3 which include individual stocks with positive inflation betas.

5.2 Portfolio inflation betas

Furthermore, we present the results of the regressions of monthly returns for each portfolio and S&P 500 index against inflation (see *Table 2*). The explanatory power of these regressions is small, as shown by the very low R^2. By construction, Q1 portfolio has inflation betas of 0.26 over the entire sample period, but this is not significant. Next portfolio is Q3 with a positive inflation beta of 0.19 followed by Q4 and Q2 portfolios with 0.12 and 0.04 inflation betas, respectively. The lower inflation

Table 2. *Regression of monthly returns on inflation for Portfolios sorted by inflation hedging ability, August 2008– August 2015.*

	Q1	Q2	Q3	Q4	S&P 500
β_2	0.26	0.04	0.19	0.12	0.02
	(1.08)	(0.15)	(0.80)	(0.78)	(0.18)
R^2	0.00	0.00	0.00	0.00	0.00

Numbers in parenthesis are the values of z-statistic.

beta has the S&P 500 index with a close to zero price of 0.02. None of the inflation betas are found to be statistically significant. These regressions have shown that the portfolios sorted by individual stocks with positive inflation betas have the best inflation hedging abilities from other portfolios and from S&P 500 index. Q1, which includes stocks with a significant cointegration relationship with consumer price (CPI) and positive long-run inflation betas, has the higher inflation beta and thus, which is in line with previous studies, document a positive long run relationship between stock prices and inflation. All portfolios are found to commove positively with inflation and be partial inflation hedgers with the Q2 portfolio and S&P 500 index to have beta values close to zero.

5.3 FFC factors

In our analysis, we examine the Fama and French (1993) (FFC) three factor loadings and, following Carhart (1997), we also include the momentum loading. *Table 3* breaks down the effects of exposure to the FFC factors for each portfolio. Q1

and Q3 portfolios stocks have the lowest -0.02% negative monthly returns over the traditional factors and the S&P 500 index has the lowest alpha which is negative -0.07% per month. For portfolios the lowest alpha is found for Q4 portfolio which contains stocks with negative inflation betas and it is equal to -0.06% per month, very close to S&P 500 index. A negative FFC alpha means that other systemic factors play a large role in explaining the differences of returns in stocks sorted by realized inflation hedging abilities. All alphas in our sample are negative but they have close to zero estimates. Market exposure is negative for all

Table 3. *Regression of monthly returns on FFC Factors for Portfolios sorted by inflation-hedging ability.*

	Q1	Q2	Q3	Q4	S&P 500
α (%)	-0.02	-0.04	-0.02	-0.06	-0.07
	(-0.12)	(-0.24)	(-0.10)	(-0.39)	(-0.43)
MKT (%)	-0.003	-0.01	-0.006	-0.01	-0.02
	(-0.06)	(-0.25)	(-0.08)	(-0.26)	(-0.28)
SMB (%)	-0.02	-0.02	-0.02	-0.009	-0.03
	(-0.31)	(-0.28)	(-0.36)	(-0.16)	(-0.46)
HML (%)	0.19**	0.13*	0.18**	0.13**	0.16**
	(2.23)	(1.99)	(2.18)	(2.03)	(2.21)
MOM (%)	0.02	0.009	0.01	0.02	0.02
	(0.90)	(0.38)	(0.52)	0.96	(0.97)
R^2	0.10	0.07	0.10	0.06	0.10

*Significant at the 10% level. **Significant at the 5% level. Newey and West (1987) adjusted t-statistics are shown in parenthesis.

the portfolios and the S&P 500 index but is close to zero and it is not statistically significant. The coefficient of the SMB factor is negative for all portfolios and S&P 500, which is consistent with the proposition that small companies have lose the ability to raise their prices when the general inflation level rises, as compared with large companies. The best inflation hedges are the largest companies. The HML coefficients are positive and significant for all the portfolios Q1 to Q4 and the S&P 500 index over the entire sample period, thus the best inflation hedges tend to be growth individual stocks. The MOM factor is insignificant although positive for all portfolios and the S&P 500 index.

5.4 Inflation hedging performance of sectors

In our analysis, we measure the inflation hedging abilities of the ten sectors of S&P 500 index, focusing on all common stocks that we used for the portfolios construction.

In this section, it is useful to examine the S&P 500's index sectors more specific and make clear the stocks that accounts for any sector. The S&P 500 index categorized by the Global Industry Classification Standard (GICS) which is an industry taxonomy developed in 1999 by MSCI and Standard and Poor's (S&P) for use by the global financial community. The GICS structure consists of 10 sectors, 24 industry groups, 67 industries and 156 sub-industries into which S&P has categorized all major public companies. Each company is assigned to a sub-industry, and to a corresponding industry, industry group and sector, according to the definition of its principal business activity.

There are ten sectors which are Materials, Utilities, Consumer Staples, Information Technologies, Energy, Health Care, Telecommunication Services, Industrials, Financials and Consumer Discretionary. More specific in Financial sector there are individual stocks from banks and insurance, diversified portfolios and real estate. Real estate will be a new sector in S&P 500 index on August 2016. Consumer Discretionary sector consist of stocks from automobiles and components, consumer durables, consumer services, media and retailing. The sector which contains stocks from industries which dealing with food, tobacco, households and personal products is the Consumer Staples sector. The Industrial sector includes individual stocks from companies which activated in capital goods, transportation , commercial and professional services. Health care equipment, pharmaceuticals, biotechnologies and life sciences contained in Health Care sector of S&P 500 index. The Information Technologies sector apart from companies stocks which main activities are software, technology hardware and semiconductors equipment. The Utilities sector contains companies such as electric, gas and water firms and integrated providers. Another sector is the Energy which is a category of stocks that relate to producing or supplying energy and includes companies involved in the exploration and development of oil or gas reserves, oil and gas drilling, or integrated power firms. The basic Materials sector is a category of stocks that accounts for companies involved with the discovery, development and processing of metals, chemical and forestry products. The last and the smaller sector is Telecommunication Services. These

companies created the infrastructure that allows data to be sent anywhere in the world. The largest companies in the sector are wireless operators, satellite companies and internet service providers.

In *Table 4* we present the results of our sectoral analysis on S&P 500 after the regression (Equation 1) of returns for each sectoral value weighted portfolio against inflation.

Table 4. *Regression of monthly returns on inflation for S&P 500 sectors, August 2008–August 2015.*

sectors	Cons.Dis.	Cons.Stap.	Energy	Financials	Health Care
β_2	-0.06 (-0.21)	0.16 (0.58)	0.15 (0.54)	0.26 (0.62)	-0.12 (-0.44)
R^2	0.00	0.00	0.00	0.00	0.00

Numbers in parenthesis are the values of z-statistic.

sectors	Industrials	Inf. Tech.	Materials	Telec. Serv.	Utilities
β_2	0.32 (1.20)	-0.01 (-0.03)	0.17 (0.38)	-0.60 (-1.54)	0.31 (1.17)
R^2	0.00	0.00	0.00	0.04	0.00

Numbers in parenthesis are the values of z-statistic.

As we see in *Table 4*, there are positive and negative coefficients for the sectors of S&P 500 index over the entire sample period. The Industrials sector has the highest inflation beta of 0.32 followed by Utilities with a lower coefficient of 0.31. These are some expected results due to the appearance of Industrial and Utilities sectors in the Q1 portfolio which includes stocks with a significant cointegration relationship with consumer price (CPI) and positive long-run inflation betas. The third best sectoral inflation beta is Financials with beta coefficient equal to 0.26. This sector is the best represented sector in the Q1 and Q3 portfolios which contains individuals stocks with positive betas. Next follow the Materials, Consumer Staples and Energy sectors with the same, on average, estimates. The other coefficients of sectoral analysis are all negative. More specifically, Information Technologies and Consumer Discretionary sectors have close to zero coefficients of -0.01 and -0.06, respectively. Health Care sector has a negative coefficient of -0.12 a rather surprising finding since two individual stocks from this sector is found to have high inflation betas in short and long run horizons. Worst sector with a high, on average, negative coefficient of -0.60 is the Telecommunication Services, a small sector in S&P 500

index. Our results agree partially with Ang, Briere and Signori (2012) analysis who find negative inflation betas for all sectors, when we find four sectors in our study, except Materials sector that is positive similar to our analysis. There is none significant coefficient in our sectoral analysis and these regressions suffers from low explanatory power because of very low R^2.

6. Conclusions

The present thesis examines the short run and long run relationships between individual stock prices and the consumer price index (CPI). We test whether common stock market investments can provide inflation hedging abilities in different horizons.

The literature has investigated the inflation hedging abilities from all the asset classes that can be used in short and long horizons, in different countries and under different circumstances. We focus on individual stocks from the S&P 500 index and US headline consumer price index (CPI) over the sample period August 2008- August 2015. In our long run analysis, we sorted individual stocks into portfolios, on the basis of their significant cointegration relationship with consumer price index and with their long run inflation betas. Portfolios Q1, Q2 are derived from our long run analysis. For short run horizon, we sorted individual stock returns with their short run inflation betas, in portfolios Q3, Q4. We applied unit root test for the integration properties of the variables which indicated that all the individual stocks, S&P 500 index and CPI are integrated order one, I(1).

