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Book

Factors affecting the bond-equity correlation

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Abstract

One of the typical market observations is that bond and equity prices are correlated to a certain degree. The extent of this correlation may, however, vary according to the period under review and the general market environment. This paper seeks to examine and tries to identify factors leading to different degrees of correlation between these two asset classes. This examination is undertaken by studying the bond-equity price relationship and trying to identify factors that drive it. More specifically, this paper seeks to understand the bond-equity price correlation between January 1995 and March 2024 for the US and European markets. It particularly focuses on the period between March 2016 and March 2024 and covers the most recent market developments.

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1.0 Introduction

Corporations can finance themselves through several ways, two of which are, by issuing bonds or shares[1]. By contrast, governments usually issue bonds to fund their deficits. Alternatively, governments can sell assets, for example through privatisation, or raise taxation[2].

From the demand side, when an investor chooses to buy a bond issued by the government, they face the risk that the government may not be able to honour the repayment of the original capital, especially in the case of governments with very high debt-to-GDP ratios. In such scenarios, long-term maturity bonds typically offer higher yields to attract investors and as compensation for the increased risk. Moreover, if a highly indebted government eases fiscal policy in a manner that is detrimental to public finances, it can trigger a sell-off in the secondary bond market. Investors, concerned about the government's ability to honour its long-term debt commitments, might decide to offload their bond holdings. This sell-off increases the supply of government bonds in the secondary market, which can drive down their prices, holding all else constant.

On the other hand, the price of shares tends to fluctuate more than that of bonds. Shares are by nature, perceived to be riskier than bonds as the capital value and periodic dividend payments are not guaranteed. Hence, it is important for investors to understand the relationship between movements in equity and bond prices, in order to be able to protect their portfolios from sudden adverse movements in either of the asset classes and preserve their overall capital outlay.

Various studies have shown that the relationship between these two variables was not always consistent. Also, the strength of the correlation between these two assets has increased and decreased over specific periods, which can also explain how strong the positive or negative the correlation was during those periods.

Another point worth mentioning, when studying the correlation between equity and bond returns, is the correlation may vary over a short period of time. This could mean that the correlation could suddenly change from positive to negative or vice-versa in a short period of time, say, from one quarter to the next of the same year[3]. This further complicates the understanding of the correlation between the two variables.

This paper seeks to understand the relationship between equity and bond returns, while looking at the prevailing market conditions that characterized periods where there was clear positive or negative correlation between the two variables. More specifically, this paper will delve into more detail for the period January 1995 until March 2024.

This analysis is divided as follows: Section 2.0 covers the theoretical literature underpinning the bond-equity correlation. Section 3.0 details how this correlation evolved over time with an emphasis on the

[1] Shares, stocks and equities are used interchangeably throughout this paper.

[2] Governments borrow money specifically through the issuance of government bonds which offer periodic coupons as is the case of corporations, but they are deemed safer since coupon payments and the original capital is backed by taxpayers' money and thus investors would have more peace of mind that the original capital will be honoured by the borrower.

[3] For instance, in Q2 2023 the correlation between US Aggregate Bond Return Index and the S&P 500 was -0.575 while in Q3 of the same year it changed to 0.629 (Refer to Appendix A were all the quarterly correlations between these two variables are presented).

most recent period i.e. from 2016 onwards. Section 4.0 seeks to identify the variables leading to the bond-equity correlation. Finally, Section 5.0 discusses the main conclusions.

2.0 Theoretical Background

Portfolio managers and other investors (hereinafter, referred to as investors) have been keen to understand the relationship between bond and equity returns to determine how best to diversify their portfolios.

Based on the underlying theory, bond prices tend to increase when yields fall and vice versa. Hence, bond returns tend to rise, in a falling yield environment. This makes it appealing for investors to shift their investment allocation from equities to bonds and vice versa. On the other hand, a surge in bond yields over a period of time, as happened in 2022 and 2023, makes bonds more attractive to purchase and may lead investors to shift from equities to bonds and vice versa. This explains the rationale behind the negative correlation between bond and equity returns.

To better understand the factors that can affect a bond's value (V_B), one can express such relationship through the following equation:

$$V_{\mathbf{B}} = \sum_{k=0}^{n} \frac{INT}{(1+\mathrm{k}_d)^t} + \frac{M}{(1+\mathrm{k}_d)^{\mathrm{N}}}$$ [4]

where:

$V_{\mathbf{B}}$ is the bond value,

INT is the annual interest paid by the bond expressed in Euro (€) terms,

M is the par (nominal) value of the bond when the bond matures,

N is the number of years for the bond to mature.

