A STRAIGHTFORWARD ANALYSIS OF SECTOR PORTFOLIOS IN THE US STOCK MARKET
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Abstract
This research focuses on analysing the US stock market in recent years –specifically the US stock market, that is, Dow Jones index, and six sector portfolios (Financials, Energy, Technology, Health Care, Consumer Discretionary and Telecommunications). All sectors achieve higher returns than expected according to the CAPM (except the “Consumer Discretionary” sector). Moreover, this fact is confirmed with the Security Market Line (SML). Thus, these results help investors to choose the most suitable sectors in the investment horizon. Therefore, this research includes relevant implications to portfolio managers to reduce the risk and maximize the return.

Keywords: US Stock Market; CAPM; Portfolio Management; Sector Analysis

JEL classification: G11, G15, O51

1. Introduction
The main objective of this paper is to build, manage and analyse different sectoral portfolios of the US stock market on the basis of the investment portfolio selection model (Markowitz, 1952). This model defends the efficient management that minimizes the risk assumed for each level of profitability. Furthermore, it also considers asset allocation as this is the procedure followed by most managers to develop an investment portfolio and that is the essential determinant of the risk-benefit binomial of the investment portfolio (Haugen, 2001).

Specifically, this paper analyses the management of six sector portfolios of the US market: Financials, Energy, Technology, Health Care, Telecommunications, and Consumer Discretionary.

Thus, this research consist in creating an investment portfolio composed of different sectors listed on the Dow Jones market index and analysing business performance, the sample mean, the variance and covariance of the market returns –the Dow Jones market index returns- with the returns of each sectoral investment portfolio, the risk measure “βeta”, the characteristic line and SML –security market line- based on the

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CAPM (Capital Asset Pricing Model), among other important concepts in portfolio management.

The rest of the paper is structured as follows. Section 2 briefly displays the motivation of the paper, including some relevant previous literature. Section 3 conducts a review of the historical evolution of the Dow Jones market index, as a good and representative indicator of the US stock market. Section 4 analyses and develops the study of sectoral portfolios using traditional portfolio management based on the Markowitz framework. To conclude, Section 5 collects the main concluding remarks of the paper.

2. Motivation and previous literature

2.1. Motivation

The stock market is an essential element in attracting funding directly from investors to companies or to governments in order to support investment projects or increase the size of the institutions. This market facilitates access to cheaper funding. Thus, this situation may lead to the creation of more jobs and sources which in turn would make the products reach the market at a lower price. So, it may favour the consumer and would help improve the economic conditions of the country.

The analysis of the US stock market is really relevant for portfolio managers all over the world, because of its potential impact on the economy at national and global level.

2.2. Some previous literature

A lot of researches in Finance has the same purpose, which is to make a management analysis on the market portfolio based on the Markowitz (1952) framework. According to this author, you can select portfolios exclusively based on the expected performance, which is based on the risk-return binominal. Therefore at all times we assume an environment of certainty where investors are more or less risk averse and that economic agents are rational, i.e. maximizing profitability for each risk level and minimizing the risk for each level of profitability (Haugen, 2001, Pisón Fernandez, 2001, Hillier et al., 2011, and Bodie et al., 2014).

According to Brealey et al. (2014), investment in the Treasury bill is less risky than the stock market since the former provides a fixed return regardless of the economic situation while the second has a market risk adjusted for specific risk investment, measured by beta factor.

Harry Markowitz –in his paper "Portfolio Selection" (1952)- selected different stocks and showed how to reduce the standard deviation of a portfolio returns and further developed the basic assumptions for the portfolios construction.

With this in mind, this section builds different sector portfolios of the US stock market, to conduct a traditional analysis of the portfolios management.
3. The US stock market index

According to Brealey et al. (2012), when economic agents invest in stocks, they do not know which return they are going to get. But if investors look at the historical evolution of the stock market returns, they can get an idea about the reasonable expected returns in accordance with risks.

Thus, this section displays one of the most important market index of the US Stock Exchange: the Dow Jones Industrial Average, which was created in 1896. The Dow Jones index (DJ) represents the 30 largest companies known as blue-chips and measures the performance of a portfolio consisting of one share of each company.