The best annual real return and inflation hedging ability is found for portfolio Q1 from our long run analysis, which is constructed from stocks with significant cointegration relationship and positive long run inflation betas, (-0.82 real return and 0.26 inflation beta estimate). Second is the portfolio Q3 from short run analysis which includes stocks with positive short run inflation beta with a point inflation beta estimate of 0.19. All the annual real returns from our portfolios are found negative but they are higher from the S&P 500 market index. Portfolios that we constructed seem to be all partial inflation hedgers.

Moreover, we examine the Fama and French (1993) (FFC) factors within a regression of portfolio returns and the four factors loadings. We find negative alphas

for all portfolios and the market index, although all coefficients were close to zero while none of them is statistical significant. All the other (FFC) factors have close to zero values and are statistically insignificant except HML factor that has price ranging from 0.13 to 0.19 for Q2, Q4 and Q1, respectively. The significant HML factor loading indicates that the best inflation hedges tend to be growth stocks.

Furthermore, we classified individual stocks into ten sectoral portfolios, one for each sector of S&P 500 index. We postulate that the Industrials sector has the best inflation hedging ability, followed by Utilities sector. We found six sectors with positive relationship with inflation and four with negative. The lowest coefficient of -0.60 is found for Telecommunication Services, a rather small sector in S&P 500 index.

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8. Appendix

Figure 6. Market map of all the inflation hedging stocks for each sector and their LR inflation betas in portfolio Q1.

Figure 7. Market map of all the inflation hedging stocks for each sector and their LR inflation betas in portfolio Q2.

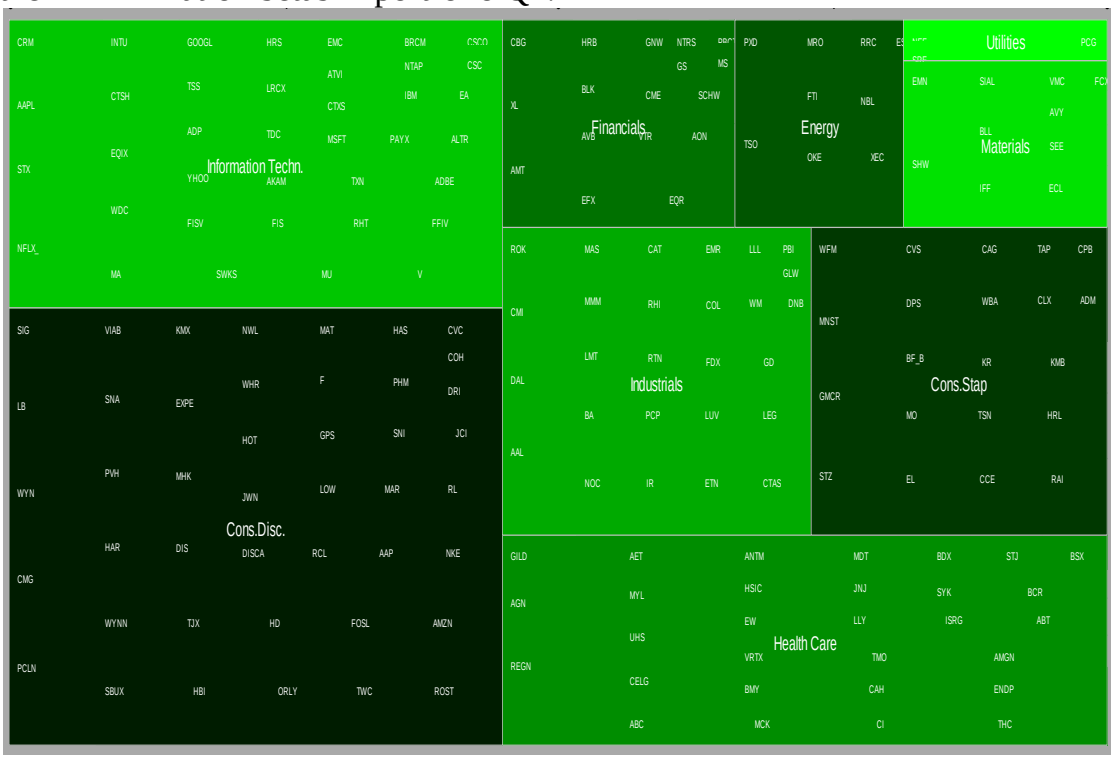

Figure 8. Market map of all the inflation hedging stocks for each sector and their LR inflation betas in portfolio Q3.

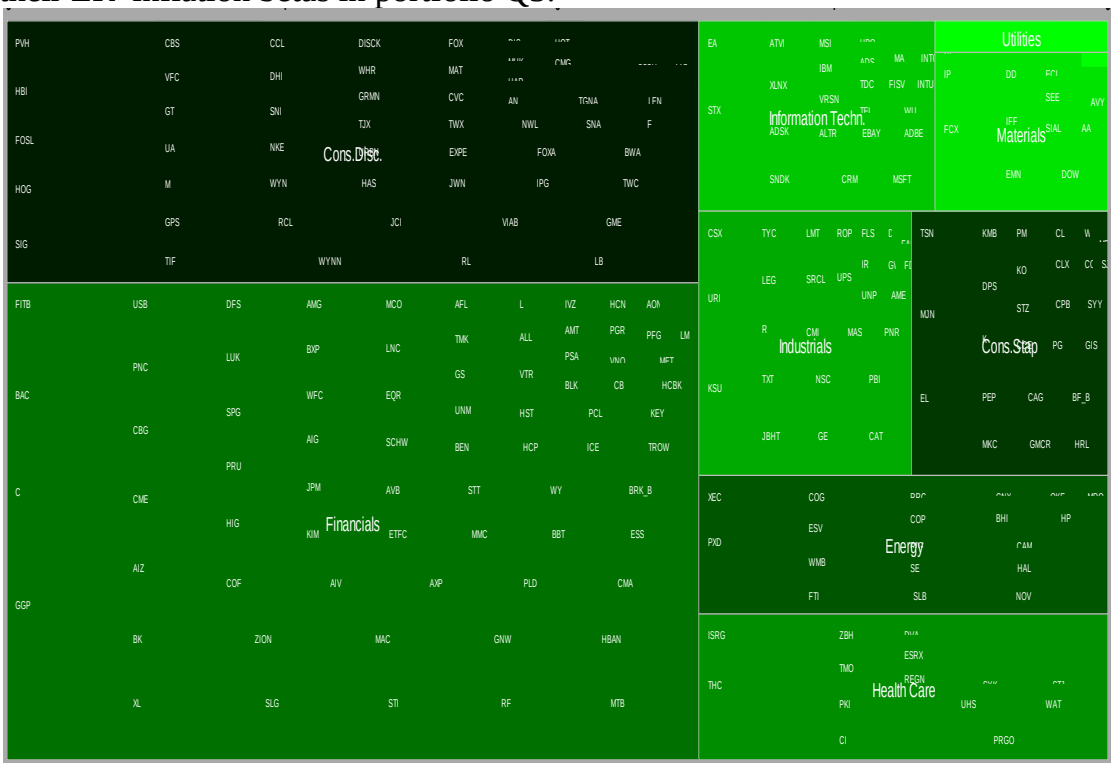

Figure 9. Market map of all the inflation hedging stocks for each sector and their LR inflation betas in portfolio Q4.

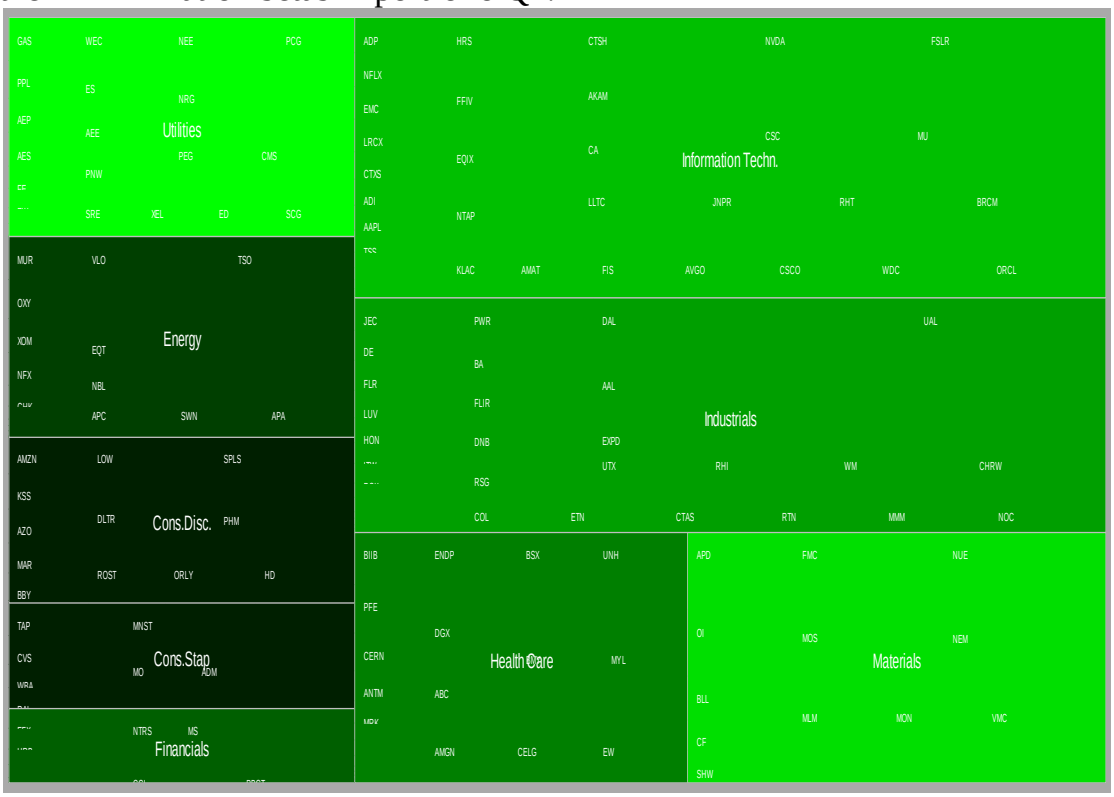

Figure 10. Unit root tests in levels and first differences in stock prices.