$\mathrm{k_d}$ is the bond's market rate of interest. This is also known as the discount rate which is used to calculate the present value of the bond's cash flows. It is only equal to the coupon interest rate only when the bond is selling at par.

[4] Refer to pages 271 - 272 of Fundamentals of Financial Management (tenth edition), International Student Edition, by Brigham Eugene F., Houston F Joel. A slight adjustment to the formula is needed if a bond pays coupon every six months rather than once a year. In such a case, INT and k_d must be divided by 2, whilst N must be multiplied by 2.

k_d can be further divided into sub-categories by adding r, which is the real interest rate, i, which is the inflation rate and adding the bond risk premium, which is the difference between the rate of return on a risky bond to a less risky bond, depending on their ratings assigned by rating agencies.

In the case of equities, the value of a stock (P_0) is derived as following:

$$P_0 = \sum_{t=1}^{\infty} \frac{D_t}{(1 + k_s)^t}$$ [5]

where:

P_0 is the stock value,

D_t is the dividend the stockholder is expected to receive at the end of Year t.

k_s is the minimum acceptable, or required, rate of return on the stock, considering both its riskiness and the returns available on other investments. The determinants of k_s include the real rate of return, expected inflation, and risk, which when summing up all the three variables together, reflect the discounted value of the future cash flow of the stock.

Against this context, investors prefer to diversify their portfolio allocations in order not to be exposed solely to the performance of one particular asset class. According to a market rule of thumb, allocating the portfolio in the ratio 60% stocks and 40% bonds is expected to result in an optimal outcome in terms of risk-adjusted return.

Over period 1966 till 2001, empirical data for US markets suggests that a positive correlation between bond and equity returns exists. However, the relationship was not consistently positive to the same extent and was far from linear. In fact, the correlation between the two asset classes was quite volatile.

One interesting question is, *what have turned the correlation from a positive one to a negative one in 2001 and what led to the return of the positive correlation in recent years?* This paper seeks to analyse the forces driving investors to switch between one asset class to the other.

The prevailing market and economic elements influencing this relationship can be simplified in terms of six factors, namely: i) Interest rates, ii) Yields, iii) Inflation, iv) Corporate earnings, v) Risks associated with the asset class and the market, vi) Economic growth.

[5] Refer to pages 313 - 315 of Fundamentals of Financial Management (tenth edition), International Student Edition, by Brigham Eugene F., Houston F Joel. Note that this is the simplest equation to understand how a stock price is derived and does not incorporate the expected growth of a stock, which also impacts it present value.

i) Interest rates

The current and expected level of interest rates can affect investors' decisions when choosing between equities and bonds, other things being equal. The interest rate is considered as the cost of funding for firms. Small capitalisation companies, who seek finance whilst growing, tend to be particularly sensitive to changes in interest rates. Although, no robust empirical evidence exists, theoretically, companies in the technology sector tend to be even more sensitive to interest rate changes as most of these company's valuations depend on their expected future cashflows. Higher interest rates would mean that their stock price would need to be discounted at a higher rate, weighing on the company's valuation.

In the case of bonds, if future interest rate hikes are not priced in by investors, bond prices are likely to be impacted negatively, as in such an environment, bond yields tend to rise. Thus, a shift in central bank stance to a more hawkish one, would likely result in a rise in yields and fall in bond prices, ceteris paribus and vice versa. Moreover, higher interest rates also make it more favourable for depositors to deposit money, rather than shifting money towards equities or bonds. Against this background, usually it is assumed that as interest rates rise, equity prices fall, and bond prices also decline. The opposite applies in a declining interest rate environment, that is, when interest rates decline, bond prices rise as well as those of equities.

ii) Yields

Changes in interest rates, including the expected policy rate path by central banks, affect bond yields. A decision by the Federal Reserve (Fed) would not only influence bond yields in the U.S. but could have spillover effects on European bond markets. In a scenario of rising bond yields, bond prices are expected to fall making them more appealing relative to stocks.

Besides other factors, yields may rise due to a sell-off (increased supply) in bonds. This may lead to lower bond prices. In such a case, investors are likely to ask for higher yields at upcoming Treasury auctions. *But is there a level which must be reached in terms of yields, which can make bonds more appealing compared to stocks?* In theory, at high yields, investors tend to favour debt over equities given that at such yields, they would be cheaper while also being a safer investment relative to equities.

For instance, when, on the 19 October 2023, the 10-year U.S. benchmark reached a 17-year peak of almost 5.0%[6], both the S&P 500 and the interest-sensitive NASDAQ Composite Index continued to decline until reaching a trough on 27 October of the same year. Thereafter, equities rose significantly as softer than expected inflation readings justified the argument for future interest rate cuts by the Fed.