Figure 1. The historical evolution of the Dow Jones market index closing price

![Dow Jones Index Chart](source: Own preparation from the database [www.nyse.com](http://www.nyse.com))

To find capital gains that may have investors, it works out a study with reference to the value displayed on the page of New York Stock Exchange (NYSE) on the date December 23, 2014, as it was when the Dow Jones recorded the biggest gain of the year. It got an increase of 52.66 points. So, each stock of the 30 companies included in the Dow Jones index generated a capital gain of 0.29%.

But if we choose the value of the Dow Jones in the worst moment, such as at the date of March 6, 2009, as reflected on the NYSE website, the opening price was 7,056.48 and the closing price was 6,626.94. Therefore, in this date, each stock of the 30 companies included in the Dow Jones market index generated by investors a loss of 6.087%.

Figure 1 shows the historical evolution of the DJ market index closing price. This Figure 1 displays the closing prices of DJ index, showing the US market evolution characterized by a clear growth of this stock market prices throughout the period – except the financial crisis in 2008-. Nevertheless, it is interesting to analyse a possible different behaviour of sectoral portfolios in the same period of time.

4. Data and methodology

This section analyses individual companies listed in the Dow Jones market index and classifies them by sector. In order to select the same number of companies for each sector, each sector portfolio comprises only two companies based on the largest market capitalization in the Dow Jones market index.
From these data through the page https://es.finance.yahoo.com/q?s=^DJI sectoral indices are created as the average between the two listed companies in each sector. The selected time period starts in 2000 and ends in 2014. However, as data of the risk-free interest rate –from the website of the Federal Reserve of the United States- is not available for the period between 2000 and May 2008 missing data, finally the sample period is from June 2008 to December 2014.

Thus, Table 1 displays information about the selected companies to create each sector portfolio for the US stock market analysis.

Table 1. Sectoral portfolios formed by the two companies listed in the Dow Jones market index and with the highest trading volume

<table>
<thead>
<tr>
<th>Sector</th>
<th>Selected companies</th>
</tr>
</thead>
<tbody>
<tr>
<td>Financials</td>
<td>JPMorgan Chase &amp; Co. (JPM)</td>
</tr>
<tr>
<td></td>
<td>American Express Company (AXP)</td>
</tr>
<tr>
<td>Energy</td>
<td>Exxon Mobil Corporation (XOM)</td>
</tr>
<tr>
<td></td>
<td>Chevron Corporation (CVX)</td>
</tr>
<tr>
<td>Technology</td>
<td>International Business Machines Corporation (IBM)</td>
</tr>
<tr>
<td></td>
<td>Intel Corporation (INTC)</td>
</tr>
<tr>
<td>Health Care</td>
<td>Pfizer Inc. (PFE)</td>
</tr>
<tr>
<td></td>
<td>Merck &amp; Co. Inc. (MRK)</td>
</tr>
<tr>
<td>Consumer Discretionary</td>
<td>The Home Depot, Inc. (HD)</td>
</tr>
<tr>
<td></td>
<td>Caterpillar Inc. (CAT)</td>
</tr>
<tr>
<td>Telecommunications</td>
<td>AT &amp; T, Inc. (T)</td>
</tr>
<tr>
<td></td>
<td>Cisco Systems, Inc. (CSCO)</td>
</tr>
</tbody>
</table>

Source: Own preparation

In this table we have chosen six sectors and each sector corresponding to appear. Regarding the sector “Financials”, both JPMorgan Chase & Co and American Express Company (AXP) is dedicated to advice clients who wish to enrich their business volume. The sector “Energy” includes Exxon Mobil Corporation is one of the largest companies in supplying the world oil and petrochemical, and Chevron Corporation dedicated to produce and transport crude oil and natural gas and to refine and market fuel for transport.

The sector “Technology” is comprised of International Business Machines Corporation is a company dedicated to providing hardware solutions plus a host of services and information technology by Intel Corporation that interacts with various groups such as customers, networks, Internet, software and services. The sector “Health Care” is made by Pfizer Inc. whose main objectives to provide access to affordable and safe medicines to all who need them, and Merck & Co. Inc. that is committed to developing and delivering products and services that improve the welfare of the population. The companies chosen for the sector “Consumer Discretionary” include The Home Depot, Inc. and Caterpillar Inc. that both are engaged in production of building materials, but the difference is that the first company is a DIY retailer and the second is the world's largest manufacturer of machinery and mining equipment. Finally, the sector “Telecommunications “ includes AT & T, Inc. and Cisco Systems, Inc. and both are engaged in the sale and maintenance of telecommunications equipment companies.
These figures contain closing price data used in the relevant companies of each sector and the Dow Jones indicator analysis. The period chosen is the June 2, 2008 until December 1, 2014. From these data we created sectoral indices through average function between the two companies in each sector.