	Levels				1st Differences			
Tests	ADF		PP		ADF***		PP***	
Stocks	Intercept	Trend	Intercept	Trend	Intercept	Trend	Intercept	Trend
AAP	-0.41	-3.72**	-0.29	-3.56**	-43.68	-43.67	-43.79	-43.78
AMZN	-0.92	-3.03	-0.91	-2.91	-41.62	-41.60	-41.67	-41.66
AN	-0.38	-2.79	-1.55	-3.04	-13.75	-13.74	-38.82	-38.81
AZO	-0.55	-3.14*	-0.49	-2.93	-43.74	-43.72	-43.72	-43.71
BBBY	-1.86	-2.48	-1.81	-2.39	-43.46	-43.48	-43.48	-43.50
BBY	-2.13	-2.12	-2.18	-2.17	-39.88	-39.87	-39.89	-39.88
BWA	-1.22	-2.65	-1.18	-2.54	-41.32	-41.31	-41.34	-41.33
CBS	-0.96	-3.16*	-0.94	-3.13	-41.36	-41.34	-41.35	-41.34
CCL	-1.41	-3.38*	-1.23	-3.19*	-41.31	-41.32	-41.40	-41.40
CMCSA	-0.09	-4.07**	-0.04	-4.54***	-31.72	-31.73	-45.00	-45.01
CMCSK	-0.22	-4.89***	0.05	-4.68***	-30.15	-30.17	-42.90	-42.91
CMG	-0.74	-2.05	-0.74	-2.03	-40.38	-40.37	-40.38	-40.37
COH	-1.65	-1.31	-1.78	-1.40	-21.36	-21.39	-40.17	-40.20
CVC	-2.16	-3.00	-1.39	-2.19	-39.32	-39.32	-39.32	-39.31
DHI	-0.96	-3.97**	-1.63	-4.71***	-23.08	-23.07	-39.93	-39.92
DIS	0.19	-3.48**	0.08	-3.71**	-31.16	-31.18	-43.83	-43.83
DISCA	-1.60	-1.56	-1.58	-1.10	-43.49	-43.51	-44.21	-44.23
DISCK	-1.77	-1.46	-1.82	-0.94	-39.88	-39.91	-40.48	-40.67
DLTR	-0.86	-2.46	-0.80	-2.13	-44.05	-44.05	-44.32	-44.33
DRI	-1.16	-3.34*	-1.16	-3.37*	-40.53	-40.51	-40.54	-40.52
EXPE	-0.77	-3.48**	-0.64	-3.40*	-40.53	-40.53	-40.60	-40.60
F	-0.60	-1.01	-0.99	-1.19	-24.50	-24.49	-36.51	-36.51
FOSL	-1.36	-1.18	-1.26	-0.78	-39.88	-39.89	-39.88	-39.89
FOX	-0.92	-3.73**	-0.79	-3.53**	-12.27	-12.29	-42.46	-42.45
FOXA	-0.92	-4.20***	-0.76	-3.92**	-43.46	-43.45	-43.73	-43.71
GME	-1.46	-3.05	-1.32	-2.95	-41.91	-41.92	-42.01	-42.03
GPC	-0.88	-3.91**	-0.84	-3.81**	-41.82	-41.81	-41.95	-41.94
GPS	-1.26	-2.05	-1.31	-2.44	-21.92	-21.91	-43.53	-43.52
GRMN	-1.33	-3.49**	-1.25	-3.41*	-42.68	-42.67	-42.76	-42.75
GT	-1.74	-3.62**	-1.76	-3.63**	-40.20	-40.20	-40.26	-40.26
HAR	-0.94	-3.78**	-0.71	-3.46**	-37.68	-37.69	-37.69	-37.69
HAS	-0.14	-2.72	0.04	-2.58	-42.51	-42.53	-42.50	-42.55
HBI	-0.64	-3.20*	-0.26	-3.01	-37.47	-37.46	-37.32	-37.31
HD	-0.32	-4.21***	-0.23	-4.06**	-41.09	-41.08	-41.13	-41.12
HOG	-1.30	-3.86**	-1.23	-3.81**	-39.77	-39.77	-39.89	-39.88
HOT	-1.01	-2.37	-0.94	-2.35	-41.27	-41.26	-41.30	-41.29
IPG	-1.17	-4.35***	-1.01	-4.18	-42.95	-42.94	-43.02	-43.01
JCI	-1.54	-2.98	-1.58	-3.08	-40.29	-40.28	-40.41	-40.40
JWN	-1.14	-2.98	-1.14	-3.01	-38.61	-38.60	-38.59	-38.58
KMX	-1.18	-2.70	-1.16	-2.72	-39.45	-39.44	-39.44	-39.43
KSS	-2.39	-3.72**	-2.36	-3.68**	-40.91	-40.90	-40.91	-40.90
LB	-0.63	-2.42	-0.63	-2.43	-40.33	-40.32	-40.34	-40.32
LEN	-1.03	-4.18***	-1.13	-4.32***	-23.59	-23.58	-38.86	-38.84
LOW	-0.31	-2.89	-0.20	-2.76	-40.70	-40.69	-40.72	-40.72
M	-0.62	-4.24***	-0.61	-4.29***	-40.22	-40.21	-40.23	-40.22
MAR	-0.76	-3.26*	-0.67	-3.13	-42.15	-42.14	-42.17	-42.16
MAT	-1.11	-0.54	-1.09	-0.46	-40.80	-40.82	-40.80	-40.82
MCD	-1.30	-2.49	-0.92	-1.98	-32.49	-32.48	-45.39	-45.38
MHK	-0.41	-3.82**	-0.65	-4.11**	-39.04	-39.05	-39.50	-39.49
NKE	-0.25	-4.58***	0.11	-4.16**	-43.02	-43.02	-43.76	-43.79
NWL	-0.26	-3.45**	-0.27	-3.46**	-40.80	-40.82	-40.83	-40.84
OMC	-0.70	-4.45***	-0.60	-4.33***	-30.61	-30.61	-41.20	-41.20
ORLY	-0.56	-4.80***	-0.49	-4.64***	-43.84	-43.82	-43.90	-43.88
PCLN	-1.15	-1.71	-1.15	-1.65	-42.82	-42.82	-42.84	-42.83
PHM	-1.48	-1.81	-1.35	-2.24	-24.23	-24.24	-40.30	-40.30
PVH	-1.31	-2.38	-1.33	-2.44	-39.03	-39.01	-39.05	-39.03
RCL	-0.66	-2.84	-0.68	-2.85	-38.95	-38.96	-38.92	-38.94
RL	-1.53	-1.33	-1.49	-1.15	-28.36	-28.38	-40.20	-40.22
ROST	-0.60	-3.21*	-0.54	-3.15	-43.67	-43.66	-43.80	-43.79