As bond yields rise, investors tend to buy bonds, especially when they think that yields have peaked. These may be funded by selling equities from their existing portfolios. Thus, in a high yield environment, it is presumed that a negative correlation would exist between equity and bond returns and vice versa, as a substitution effect would dominate investors decisions.

iii) Inflation

Actual general price rises and increasing inflationary expectations by consumers affect investors decisions. Inflation above the 2% target set by central banks in advanced economies, generally means

[6] The all-time peak for the U.S. benchmark 10-year yield was reached on the 6 January 2007 at 5.1%.

that central banks will eventually intervene, irrespective if inflation is caused by cost-push or demand-pull factors. Inflation above the 2%, as measured by the Harmonised Index of Consumer Prices in the euro area (HICP) and by the Consumer Price Index (CPI) and Personal Consumption Expenditures (PCE) Price Index in the U.S., usually means that central banks will adopt a contractionary monetary policy. To this effect, central banks may choose to raise borrowing costs through hiking interest rates and/or absorb liquidity through other tools, to negatively impact demand and hence ease price pressures in the economy. In turn, raising interest rates would imply that bond yields would rise, while their prices would fall. In such an environment where inflation is not fuelled by higher profit margins, equities would likely experience a drop in price. Thus, the higher and more prolonged increase in the inflation rate, the more positive would be the correlation between bonds and equities, as they would move in the same direction in terms of returns.

iv) Corporate earnings

Prospective corporate earnings and company's growth outlook could affect the stock price of a company and other related companies which in turn would affect the equity-bond correlation.

Future earnings are usually reported on a quarterly basis together with actual company results for the previous three months. If a particular company is expected to register higher earnings growth due to favourable market conditions and increased demand for the product/s that the company produces, such news could positively impact not only the equities of that company but also those of companies in the same or related sector or industry. Corporate earnings could also affect the cash flow of the company which in turn increases the credit worthiness of the corporation, improving the prospects for bond holders of that particular firm.

Other things being equal, better prospects for company profits in the foreseeable future affect positively the equity of that firm. Simultaneously, it will also affect the demand for bonds issued by the same company, as better expected earnings increase the likelihood that the company can honour its debt and reduce the issuer's probability of default.

iv) Market and Geopolitical Risk

Asset class risk can be associated with assets depending on how much return is expected from such assets and how easy it is for the investor to transform them back into cash. Risk can also be associated with the risk that the market downturn due to a specific financial event or a recession in an economy which eventually affects households' incomes and also companies' profitability. In turn, this affects investors' confidence and risk appetite. The CBOE Volatility Index can be regarded as a numerical expression of the fear or risk investors perceive of the S&P 500, which is regarded as one of the most important index measurements of equities risk in the U.S and hence a sharp drop in such index could reflect a drop in performance of the S&P 500. Risk can also be associated with weaker economic growth (GDP).

Another source of risk arises from high and persistent fiscal deficits, especially those driven by unsustainable expenditure. This could affect the demand for long-term government bonds especially if the debt-to-GDP ratio of that country is already high.

Geopolitical concerns may also impact the bond-equity correlation. One such example is the terrorist attacks of 11 September 2001 in the U.S. which led the S&P 500 to plunge by more than 28 % over the period till 9 October 2002[7]. The market volatility index in short known as VIX, increased during the

[7] The GDP however, recouped from the downturn in 2001, and registered four consecutive quarters of growth from Q4 2001 till Q3 2002.

September 11th terrorist attacks (and also during and the Great Financial Crises), quadrupling in the space of two months from 20 to 80.

In a nutshell, as risk increases, one would expect risk averse investors to shift towards safer assets such as bonds and term deposit accounts over equities. Thus, the higher the risk, the more investors are envisaged to shift their portfolio allocation from equities to bonds. In such cases the bond-equity correlation would be expected to be negative.

vi) Economic Growth

In periods of sustained economic growth, both equity and bond returns tend to appreciate. For instance, during 1989 and the first half of 2003, US real GDP generally grew over consecutive quarters. In fact, the U.S. economy was referred to as entering a new era during this period because of the GDP growth boom. During this phase, households had more disposable income and used that income to purchase more stocks and bonds, boosting their value. While the U.S. sustained consecutive GDP growth rates, the stock market boomed. This period was therefore characterised by a strong positive correlation between the returns on equities and bonds.

The next section examines how the above-mentioned factors could affect the equity-bond return correlation and to what extent this could have affected the degree of strength in the correlation between the two variables.

3.0 Historical Equity – Bond Price correlation

Over the past years, various research has been conducted to seek to understand whether the negative correlation was visible throughout the years and what factors could have affected it.