Then we obtained the values for the free interest rate risk through the website of the Federal Reserve of the United States. The Treasury Bills (secondary markets) 1 year instrument on a monthly basis was chosen.

The monthly risk-free interest rate \( i^{(12)} \) is expressed as a percentage, so the first step is to divide the results between 100 and second to apply the following formula:

\[
i^{(12)} = \left(1+i\right)^{1/12}-1
\]

**Figure 2. Evolution of the sectoral portfolios closing prices –formed by the two companies listed in the Dow Jones market index**

Financials (JPM and AXP)  
Energy (XOM and CVX)  
Technology (INTC and IBM)  
Health Care (PFE, MRK)  
Consumer Discretionary (HD, CAT)  
Telecommunications (T, CSCO)

Source: Compiled by authors from Yahoo Finance website
Figure 3 collects the evolution of the monthly risk-free interest rate.

**Figure 3. Evolution of the monthly risk-free interest rate**

![Graph showing the evolution of the monthly risk-free interest rate from June 2008 to June 2014.](image)

Source: Compiled by authors from the Federal Reserve website

5. Analysis of the sectoral portfolios

This paper proceeds to manage sector portfolios, from a traditional perspective as well as the model of Markowitz (1952) framework, using the mean-variance criterion and therefore jointly considers the expected return and the risk for analysing portfolios.

Thus, the returns on financial assets –which in our case are sectoral indices– are obtained through the formula:

\[
 r_t = (P_t - P_{t-1})/P_{t-1} 
\]

(2)

where \( P_{t-1} \) is the price of financial assets at time \( t-1 \) and \( P_t \) is the price of the financial asset at time \( t \).

**Figure 4. Evolution of the sectoral portfolios and the DJ market index returns**

![Graph showing the evolution of the sectoral portfolio returns and the Dow Jones (DJ) market index returns from June 2008 to June 2014.](image)

Source: Compiled by authors from Yahoo Finance website

Figure 4 shows the evolution of the sectoral portfolio returns and the Dow Jones (DJ) market index returns. Through these returns we can analyse income increases or decreases as a percentage of the wealth of investors as a result of the investment in a financial asset. For the sample mean of each sector we have used the unbiased estimator of the expected return (Figure 5, Panel A).
The sample mean of the DJ returns (about 0.80%) is lower than the sample mean of the sectors “Technology”, “Health Care”, “Telecommunications”, “Financials” and “Energy”, whose values are 2.3%, 1.89%, 1.53%, 1.51% and 1.43%, respectively. Only in the case of the sector “Consumer Discretionary” the DJ sample mean is higher, 0.80% vs. 0.56%.

As far as the sample variances of each sector and the market returns are concerned, Figure 5, Panel B, depicts the relevant differences between them.

As expected, the sector “Technology” is the most risky sector, because it also shows the most highly return. In general, the same sectors that show higher average returns than the market returns also exhibit higher sample variance than the market one (sectors “Technology”, “Health Care”, “Telecommunications” and “Financials”). Only the “Energy” sector show lower sample variance than the market variance, along with the “Consumer Discretionary” sector.

The next step is to get the beta coefficient ($\beta$) to measure the sensitivity of each sector returns to changes in the market portfolio returns, that is, the DJ index returns. Figure 5, Panel C, shows that the performance of each sector react less than the market average because all values are below 1, the $\beta$ value of the market portfolio (DJ index).

The most sensitive sectors to changes in the market portfolio returns may be the sectors “Financials”, “Health Care” and “Energy”. Thus, changes of 1% in market returns may expect changes in the same sense of amount 0.85%, 0.73% and 0.72% respectively in these sectors.

Below the security characteristic line relates the market portfolio (DJ) returns and each sector stock returns.

$$r_j = A_j + \beta_j r_M$$

where $A_j$ is the intercept, $\beta_j$ shows the systematic risk of sector $j$, $r_M$ is the stock market returns (DJ index returns) and $r_j$ shows the sector stock returns.
Figure 6 depicts the security characteristic line between a particular sector stock return and the market stock return at every point in time.