SBUX	-0.59	-2.79	-0.58	-2.75	-42.52	-42.51	-42.49	-42.48
SIG	-0.86	-3.35*	-0.86	-3.39**	-42.96	-42.94	-42.83	-42.82
SNA	0.22	-4.63***	0.27	-4.60***	-40.90	-40.94	-40.92	-40.94
SNI	-0.81	-2.25	-0.73	-2.14	-29.83	-29.82	-41.38	-41.37
SPLS	-2.46	-2.66	-2.26	-2.43	-30.60	-30.60	-42.98	-42.97
SWK	-1.05	-3.16*	-1.05	-2.94	-40.93	-40.92	-41.04	-41.06
TGNA	-0.68	-2.70	-0.86	-2.90	-38.79	-38.79	-39.50	-39.49
TGT	-1.60	-3.93**	-1.47	-3.79**	-43.23	-43.21	-43.27	-43.21
TIF	-1.26	-2.76	-1.21	-2.65	-29.34	-29.33	-40.89	-40.88
TJX	-0.33	-3.24*	-0.27	-3.17*	-44.00	-43.99	-44.40	-44.34
TSCO	-0.76	-2.44	-0.72	-2.20	-41.45	-41.44	-41.82	-41.81
TWC	-0.11	-3.62**	0.07	-3.36*	-41.43	-41.43	-41.81	-41.82
TWX	0.02	-4.11***	-0.22	-4.46***	-31.22	-31.25	-44.11	-44.13
UA	-0.08	-4.32***	0.06	-4.13***	-41.02	-41.02	-41.19	-41.21
URBN	-2.53	-3.14	-2.38	-2.96	-40.39	-40.37	-40.46	-40.48
VFC	-0.04	-4.55***	0.01	-4.48***	-41.20	-41.20	-41.20	-41.21
VIAB	-1.12	-1.01	-1.09	-0.96	-31.11	-31.11	-42.98	-42.99
WHR	-0.97	-2.85	-0.97	-2.84	-41.12	-41.11	-41.12	-41.12
WYN	-0.90	-2.92	-0.70	-2.48	-36.65	-36.64	-36.65	-36.63
WYNN	-0.90	-1.99	-1.16	-2.16	-23.49	-23.48	-39.76	-39.74
YUM	-0.81	-3.69**	-0.69	-3.56**	-42.33	-42.32	-42.43	-42.42
ADM	-0.75	-2.37	-1.14	-3.04	-12.02	-12.03	-44.68	-44.67
BF_B	0.30	-4.01**	-0.10	-4.67***	-31.85	-31.87	-43.71	-43.69
CAG	0.61	-2.81	0.58	-3.11	-22.31	-30.78	-41.47	-41.49
CCE	-0.83	-2.30	-0.81	-2.26	-42.45	-42.43	-42.41	-42.40
CL	-0.74	-4.17**	-0.44	-4.22***	-44.45	-44.44	-45.10	-45.09
CLX	-0.17	-4.06**	0.18	-3.71**	-46.37	-46.36	-47.59	-47.63
COST	-0.05	-4.27***	0.10	-4.11**	-43.89	-43.89	-44.00	-44.01
CPB	-0.38	-3.09	-0.29	-3.01	-40.85	-40.84	-41.03	-41.07
CVS	0.39	-3.00	0.70	-3.19*	-45.15	-45.19	-45.75	-45.92
DPS	-0.72	-2.89	-0.73	-2.96	-42.18	-42.16	-42.13	-42.12
EL	-0.59	-1.91	-0.57	-1.89	-40.99	-40.97	-40.98	-40.97
GIS	-0.21	-3.67**	0.14	-3.22*	-31.63	-31.64	-44.23	-44.26
GMCR	-1.92	-1.52	-1.93	-1.54	-39.92	-39.95	-39.92	-39.95
HRL	0.03	-3.97**	0.36	-4.01**	-31.18	-31.18	-42.85	-42.84
HSY	-0.63	-1.84	-0.80	-2.06	-31.47	-31.46	-44.80	-44.79
K	-0.25	-3.09	-0.43	-3.33*	-32.68	-32.70	-43.84	-43.85
KMB	0.21	-3.22*	-0.11	-3.74**	-31.20	-31.21	-47.15	-47.17
KO	-1.12	-2.93	-0.91	-2.91	-44.95	-44.94	-46.12	-46.11
KR	1.35	-1.78	1.46	-1.75	-45.03	-45.19	-45.05	-45.32
MDLZ	0.22	-4.39***	0.41	-4.18***	-43.77	-43.79	-43.87	-43.93
MJN	-2.46	-2.74	-2.82*	-2.35	-40.43	-40.47	-42.03	-42.53
MKC	0.25	-3.03	-0.08	-3.45*	-30.93	-30.94	-44.55	-44.55
MNST	-0.71	-3.26*	-0.52	-2.85	-30.31	-30.30	-43.81	-43.79
MO	0.38	-3.54**	0.48	-3.73**	-33.59	-33.61	-44.59	-44.60
PEP	-0.35	-4.22***	-0.18	-4.05**	-43.39	-43.39	-43.58	-43.58
PG	-0.49	-2.75	-0.67	-3.45**	-31.81	-31.80	-45.28	-45.27
PM	-0.97	-1.85	-0.96	-2.12	-31.44	-31.44	-42.80	-42.79
RAI	0.52	-3.48**	0.81	-3.77**	-31.55	-31.57	-42.35	-42.40
SJM	-1.23	-2.78	-1.21	-2.64	-41.19	-41.19	-41.36	-41.38
STZ	0.73	-3.28*	0.72	-3.28*	-40.04	-40.10	-40.05	-40.11
SYY	-0.90	-3.85**	-0.75	-3.64**	-44.12	-31.89	-44.23	-44.22
TAP	-0.74	-3.22*	-0.52	-3.07	-30.48	-30.49	-43.17	-43.20
TSN	-1.28	-4.44***	-0.78	-3.69**	-39.31	-39.30	-39.36	-39.35
WBA	0.50	-1.92	0.35	-2.21	-43.09	-43.13	-43.00	-43.04
WFM	-1.66	-1.19	-1.66	-1.17	-41.80	-41.83	-41.78	-41.82
WMT	-0.96	-3.11	-0.78	-3.22*	-23.00	-22.99	-46.17	-46.15
APA	-1.88	-2.08	-1.86	-2.15	-30.53	-30.52	-42.68	-42.67
APC	-1.66	-2.85	-2.24	-3.50**	-31.61	-31.60	-42.59	-42.58
BHI	-2.20	-3.57**	-2.62	-3.85**	-30.32	-30.35	-44.25	-44.25
CAM	-1.68	-2.84	-2.21	-3.21*	-30.88	-30.87	-43.63	-43.62
CHK	-2.34	-2.39	-2.49	-2.56	-30.10	-30.09	-41.85	-41.88
CNX	-1.73	-1.88	-2.28	-2.45	-18.03	-18.02	-41.15	-41.14
COG	-0.84	-2.27	-1.20	-2.56	-30.39	-30.38	-42.78	-42.77