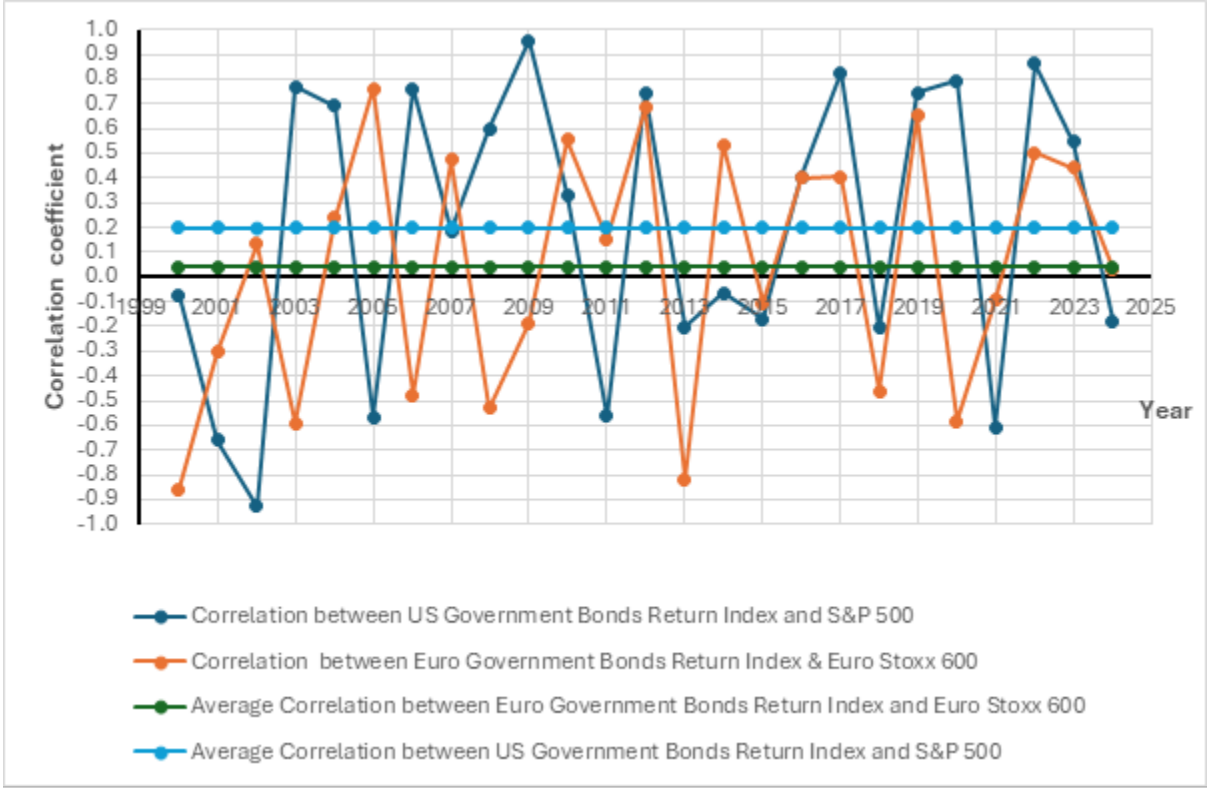
A study by Sean Markowicz[8] investigates the equity-bond return correlation over the period 1931 – 2021. This shows that the negative correlation is more of a recent phenomenon, as before 2001, the correlation between these two variables was more frequently positive rather than negative. Such study proxies equity returns by U.S. large-capitalisation companies and bond returns using 10-year U.S. Treasuries, respectively. More specifically, using a 5-year rolling equity-bond correlation, throughout the period 1931 and 1955, it transpires that the correlation was positive, except for some specific years. The period between 1956 and 1964 was characterised by a negative correlation between the two variables, whilst the period between 1965 and 1999 was marked by an extended period of strong positive correlation. However, this strong positive correlation weakened significantly reaching negative figures from 2001 till end 2021.

For the purpose of this study, the correlation between bond and equity returns was computed and illustrated in *Figure 1* below. Bond and equity return variables were proxied by the U.S. Government

[8] See Article entitled *Why is there a negative correlation between equities and bonds,* by Sean Markowicz, CFA, https://mybrand.schroders.com/m/6662cf1f5d2d8543/original/202202_what-drives-the-equity-bond-correlation.pdf.