Figure 6 shows that the slope of each characteristic line is positive and the coefficient of determination ($R^2$) is between 0.29 (Telecommunications) and 0.55 (Energy). Thus, there is a positive relationship between each sector and market stock returns.

**Figure 6. Security characteristic line between a particular sector stock return and the market stock return at every point in time.** The Y-axis is the sector stock return and the X-axis is the stock market return.

Source: Compiled by authors from Yahoo Finance website

Specifically, the sector “Energy” depends largely on the market stock returns, along with the sectors “Consumer Discretionary” and “Financials”. Conversely, the less influenced sector by the market is the sectors “Telecommunications”, “Technology” and “Health Care”.

To conclude this section shows the Security Market Line (SML) which relates the systematic risk ($\beta$) of an asset or portfolio with its expected return. So, this analysis uses the Capital Asset Pricing Model (CAPM) that relates the risk assumed by each sector with the required sector returns.

This CAPM model assumes that individuals are price takers and have homogeneous expectations regarding the planning horizon of the investment. Also it hypothesizes that investors are rational and try to maximize the expected return for each risk level. If financial markets were perfect then there would be no transaction costs or taxes and no arbitrage opportunities. Figure 7 shows the SML line.
Figure 7. The Security Market Line (SML)

Source: Compiled by authors from Yahoo Finance website

The points that are above the SML line represent actual returns of each sector portfolio throughout the sample period (blue returns). However, the points on the SML line are the expected returns according to the CAPM model (red returns). Therefore, given the distances between the blue and red dots represent arbitrage opportunities. As we can see, only the “Consumer Discretionary” portfolio has an actual returns—throughout the sample period—that practically coincide with the expected return. Nevertheless, the “Energy”, “Financials”, “Telecommunications”, “Health Care” and “Technology” sectors offer arbitrage opportunities along the analysed sample period, as the sector portfolios have actually achieved a higher-than-expected performance by the CAPM.

6. Concluding remarks

This research focuses on analysing the US stock market, both from the perspective of the real and financial economy. To do this, this research analyses the evolution in recent years of the main indicators of the US stock market, that is, Dow Jones and S&P500 indices. In addition, this study analyses and compares six sector portfolios integrated each by the two leading companies in the sector (Financials, Energy, Technology, Health Care, Consumer Discretionary and Telecommunications).

After conducting a preliminary analysis of traditional portfolio management, all sectors except the sector “Consumer Discretionary” show yields actually achieved higher than expected according to the CAPM. Thus, this fact is confirmed with the Security Market Line (SML), according to which all portfolios (excluding the sector “Consumer Discretionary”) are above that line. This indicates that investors choose to invest in these sectors are able to take advantage of arbitrage opportunities that supposed to get a higher than expected according to the Capital Asset Pricing Model (CAPM) performance.

To conclude, after analysing the security characteristic lines for each sector, the sector “Energy” is the most affected sector by changes in the stock market returns (associated to a greater slope or beta factor and therefore a greater risk factor), along with “Consumer Discretionary” and “Financials” sectors. The less sensitive sector to market
changes is the “Telecommunications” sector, together with “Technology” and “Health Care”.

The comparison between the actual results obtained by different sector portfolios (based on the Markowitz model) and results expected by the CAPM shows that those sectors that are at the top of the chart and greater distance from the SML line are those who have offered better results, compared to the expected according to CAPM, in the period analysed. Therefore, the most attractive sectors for investors who have obtained after this analysis are in the ranking showed in Table 2:

<table>
<thead>
<tr>
<th>Ranking</th>
<th>Sectors</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Technology</td>
</tr>
<tr>
<td>2</td>
<td>Health Care</td>
</tr>
<tr>
<td>3</td>
<td>Telecommunications</td>
</tr>
<tr>
<td>4</td>
<td>Financials</td>
</tr>
<tr>
<td>5</td>
<td>Energy</td>
</tr>
<tr>
<td>6</td>
<td>Consumer Discretionary</td>
</tr>
</tbody>
</table>

Source: Own preparation

Accordingly, and considering the risk taken by the sector portfolios (measured by beta factor) and average sample performance observed and predicted based on CAPM performance, we can confirm that all sectors analysed –except the sector “Consumer Discretionary”- show arbitrage opportunities for investors, as they exhibit yields higher than expected according to the CAPM model.

Therefore, this research includes relevant implications to portfolio managers to reduce the risk and maximize the return in the investment horizon.

References


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