COP	-0.81	-2.58	-1.12	-2.95	-32.43	-32.42	-44.48	-44.46
CVX	-1.27	-1.36	-1.42	-1.72	-33.07	-33.07	-46.05	-46.08
DO	-0.85	-1.30	-1.10	-1.82	-30.59	-30.58	-43.18	-43.18
DVN	-2.84**	-2.83	-3.34***	-3.34*	-30.80	-30.79	-43.91	-43.89
EOG	-1.05	-3.15	-1.29	-3.37*	-31.40	-31.39	-44.31	-44.29
EQT	-1.02	-4.06**	-1.17	-3.91**	-30.12	-30.11	-42.43	-42.42
ESV	-0.72	-0.61	-0.87	-0.71	-30.62	-30.62	-42.90	-42.91
FTI	-0.96	-0.86	-1.25	-1.15	-19.28	-19.27	-45.89	-45.93
HAL	-1.36	-2.99	-1.76	-3.25*	-30.33	-30.33	-41.24	-41.23
HES	-2.38	-2.93	-2.66	-3.33*	-31.07	-31.06	-44.16	-44.15
HP	-1.60	-3.52**	-1.36	-3.27*	-29.96	-29.96	-42.29	-42.29
MRO	-1.04	-1.67	-1.50	-2.08	-22.77	-32.19	-45.13	-45.12
MUR	-1.95	-2.24	-2.34	-2.66	-31.89	-31.88	-44.78	-44.76
NBL	-1.27	-1.81	-1.30	-1.32	-31.66	-31.66	-45.14	-45.18
NFX	-1.98	-1.98	-1.91	-1.91	-42.32	-42.31	-42.32	-42.31
NOV	-1.14	-1.76	-1.81	-2.53	-32.59	-32.58	-42.88	-42.87
OKE	-0.83	-1.35	-0.79	-1.22	-29.40	-29.40	-43.25	-43.24
OXY	-2.53	-2.96	-2.33	-2.90	-32.01	-32.01	-45.55	-45.55
PXD	-1.00	-2.33	-0.94	-2.21	-29.29	-29.29	-42.06	-42.05
RIG	-1.07	-2.03	-1.00	-1.95	-29.57	-29.56	-41.79	-41.78
RRC	-1.65	-1.57	-1.82	-1.51	-30.86	-30.87	-44.15	-44.24
SE	-0.49	-3.01	-0.84	-3.01	-31.82	-31.82	-44.71	-44.70
SLB	-1.33	-3.38*	-1.98	-4.23***	-30.74	-30.75	-45.69	-45.69
SWN	-1.85	-2.20	-1.69	-2.09	-33.71	-33.73	-46.93	-47.16
TSO	-0.42	-3.45*	-0.34	-3.39*	-31.31	-31.31	-42.37	-42.37
VLO	-0.06	-3.35*	-0.25	-3.50**	-31.02	-31.07	-41.30	-41.38
WMB	-0.31	-4.42***	-0.38	-4.98***	-30.76	-30.78	-42.49	-42.56
XEC	-1.11	-2.26	-1.04	-2.19	-42.08	-42.06	-42.14	-42.13
XOM	-0.94	-1.56	-1.39	-2.81	-12.31	-12.31	-51.69	-51.69
ACE	-0.89	-4.57***	-0.48	-5.35***	-11.24	-11.24	-50.51	-50.55
AFL	-2.09	-3.48**	-2.19	-3.68**	-50.19	-50.18	-49.84	-49.83
AIG	-5.06***	-7.42***	-5.08***	-6.51***	-13.28	-13.36	-34.94	-34.99
AIV	-1.59	-3.91**	-1.46	-3.77**	-48.16	-48.15	-47.85	-47.85
AIZ	-1.08	-4.51***	-1.08	-4.51***	-43.79	-43.83	-43.71	-43.80
ALL	-0.72	-4.00**	-0.76	-4.19***	-26.28	-26.31	-45.25	-45.27
AMG	-1.26	-4.79***	-1.11	-4.54***	-42.39	-42.37	-42.34	-42.33
AMP	-0.79	-5.18***	-0.43	-4.68***	-43.42	-43.41	-46.16	-46.18
AMT	-0.29	-3.57**	-0.95	-3.96**	-24.81	-24.83	-45.10	-45.09
AON	0.08	-2.58	0.10	-2.76	-30.21	-30.23	-46.36	-46.39
AVB	-1.33	-3.43*	-0.73	-2.83	-50.92	-50.90	-51.59	-51.58
AXP	-1.14	-3.31*	-1.01	-3.07	-44.80	-44.79	-44.75	-44.74
BAC	-3.17**	-3.21*	-3.34***	-3.49**	-7.34	-7.35	-42.13	-42.19
BBT	-1.18	-3.44*	-1.86	-4.03**	-23.53	-23.54	-49.90	-49.89
BEN	-1.74	-3.41*	-1.58	-3.15	-31.41	-31.40	-44.58	-44.56
BK	-1.24	-3.54**	-1.34	-3.74**	-41.14	-41.13	-41.48	-41.47
BLK	-1.34	-3.66**	-1.06	-3.37*	-45.94	-45.93	-46.11	-46.10
BRK_B	-0.70	-3.41*	-0.33	-3.36*	-42.68	-42.68	-44.31	-44.38
BXP	-2.05	-4.38***	-1.39	-3.99**	-52.52	-52.50	-53.20	-53.18
C_	-4.44***	-4.47***	-4.11***	-4.13***	-23.07	-23.15	-38.04	-38.09
CB	-0.54	-5.94***	0.11	-5.12***	-48.07	-32.28	-51.84	-51.86
CBG	-1.13	-2.87	-1.52	-3.41*	-26.31	-26.31	-46.21	-46.19
CCI	-1.23	-4.29***	-0.97	-4.02**	-38.67	-38.65	-38.67	-38.66
CINF	-0.51	-4.90***	-0.37	-4.31***	-35.19	-35.18	-51.40	-51.39
CMA	-2.01	-3.49**	-1.52	-2.97	-44.66	-44.65	-48.04	-48.04
CME	-1.72	-4.01**	-1.53	-3.87**	-44.61	-44.59	-44.68	-44.67
COF	-1.76	-4.19***	-1.53	-3.85**	-5.00	-5.11	-43.98	-43.97
DFS	-1.01	-4.01**	-0.82	-3.56**	-43.94	-43.92	-44.28	-44.26
EFX	0.45	-4.55***	0.67	-4.44***	-43.45	-43.48	-43.58	-43.64
EQR	-1.66	-3.15*	-0.96	-2.65	-54.99	-54.97	-56.10	-56.08
ESS	-0.79	-4.33***	-0.23	-3.78**	-51.16	-51.15	-51.83	-51.84
ETFC	-2.28	-2.78	-1.93	-2.46	-41.42	-41.48	-42.47	-42.85
FITB	-2.67*	-5.11***	-2.00	-3.56**	-2.99	-2.98	-41.82	-41.80
GGP	-1.11	-3.07	-1.07	-2.96	-1.91	-2.11	-36.97	-36.95
GNW	-2.74*	-2.79	-2.69*	-2.75	-43.80	-43.79	-43.67	-43.66

GS	-2.52	-3.42*	-2.43	-3.35*	-42.64	-42.64	-42.78	-42.77
HBAN	-1.01	-4.04**	-1.88	-3.65**	-14.70	-14.69	-45.14	-45.15
HCBK	-1.71	-1.38	-1.98	-1.59	-50.25	-50.28	-51.83	-52.14
HCN	-1.43	-3.90**	-1.00	-3.84**	-52.07	-52.06	-53.21	-53.19
HCP	-2.15	-3.50**	-1.65	-3.10	-32.70	-32.69	-51.56	-51.37
HIG	1.02	-0.56	-2.68	-4.38***	-2.31	-2.78	-41.13	-41.12
HRB	-0.71	-2.80	-0.51	-2.68	-41.58	-41.61	-41.66	-41.71
HST	-1.93	-3.76**	-1.61	-3.26*	-49.22	-49.21	-49.66	-49.64
ICE	0.66	-1.44	-1.31	-6.37***	-5.22	-5.21	-49.85	-49.86
IVZ	-1.61	-4.73***	-1.19	-4.20***	-47.46	-47.44	-48.05	-48.14
JPM	-2.61*	-5.11***	-2.21	-4.66***	-46.43	-46.42	-48.80	-48.79
KEY	-1.33	-3.86**	-1.80	-4.25***	-27.41	-27.45	-56.78	-57.77
KIM	-2.18	-4.51***	-1.91	-4.36***	-48.27	-48.27	-48.11	-48.14
L	-2.58*	-4.08***	-1.96	-3.47**	-48.72	-48.71	-50.51	-50.50
LM	-2.11	-3.82**	-1.89	-3.59**	-42.62	-42.61	-42.92	-42.91
LNC	-1.95	-4.11**	-1.67	-3.85**	-41.68	-41.69	-41.85	-41.89
LUK	-2.60*	-2.86	-3.73***	-3.96***	-14.22	-13.28	-41.69	-41.68
MAC	-1.85	-4.01**	-1.14	-3.35*	-25.95	-25.94	-42.80	-42.79
MCO	-0.37	-4.29***	-0.26	-4.21***	-41.47	-41.48	-41.49	-41.51
MET	-2.71*	-4.51***	-2.39	-4.26***	-44.13	-44.12	-44.24	-44.24
MHFI	-0.49	-5.21***	-0.43	-5.18***	-40.05	-40.05	-40.06	-40.06
MMC	-0.30	-3.47**	-0.03	-3.84**	-49.29	-49.29	-49.39	-49.39
MS	-2.16	-1.81	-2.38	-2.89	-31.18	-31.20	-42.59	-42.68
MTB	-1.33	-3.78**	-1.25	-3.73**	-46.50	-46.49	-47.92	-47.91
NDAQ	-1.18	-3.48**	-0.46	-2.88	-42.79	-42.79	-45.07	-45.19
NTRS	-1.31	-2.87	-1.86	-3.20*	-33.14	-33.22	-51.98	-52.26
O	-1.83	-3.77**	-1.31	-3.71**	-32.80	-32.80	-52.32	-52.35
PBCT	0.44	0.00	-0.95	-1.70	-51.74	-51.73	-61.43	-62.23
PCL	-1.48	-3.48**	-1.74	-4.10**	-32.79	-32.79	-51.94	-51.93
PFG	-1.42	-4.17***	-1.69	-4.31***	-29.69	-29.72	-42.09	-42.11
PGR	-0.21	-4.57***	-0.57	-5.31***	-21.14	-21.17	-48.41	-48.44
PLD	-2.25	-5.17***	-2.27	-5.14	-27.74	-27.75	-48.38	-48.37
PNC	-2.83**	-5.63***	-2.62*	-5.41***	-45.53	-45.52	-48.49	-48.52
PRU	-2.10	-4.52***	-2.03	-4.40***	-30.23	-30.23	-41.52	-41.53
PSA	-1.49	-4.53***	-0.87	-4.59***	-54.65	-54.63	-56.68	-56.67
RF	-2.04	-3.56**	-2.55	-3.88**	-28.22	-28.25	-45.43	-45.64
SCHW	-1.13	-2.51	-0.54	-2.09	-32.08	-32.14	-49.19	-49.55
SLG	-1.52	-3.70**	-1.48	-3.70**	-22.53	-22.56	-43.48	-43.39
SPG	-1.43	-3.98**	-0.96	-3.68**	-53.75	-53.73	-53.84	-53.82
STI	-2.32	-3.40*	-2.48	-4.01**	-23.97	-23.99	-44.83	-44.94
STT	-3.97***	-6.23***	-4.00***	-6.26***	-47.23	-47.22	-48.32	-48.31
TMK	-0.78	-4.65***	-0.69	-4.48***	-45.97	-45.97	-45.59	-45.59
TROW	-1.72	-4.57***	-1.41	-4.17***	-47.20	-47.18	-47.75	-47.73
TRV	-0.97	-5.91***	-0.44	-4.89***	-33.95	-33.93	-52.09	-52.07
UNM	-0.87	-3.43*	-1.57	-3.82**	-33.29	-33.28	-48.20	-48.20
USB	-0.92	-3.44*	-1.64	-4.76***	-7.25	-7.25	-46.57	-46.60
VNO	-2.36	-4.38***	-1.67	-3.85**	-31.73	-31.72	-51.47	-51.45
VTR	-1.91	-3.79**	-1.57	-3.21*	-50.97	-50.96	-50.62	-50.61
WFC	-1.88	-4.15**	-1.76	-4.51***	-24.50	-24.49	-49.10	-49.08
WY	-1.10	-4.02**	-1.12	-4.05**	-39.50	-39.49	-39.50	-39.49
XL	-0.90	-2.68	-1.88	-3.72**	-25.91	-25.91	-41.10	-41.09
ZION	-2.18	-3.41*	-2.47	-3.49**	-25.61	-25.64	-42.92	-42.97
A	-1.16	-3.32*	-1.10	-3.24*	-29.99	-29.98	-41.24	-41.22
ABC	0.21	-2.73	0.26	-2.73	-45.27	-45.27	-45.33	-45.34
ABT	0.21	-3.35*	0.50	-3.16*	-31.29	-31.35	-42.92	-43.15
AET	0.19	-3.93**	0.29	-3.86**	-42.59	-42.65	-42.64	-42.66
AGN	0.59	-3.30*	1.11	-2.84	-41.24	-41.25	-41.67	-41.75
ALXN	-0.61	-3.35*	-0.51	-3.06	-42.85	-42.84	-43.57	-43.56
AMGN	0.30	-2.58	0.51	-2.49	-45.68	-45.72	-46.29	-46.50
ANTM	-0.07	-2.65	-0.03	-2.63	-29.73	-29.76	-40.79	-40.81
BAX	-1.10	-3.66**	-1.01	-3.59**	-29.92	-29.97	-39.59	-39.62
BCR	0.38	-2.75	0.43	-2.39	-18.00	-18.09	-42.38	-42.43
BDX	0.68	-2.70	0.62	-2.65	-31.34	-31.44	-41.50	-41.62
BIIB	-0.51	-4.94***	-0.46	-4.88***	-44.60	-44.58	-44.61	-44.72