Bond Return Index[9] and the Standard and Poor's 500 (S&P 500) [10] respectively. Return and price data was sourced from Refinitiv. The correlation between the U.S Government Bond Return Index and the S&P 500 is depicted by the blue dot plot in *Figure 1*. On the other hand, the correlation between Euro Government Bond Return Index[11] and Euro Stoxx 600 is also depicted in *Figure 1* and is illustrated by the orange dot plot. The correlation between the U.S. Government Bond Return Index and the S&P 500 for the period 2000 till Q1 2024 and their respective R squared are illustrated in Annex A of this paper. In this case, the analysis of bond returns was limited to government bond returns only, due to data availability.

Figure 1- Correlation between Bond and Equity returns



Source: Refinitiv LSEG data, Central Bank of Malta workings. US Government Bonds Return Index is the property of Refinitiv's LSEG and past performance is not essentially a guarantee of future performance.

The data for the period under review covers the period from 1999 until the end of Q1 2024. As one can notice, when plotting the same data but using the Euro Government Bond Return Index for bond returns and the Euro Stoxx 600 for stock returns, a similar pattern as shown by the orange dot plot in

[9] The U.S. Government Bond Return Index is a bond return index which excludes income from coupons but focuses on the return from U.S. government bonds.

[10] The Standard and Poor's 500 (S&P 500) is defined as an index based on the stock prices of the largest 500 firms traded on the New York Stock Exchange, the NASDAQ Stock Market, and the American Stock Exchange.

[11] The Euro Government Bond Return Index is a benchmark that measures the investment grade, euro-denominated, fixed-rate bond market, including treasuries, government-related and ignores income from coupons but focuses on the return from the price of such bonds.

Figure 1 emerges. Basically, this may be the result of spillovers in equity and bond returns from the U.S. on to the European market.

It transpires that the correlation between the returns of the two asset classes was not always negative nor always positive but rather fluctuated through the period under review. This paper also corroborates the finding as the correlations were rather sporadic. Various research on the topic concludes that as from 2001, the correlation between the two variables started to be rather negative. Even though this paper shows that the correlation between these variables was negative, it was not consistent over the period under review.

Figure 1 above depicts a similar pattern as illustrated in the Russell Investments website[12]. The study by Peter Mortensen uses the Bloomberg Barclays Global Aggregate Total Return Index[13] for the analysis.

Hence, the difference between *Figure 1* above and the graph illustrated in the study by Peter Mortensen was that a more global fixed-rate bond index was used in the latter case.

The following table summarizes the periods when the correlation between the U.S. Government Bonds return index and the S&P500 was positive and negative.

Table 1: Correlations between the S&P 500 and the US Government bond index returns

Year	Periods showing positive correlation	Periods showing negative correlation
2000		-0.073
2001		-0.658
2002		-0.927
2003	0.769	
2004	0.692	
2005		-0.568
2006	0.759	
2007	0.188	
2008	0.598	
2009	0.954	
2010	0.33	
2011		-0.563
2012	0.746	
2013		-0.202
2014		-0.064
2015		-0.17
2016	0.403	
2017	0.825	
2018		-0.207
2019	0.746	
2020	0.795	
2021		-0.607
2022	0.862	
2023	0.019	
2024	0.141	

[12] Mortensen Peter, 26th October, Is the stock-bond correlation positive or negative?, https://russellinvestments.com/us/blog/is-the-stock-bond-correlation-positive-or-negative

[13] Bloomberg Barclays Global Aggregate Total Return Index is a multi-currency benchmark which includes treasury, government-related, corporate and securitized fixed-rate bonds from both developed and emerging markets issuers.

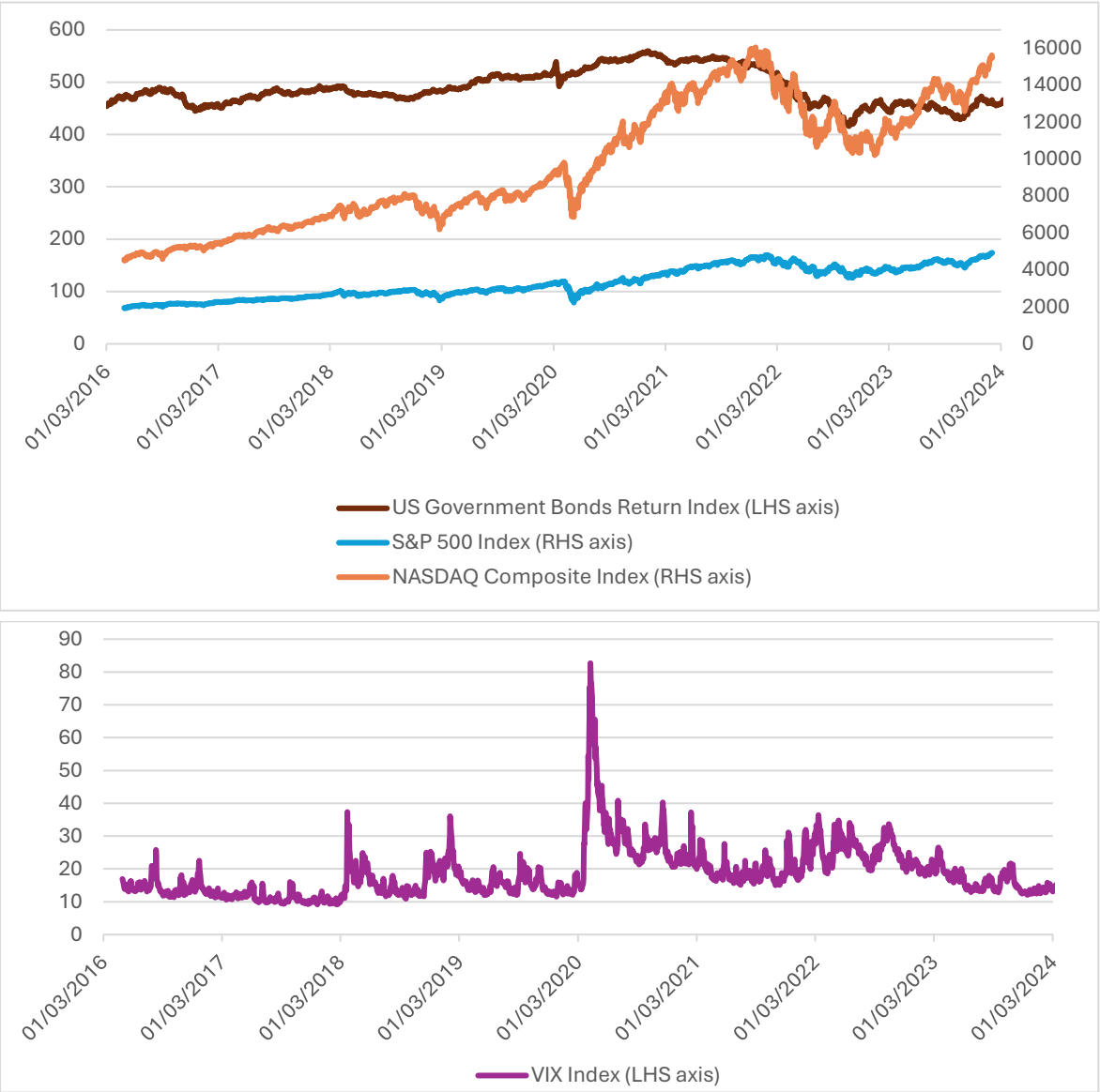
It appears that the periods 2003 – 2010, 2019 and 2020 and 2022 – 2024 were characterised by a positive correlation (except for 2005). The predominant factors affecting the positive correlation between U.S. bond and equity returns was the tightening cycle initiated by the Federal Reserve. For instance, on 28-29 June 2006, the FOMC raised rates for the seventeenth consecutive time by 25 basis points. That also happened in the tightening cycle initiated by the Fed in June 2022. For the latter period 2022 – 2024, with inflation dominating the agenda during these periods, the Fed raised rates and bond yields rose, and their prices dropped. In turn their return declined with equities also registering losses. For instance, in 2022, the S&P 500 fell from a level of 4,800 during the beginning of January 2022 whilst it declined by over 25 per cent until October 2022 and the bond return index declining by 21 per cent. This also applies when gains are registered in both returns as was seen during Autumn 2023. During that period, the Fed signalled that is near the end of its tightening cycle. In response, bond yields declined and their returns rose. Concurrently, equities also registered gains due to a better outlook on expected future cash flows.

4.0 Main factors influencing the correlation between equity and bond returns

As was claimed in the theoretical background of this paper, there are six main factors which can influence the correlation between equity and bond returns. In this section, we delve further into these factors to better understand the relationship between these two variables.

If one had to look graphically at the performance of equities, bonds and the VIX, specifically, over the period Q1 2016 till end of Q1 2024, as illustrated in *Figure 2*, *Figure 3* and *Figure 4* hereunder, one can notice three particular periods.

Figure 2 - VIX, U.S. Equities and Bond Performance



Source: Refinitiv LSEG data, Central Bank of Malta workings. US Government Bonds Return Index is the property of Refinitiv's LSEG and past performance is not essentially a guarantee of future performance.

One of these periods shows the rally in equities after the start of the pandemic (Q1 2020), which lasted until Q4 2021. During this period, bond returns increased and thus, this period was characterized by a positive relationship between bond and equity performance. Subsequently, the period Q4 2021 till Q4 2022, was characterised by a decline in bond returns and a slowdown in the equity rally (again a positive relationship between the two variables).