BMY	-0.42	-4.52***	-0.34	-4.42***	-31.33	-31.32	-42.86	-42.85
BSX	-1.09	-2.13	-0.97	-2.09	-43.40	-43.43	-43.48	-43.52
CAH	0.11	-3.01	0.13	-3.16*	-33.39	-33.41	-50.86	-50.97
CELG	0.08	-3.35*	0.41	-3.26*	-44.43	-44.47	-44.99	-45.20
CERN	-1.29	-2.78	-1.28	-2.63	-40.84	-40.85	-40.86	-40.87
CI	0.39	-3.30*	-0.30	-4.04**	-30.31	-30.37	-40.36	-40.37
DGX	-1.91	-4.06**	-1.85	-4.02**	-40.66	-40.65	-40.68	-40.67
DVA	-0.47	-3.74**	-0.35	-4.13**	-31.58	-31.57	-42.65	-42.64
ENDP	-0.21	-2.18	-0.30	-2.33	-39.48	-39.48	-39.48	-39.48
ESRX	-0.65	-2.79	-0.30	-2.41	-43.43	-43.43	-44.05	-44.09
EW	-0.85	-1.97	-0.84	-1.95	-41.65	-41.64	-41.64	-41.62
GILD	0.10	-2.23	0.36	-2.19	-42.13	-42.16	-42.41	-42.52
HSIC	-0.29	-4.22***	-0.12	-3.96**	-31.89	-31.91	-43.07	-43.09
HUM	-0.23	-3.30*	-0.29	-3.51**	-42.19	-42.20	-42.22	-42.22
ISRG	-1.25	-2.46	-1.24	-2.46	-41.17	-41.15	-41.17	-41.16
JNJ	0.06	-2.95	-0.03	-3.37*	-32.27	-32.29	-44.92	-44.93
LH	-1.04	-3.43*	-0.96	-3.44*	-42.57	-42.56	-42.78	-42.77
LLY	-0.02	-4.07**	0.26	-4.12**	-22.61	-22.65	-45.33	-45.37
MCK	-0.09	-3.68**	0.06	-3.52**	-44.71	-44.72	-44.77	-44.78
MDT	-0.05	-3.44*	-0.06	-3.43*	-41.44	-41.52	-41.42	-41.50
MRK	-0.93	-3.97**	-0.55	-3.94**	-43.12	-43.11	-43.35	-43.33
MYL	-0.97	-3.35*	-0.93	-3.31*	-38.75	-38.74	-38.77	-38.76
PDCO	-0.87	-4.33***	-0.68	-4.16**	-42.62	-42.62	-42.91	-42.93
PFE	-0.41	-3.72**	-0.20	-4.05**	-44.33	-44.33	-44.70	-44.70
PKI	-0.50	-4.29***	-0.33	-4.19***	-41.86	-41.88	-42.05	-42.08
PRGO	-0.76	-2.09	-0.72	-1.93	-40.68	-40.68	-40.88	-40.87
REGN	-0.19	-3.56**	-0.10	-3.45*	-41.33	-41.32	-41.46	-41.46
STJ	-0.74	-3.14	-0.77	-3.14	-39.50	-39.52	-39.51	-39.52
SYK	-0.10	-3.27*	-0.10	-3.27*	-41.14	-41.19	-41.14	-41.19
THC	-0.84	-2.78	-0.97	-2.63	-40.37	-40.37	-40.36	-40.36
TMO	0.17	-3.11	0.26	-3.39*	-31.10	-31.15	-42.37	-42.51
UHS	0.06	-3.00	0.08	-3.01	-41.36	-41.38	-41.35	-41.37
UNH	-0.07	-4.97***	-0.22	-4.97***	-14.02	-14.03	-42.57	-42.57
VAR	-1.18	-3.35*	-1.13	-3.34*	-29.75	-29.74	-40.98	-40.96
VRTX	-0.95	-3.91**	-0.93	-3.93**	-41.87	-41.86	-41.86	-41.86
WAT	-0.66	-3.46**	-0.44	-3.22*	-42.92	-42.92	-43.34	-43.35
XRAY	-1.22	-5.18***	-1.03	-5.00***	-41.86	-41.86	-42.11	-42.13
ZBH	-0.75	-3.89**	-0.69	-3.85**	-39.63	-18.32	-39.70	-39.73
AAL	-1.18	-2.87	-1.18	-2.86	-40.94	-40.93	-40.97	-40.95
AME	-0.12	-2.75	-0.07	-3.93**	-19.16	-19.16	-41.81	-41.81
APH	-0.34	-4.25**	-0.15	-4.07**	-42.81	-42.81	-43.11	-43.14
BA	-0.58	-3.67**	-0.52	-3.63**	-40.39	-40.39	-40.44	-40.44
CAT	-1.10	-1.74	-1.12	-1.79	-40.90	-40.89	-40.93	-40.92
CHRW	-2.63	-2.86	-2.40	-2.87	-43.89	-43.88	-44.00	-44.01
CMI	-1.01	-2.25	-0.91	-2.19	-31.39	-31.38	-43.10	-43.08
COL	-0.93	-2.86	-0.86	-2.78	-42.43	-42.42	-42.42	-42.41
CSX	-0.91	-3.69**	-0.68	-3.49**	-42.10	-42.09	-42.68	-42.69
CTAS	0.08	-3.76**	0.16	-3.70**	-41.58	-41.60	-41.58	-41.61
DAL	-0.64	-2.37	-0.76	-2.41	-19.88	-40.38	-41.06	-41.05
DE	-1.59	-3.10	-1.25	-3.04	-17.96	-17.96	-40.52	-40.51
DHR	-0.43	-4.69***	-0.24	-4.47***	-30.75	-30.75	-43.21	-43.20
DNB	-1.12	-3.35*	-0.97	-3.22*	-42.01	-42.02	-42.20	-42.23
DOV	-0.97	-2.90	-0.91	-2.79	-41.71	-41.70	-41.72	-41.71
EMR	-1.30	-2.16	-1.32	-2.36	-33.62	-33.62	-47.33	-47.33
ETN	-1.08	-2.62	-1.08	-2.61	-40.95	-40.94	-40.95	-40.94
EXPD	-2.29	-2.96	-1.87	-2.53	-42.94	-42.93	-43.65	-43.63
FAST	-1.13	-2.04	-1.04	-1.83	-41.70	-41.70	-41.91	-41.91
FDX	-0.89	-3.29*	-0.74	-3.12	-41.35	-41.34	-41.54	-41.53
FLIR	-2.61*	-3.02	-2.82*	-3.26*	-43.66	-43.66	-43.70	-43.70
FLR	-2.01	-2.77	-2.41	-3.47**	-31.87	-31.86	-43.61	-43.59
FLS	-1.32	-2.30	-1.35	-3.26*	-19.41	-19.40	-43.24	-43.23
GD	0.11	-2.91	0.09	-3.14	-42.78	-42.84	-42.78	-42.82
GE	-1.13	-4.59***	-1.09	-4.57***	-23.51	-23.57	-40.97	-41.00
GLW	-2.04	-2.58	-2.00	-2.57	-40.97	-40.96	-41.05	-41.04