Another period worth noting was Q4 2023 till end of Q1 2024. During this period, equities and bonds rallied simultaneously, exhibiting a positive relationship. Over this period, there was a shift in market expectations that major central banks would soon exit the tightening cycle and start cutting interest rates as inflation had likely peaked.

At the same time, volatility in the S&P 500 as measured by the VIX, declined significantly during these specific periods. Thus, prima facie, a decline in the VIX could imply an appreciation in bond and equity returns, especially in the latter.

Besides the VIX, the prevailing market conditions, as explained in the theoretical background, could affect the correlation between the two asset returns. Also, by delving beyond the VIX, one could understand more holistically what could have led to the positive correlation.

For instance, if one had to combine all the six main factors[14] in order to be able to understand what were the market conditions during that particular period, Q1 2020 till Q4 2021 was characterised by quantitative easing by the Fed. At the same time, the Fed lowered interest rates to ease borrowing costs and thus help lift the economy from its downturn because of measures taken during the pandemic. This period was also characterised by rising inflation primarily due to disruptions in supply chains. During this period, U.S. treasury yields rose. Moreover, in the beginning of the pandemic, corporate earnings in the U.S. were at risk but rebounded thereafter aided by direct government support to U.S. SMEs and due to the expansionary monetary policy by the Fed.[15]By mid-2020, U.S. GDP had contracted, mainly led by a lack of private consumption due to the pandemic but rebounded by Q4 2021.

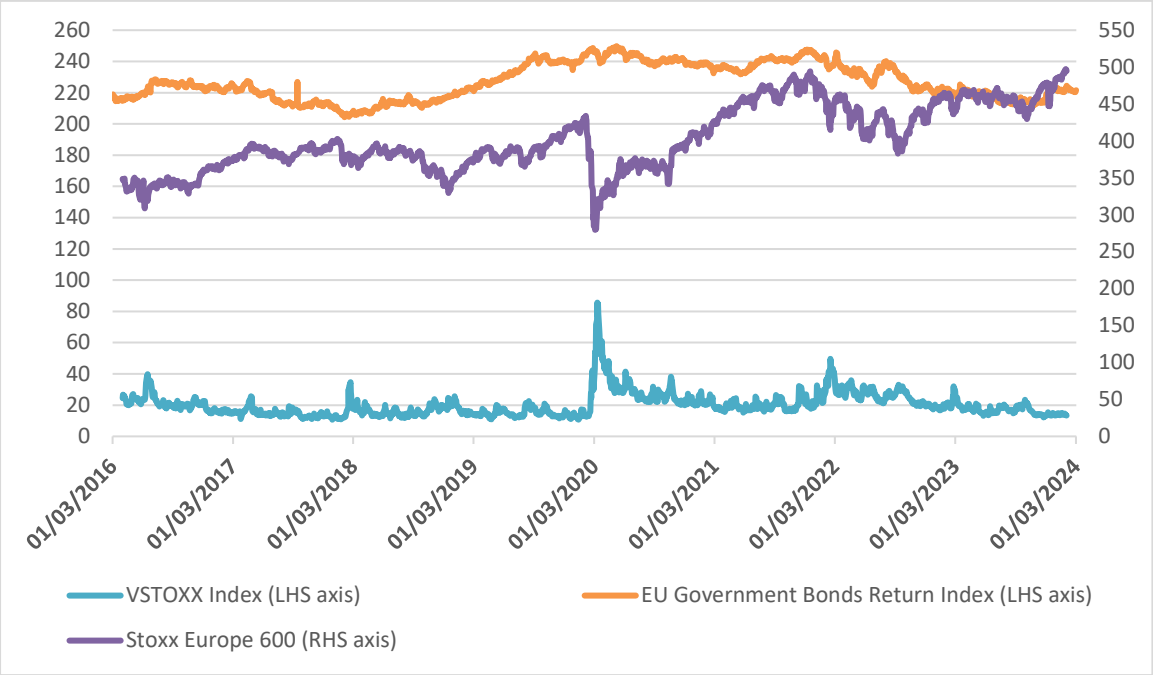
In the case of the Euro area, the volatility in European equities is measured by the VSTOXX, with the latter being based on a methodology developed by Deutsche Borse and Goldman Sachs. It measures the implied volatility from the Euro Stoxx 600 index options traded on Eurex with a rolling 30-day expiry.[16]

[14] The six main factors are the current and expected level of interest rates, bond yields, current and the expected inflation rate, corporate earnings, market and geopolitical risks and economic growth.