GWW	-1.05	-1.93	-1.01	-1.61	-42.07	-42.07	-42.41	-42.42
HON	-0.02	-4.83***	-0.29	-4.77***	-22.39	-22.40	-42.24	-42.24
IR	-0.73	-2.83	-0.68	-2.98	-29.82	-29.81	-41.48	-41.47
IRM	-1.55	-3.14	-1.53	-3.69**	-29.40	-29.39	-38.57	-38.55
ITW	-0.64	-3.91**	-0.51	-3.79**	-43.87	-43.86	-43.98	-43.97
JBHT	-0.94	-4.94***	-0.72	-4.60***	-43.60	-43.58	-44.94	-44.93
JEC	-3.94***	-4.41***	-3.63***	-4.11***	-20.79	-20.78	-43.15	-43.15
KSU	-0.75	-3.44*	-0.67	-3.39*	-41.55	-41.54	-41.67	-41.67
LEG	-0.41	-3.51**	-0.15	-3.25*	-42.91	-42.91	-42.96	-42.97
LLL	-0.77	-2.57	-0.87	-2.74	-43.41	-43.43	-43.30	-43.32
LMT	0.90	-2.14	0.78	-2.66	-45.03	-45.13	-44.79	-44.89
LUV	0.00	-2.34	0.05	-2.32	-44.18	-44.27	-44.10	-44.17
MAS	-1.23	-3.49**	-1.27	-3.54**	-39.99	-39.99	-40.07	-40.07
MMM	-0.54	-2.66	-0.54	-2.96	-31.12	-31.11	-44.23	-44.21
NOC	0.73	-3.12	0.65	-3.17*	-41.30	-41.38	-41.39	-41.44
NSC	-1.09	-3.58**	-1.00	-3.48**	-42.22	-42.20	-42.25	-42.23
PBI	-1.78	-2.15	-1.72	-2.09	-42.20	-42.18	-42.21	-42.20
PCAR	-1.49	-3.67**	-1.31	-3.51**	-41.61	-41.59	-41.74	-41.72
PCP	-1.01	-1.85	-0.94	-1.73	-29.05	-29.04	-40.82	-40.81
PH	-0.97	-3.23	-0.90	-3.15*	-41.90	-41.89	-41.92	-41.91
PNR	-0.94	-3.51**	-0.78	-3.28*	-40.62	-40.61	-40.91	-40.90
PWR	-2.82*	-4.30***	-2.49	-3.93***	-29.42	-29.41	-42.05	-42.04
R	-1.23	-4.20***	-1.23	-4.19***	-41.96	-41.98	-41.95	-41.96
RHI	-0.98	-3.79**	-0.73	-3.48**	-43.17	-43.16	-43.53	-43.52
ROK	-1.15	-2.79	-1.12	-2.74	-41.40	-41.38	-41.41	-41.40
ROP	-0.22	-5.62***	-0.25	-5.08***	-32.39	-32.39	-46.34	-46.36
RSG	-0.64	-3.87**	-0.66	-3.96**	-39.17	-39.19	-39.16	-39.17
RTN	0.51	-2.27	0.27	-2.51	-30.39	-30.46	-43.67	-43.71
SRCL	-0.55	-3.92**	-0.26	-3.54**	-44.22	-44.21	-46.74	-46.73
TXT	-1.97	-4.67***	-2.08	-4.73***	-38.52	-38.53	-38.53	-38.53
TYC	-0.50	-4.19***	-0.43	-4.18***	-29.50	-29.51	-41.65	-41.65
UAL	-1.35	-2.72	-1.40	-2.86	-12.18	-12.16	-38.11	-38.10
UNP	-0.59	-4.54***	-0.37	-4.23***	-41.51	-41.50	-42.59	-42.59
UPS	-0.95	-4.48***	-0.85	-4.37***	-41.96	-41.95	-42.08	-42.07
URI	-0.90	-2.71	-0.91	-3.09	-37.63	-37.62	-37.67	-37.66
UTX	-1.24	-2.76	-1.12	-2.95	-30.56	-30.55	-44.00	-44.00
WM	-0.44	-3.92**	-0.40	-3.68**	-30.48	-30.50	-41.26	-41.27
AAPL	-0.76	-2.13	-0.76	-2.12	-40.58	-40.57	-40.58	-40.57
ACN	-0.36	-4.93***	-0.11	-4.64***	-41.93	-30.30	-42.61	-42.62
ADBE	-0.54	-3.19*	-0.38	-3.09	-31.17	-31.24	-43.92	-43.98
ADI	-1.14	-4.81***	-1.05	-4.81***	-43.49	-43.48	-43.66	-43.64
ADP	-0.16	-4.21***	-0.07	-4.44***	-21.81	-21.81	-47.79	-47.81
ADS	-0.66	-4.45***	-0.61	-4.39***	-38.20	-38.19	-38.10	-38.09
ADSK	-1.39	-3.46**	-1.34	-3.42*	-42.39	-42.38	-42.37	-42.36
AKAM	-1.23	-2.76	-1.11	-2.62	-28.90	-28.89	-41.53	-41.53
ALTR	-1.38	-2.35	-1.19	-2.09	-43.50	-43.49	-43.98	-43.96
AMAT	-1.73	-3.33*	-1.62	-3.23*	-42.72	-42.71	-42.72	-42.71
ATVI	-0.54	-3.40*	-0.30	-3.58**	-44.90	-44.95	-45.73	-45.96
AVGO	-0.15	-1.85	0.06	-1.53	-39.04	-39.04	-39.70	-39.72
BRCM	-1.95	-2.67	-1.85	-2.56	-43.22	-43.20	-43.22	-43.20
CA	-1.54	-4.38***	-1.36	-4.15**	-46.30	-46.28	-46.25	-46.23
CRM	-0.76	-2.78	-0.73	-2.71	-42.33	-42.32	-42.35	-42.33
CSC	-1.30	-1.97	-1.19	-1.89	-42.35	-42.35	-42.38	-42.39
CSCO	-1.75	-2.69	-1.50	-2.46	-42.75	-42.75	-42.96	-42.96
CTSH	-0.96	-2.12	-0.78	-1.77	-44.04	-44.02	-44.75	-44.73
CTXS	-1.97	-2.06	-1.89	-1.87	-44.76	-44.77	-44.74	-44.72
EA	-0.35	-2.09	-0.17	-2.00	-41.91	-24.77	-41.95	-42.19
EBAY	-0.88	-3.86**	-0.80	-3.76**	-30.31	-30.30	-43.94	-43.93
EMC	-1.37	-2.07	-1.50	-2.13	-43.42	-43.41	-43.52	-43.51
EQIX	-0.76	-3.67**	-0.72	-3.57**	-41.72	-41.71	-41.79	-41.78
FFIV	-1.74	-1.73	-1.72	-1.67	-40.80	-40.81	-40.80	-40.81
FIS	-0.59	-3.14	-0.44	-3.28*	-46.04	-46.02	-46.56	-46.61
FISV	0.22	-3.80**	0.38	-3.64**	-44.51	-44.53	-44.44	-44.47
FSLR	-1.96	-1.69	-1.93	-1.61	-41.80	-41.81	-41.85	-41.87

GOOGL	-0.56	-3.69**	-0.54	-3.68**	-41.68	-41.68	-41.69	-41.69
HPQ	-1.31	-1.24	-1.23	-1.15	-42.09	-42.08	-42.13	-42.12
HRS	-0.52	-2.94	-0.40	-2.84	-29.33	-29.35	-41.79	-41.80
IBM	-1.44	-1.54	-1.39	-1.39	-42.11	-42.10	-42.38	-42.37
INTC	-1.34	-3.66**	-1.12	-3.52**	-21.51	-21.50	-45.79	-45.78
INTU	-0.83	-3.75**	-0.56	-3.58**	-47.17	-47.15	-47.11	-47.09
JNPR	-2.08	-2.06	-1.97	-1.95	-42.60	-42.59	-42.70	-42.69
KLAC	-1.23	-4.37***	-1.23	-4.46***	-40.94	-40.92	-40.96	-40.95
LLTC	-1.26	-4.19***	-1.16	-4.13**	-42.25	-42.23	-42.29	-42.28
LRCX	-1.35	-2.89	-1.20	-2.71	-40.81	-40.80	-40.84	-40.83
MA01	-0.26	-4.85***	-0.14	-5.19***	-45.64	-45.64	-45.90	-45.90
MCHP	-1.33	-3.88**	-1.24	-3.77**	-42.63	-42.62	-42.68	-42.67
MSFT	-0.92	-3.11	-0.62	-3.08	-32.08	-32.08	-44.99	-45.00
MSI	-0.97	-3.54**	-0.85	-3.37*	-41.93	-41.92	-42.10	-42.09
MU	-1.28	-1.98	-1.24	-1.94	-39.14	-39.13	-39.33	-39.32
NFLX	-0.41	-1.48	-0.43	-1.51	-39.63	-39.62	-39.63	-39.62
NTAP	-1.66	-1.57	-1.58	-1.44	-42.91	-42.92	-42.92	-42.93
NVDA	-2.10	-3.04	-2.12	-3.12	-40.66	-40.64	-40.66	-40.65
ORCL	-1.16	-3.05	-1.40	-3.58**	-30.57	-30.56	-44.38	-44.37
PAYX	-0.60	-4.15**	-0.41	-3.95**	-44.08	-44.08	-44.19	-44.19
QCOM	-1.41	-4.08**	-1.20	-3.77**	-43.71	-43.70	-44.39	-44.38
RHT	-1.28	-2.56	-1.23	-2.51	-41.58	-41.57	-41.60	-41.58
SNDK	-1.44	-2.12	-1.51	-2.03	-38.79	-38.78	-38.76	-38.76
STX	-0.79	-3.13	-0.85	-3.45**	-40.30	-40.29	-40.48	-40.47
SWKS	-0.63	-2.15	-0.52	-2.00	-40.66	-40.65	-40.85	-40.84
SYMK	-1.48	-3.74**	-1.82	-4.11**	-31.91	-31.92	-44.44	-44.42
TDC	-1.74	-0.86	-1.71	-0.74	-41.58	-41.66	-41.64	-41.76
TEL	-0.77	-3.97**	-0.80	-4.03**	-40.28	-40.27	-40.32	-40.31
TSS	0.51	-4.54***	0.80	-4.35***	-43.23	-43.30	-43.44	-43.58
TXN	-0.84	-3.53**	-0.68	-3.29*	-31.68	-31.67	-44.55	-44.53
V	0.03	-3.73**	-0.01	-3.86**	-44.80	-44.80	-45.19	-45.20
VRSN	-0.24	-4.32***	-0.22	-4.72***	-45.51	-45.52	-46.13	-46.16
WDC	-1.06	-2.95	-1.01	-2.87	-44.14	-44.13	-44.08	-44.07
WU	-3.59***	-4.32***	-3.49***	-4.25***	-44.53	-44.57	-44.57	-44.62
XLNX	-1.54	-4.04**	-1.46	-3.82**	-43.15	-43.15	-43.48	-43.47
XRX	-2.14	-3.40*	-2.09	-3.36*	-41.91	-41.90	-41.92	-41.92
YHOO	-0.51	-2.86	-0.28	-2.70	-42.73	-42.75	-43.00	-43.09
AA	-3.45***	-3.48**	-3.44***	-3.47**	-40.58	-29.23	-40.59	-40.58
APD	-0.52	-4.05**	-0.37	-3.94**	-30.40	-30.44	-42.03	-42.07
ARG	-1.14	-3.39*	-0.91	-3.34*	-15.49	-15.49	-47.01	-47.00
AVY	-0.95	-2.95	-0.89	-2.90	-41.99	-41.99	-41.95	-41.96
BLL	-0.66	-4.37***	-0.52	-4.18***	-43.02	-43.00	-43.15	-43.14
CF	-0.66	-3.08	-0.79	-5.15***	-14.41	-14.40	-41.17	-41.18
DD	-1.01	-2.85	-0.97	-2.78	-29.48	-29.47	-42.33	-42.32
DOW	-1.33	-3.26*	-1.37	-3.32*	-43.57	-43.55	-43.40	-43.39
ECL	0.36	-3.13	0.09	-3.78**	-32.11	-32.13	-46.70	-46.73
EMN	-0.91	-2.76	-0.91	-2.78	-40.90	-40.89	-40.90	-40.88
FCX	-1.35	-1.20	-1.32	-1.18	-28.29	-28.31	-39.86	-39.87
FMC	-1.30	-3.01	-1.11	-2.75	-44.17	-44.15	-44.38	-44.36
IFF	-0.12	-3.69**	0.02	-3.37*	-30.20	-30.20	-45.24	-45.24
IP	-1.11	-3.34*	-1.13	-3.39*	-41.37	-28.18	-41.41	-41.40
MLM	-0.95	-2.95	-0.84	-3.03	-23.77	-23.81	-37.62	-37.64
MON	-1.08	-2.41	-1.79	-3.75**	-30.12	-30.13	-41.09	-41.14
MOS	-3.33***	-3.31*	-4.32***	-4.29***	-30.41	-30.41	-40.63	-40.62
NEM	-0.74	-1.64	-0.50	-1.43	-43.52	-43.55	-43.56	-43.61
NUE	-2.38	-4.26***	-2.60	-4.99***	-32.99	-32.98	-45.78	-45.77
OI	-3.01**	-3.01	-3.07**	-3.07	-38.53	-38.52	-38.52	-38.51
PPG	-0.42	-3.86**	-0.24	-3.87**	-44.46	-44.45	-44.47	-44.46
PX	-1.01	-2.66	-1.12	-3.88**	-20.73	-20.72	-45.35	-45.34
SEE	-0.08	-1.47	-0.08	-1.65	-44.42	-44.43	-44.53	-44.58
SHW	-0.73	-3.02	-0.22	-3.05	-43.71	-43.69	-44.37	-44.35
SIAL	-0.24	-4.49***	0.23	-4.16**	-30.73	-30.74	-45.16	-45.31
VMC	-1.45	-2.50	-1.25	-2.38	-38.27	-38.29	-38.21	-38.22
CTL	-1.93	-2.48	-1.79	-2.20	-30.28	-30.28	-41.93	-41.94

FTR	-2.21	-2.33	-2.14	-2.27	-41.59	-41.58	-41.61	-41.60
LVLT	-2.01	-4.13**	-1.98	-4.12**	-40.69	-40.70	-40.78	-40.79
T	-0.62	-3.49**	-0.66	-4.01**	-34.01	-34.01	-44.41	-44.39
VZ	-0.99	-3.50**	-0.75	-3.19*	-31.86	-31.85	-41.51	-41.50
AEE	-0.85	-3.23*	-0.80	-4.12**	-30.55	-30.54	-44.28	-44.26
AEP	-0.10	-3.94**	-0.09	-4.90***	-12.60	-12.63	-46.25	-46.28
AES	-2.13	-3.26*	-3.02**	-4.05**	-26.01	-26.02	-46.29	-46.28
CMS	-0.42	-3.83**	-0.24	-3.46**	-43.22	-43.21	-44.08	-44.06
CNP	-1.09	-1.79	-0.95	-2.08	-44.62	-44.61	-44.47	-44.46
D_	-0.28	-3.68**	0.03	-4.39***	-12.87	-12.87	-47.26	-47.24
DTE	-0.96	-3.34*	-0.44	-3.44*	-44.87	-44.86	-44.84	-44.83
DUK	-0.74	-4.26***	-0.53	-3.88**	-12.24	-12.23	-48.98	-48.97
ED	-1.63	-2.18	-1.14	-2.28	-46.67	-46.68	-46.67	-46.68
EIX	-0.68	-5.54***	-0.47	-5.89***	-12.92	-12.93	-47.18	-47.20
ES	-1.10	-3.54**	-0.60	-3.71**	-46.36	-46.35	-47.28	-47.27
ETR	-2.58*	-3.61**	-2.75*	-4.04***	-31.36	-31.37	-44.46	-44.46
EXC	-3.23**	-3.30*	-4.24***	-4.31***	-31.38	-31.39	-46.51	-46.52
FE	-2.33	-2.48	-3.36***	-3.53**	-30.88	-30.90	-45.16	-45.16
GAS	-1.28	-3.28*	-0.82	-4.05**	-44.12	-18.54	-45.17	-45.27
NEE	-0.37	-3.35*	-0.06	-4.65***	-32.31	-32.31	-45.76	-45.74
NI	-0.53	-5.16***	0.13	-4.90***	-43.93	-43.91	-45.05	-45.05
NRG	-3.09**	-3.52**	-3.09**	-3.52**	-30.77	-30.76	-40.90	-40.89
PCG	-1.39	-2.64	-1.29	-3.52**	-12.14	-12.13	-49.51	-49.50
PEG	-0.95	-4.09**	-1.03	-5.24***	-32.86	-32.87	-46.48	-46.49
PNW	-0.75	-3.72**	-0.64	-2.93	-12.27	-12.26	-43.12	-43.11
POM	-0.20	-3.47**	-0.23	-3.73**	-29.21	-29.25	-41.52	-41.57
PPL	-1.50	-3.77**	-1.97	-5.24***	-25.46	-25.47	-47.47	-47.53
SCG	-1.24	-3.81**	-0.86	-4.09**	-45.47	-45.45	-45.49	-45.48
SO	-0.72	-2.45	-0.87	-2.33	-11.62	-11.58	-47.45	-47.45
SRE	0.01	-3.05	-0.34	-4.02**	-11.94	-11.96	-46.95	-46.93
TE	-1.39	-3.19*	-0.61	-3.11	-31.44	-31.43	-43.82	-43.80
WEC	-0.93	-3.26*	-0.53	-3.87**	-44.73	-44.72	-44.95	-44.93
XEL	-0.22	-3.96**	-0.40	-4.52***	-11.63	-11.62	-47.21	-47.20
U.S CPI	-0.57	-4.28***	0.03	-2.50	-4.24	-4.26	-4.34	-4.35
S&P 500	-0.30	-5.47***	-0.58	-5.45***	-9.46	-9.49	-9.46	-9.48

*Significant at the 10% level. **Significant at the 5% level ***Significant at the 1% level.
Critical values : Intercept: 1% -3.43, 5% -2.86, 10% -2.56, Trend: 1% -3.96, 5% -3.41, 10% -3.12.
With red color are the stocks that excluded from our analysis. The results from first differences are all significant at the 1% level.