[15] Refer to https://www.federalreserve.gov/econres/notes/feds-notes/corporate-profits-in-the-aftermath-of-covid-19-20230908.html

[16] Based on the definition provided by Bloomberg Terminal.

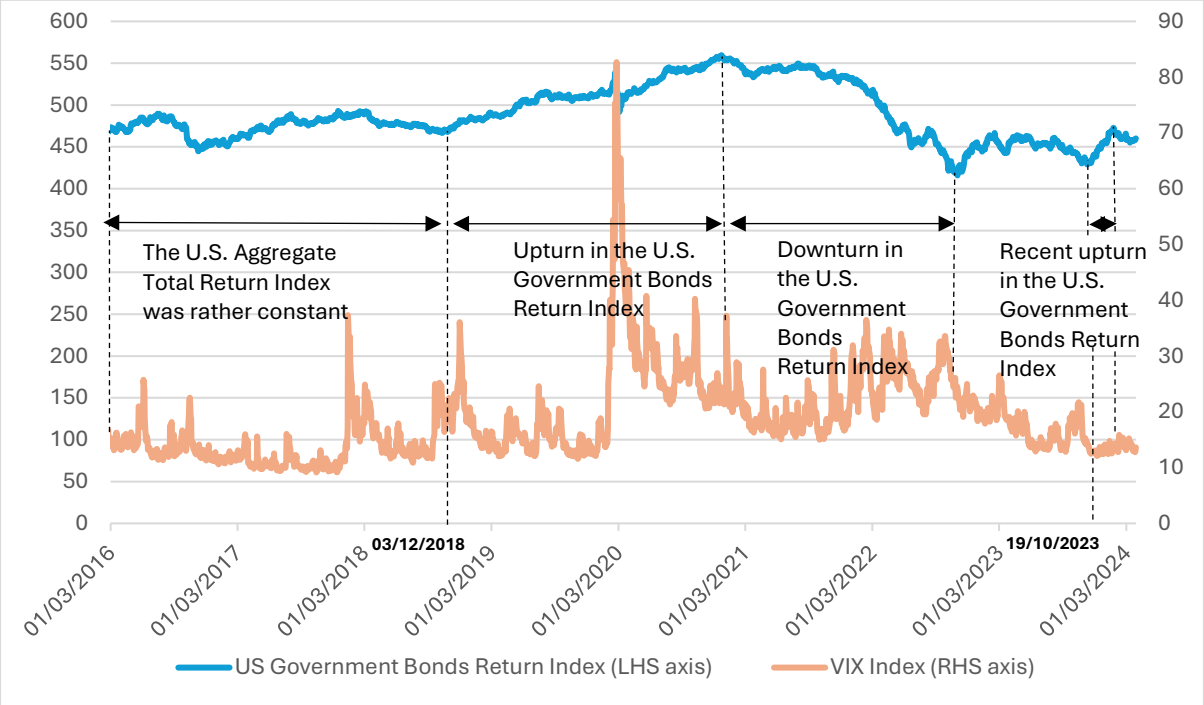
Figure 3 - VSTOXX, European Equities and Bond Performance



Source: Refinitiv LSEG data, Stoxx.com, Central Bank of Malta workings. EU Government Bonds Return Index is the property of Refinitiv's LSEG and past performance is not essentially a guarantee of future performance.

Figure 3 above depicts a similar pattern for the Euro area as that for the U.S. (which was illustrated in *Figure 2*). This is because changes in bond yields in this leading market can impact bond yields in the Euro area. Similarly, the major spike in the VIX, registered on 3 March 2020 was also mirrored in Europe's VSTOXX. Volatility in the equity prices at the height of the pandemic was visible across both major markets while stock returns declined due to the broad-based sell-off in equities.

Figure 4 - VIX and Bond Performance



Source: Refinitiv LSEG data, Central Bank of Malta workings. US Government Bonds Return Index is the property of Refinitiv's LSEG and past performance is not essentially a guarantee of future performance.

Turning back to the US and taking the VIX as a measure of risk, it spiked at the beginning of the pandemic (February-March 2020) but experienced a considerable downward trend thereafter until it stabilised in Q3 2021.

Over this period, monetary policy was expansionary, and interest rates were falling. In turn, equities, including the interest-sensitive NASDAQ Composite Index, rose. GDP also experienced six consecutive quarters of growth compared to the corresponding period of the previous year[17]. Market risk stabilised following the sudden spike at beginning of the pandemic. Concurrently, over the period 26 February 2020 till 27 July 2020, appetite[18] for bonds and equities rose the most.

Was this case also experienced in the other two periods that followed? The period between Q4 2021 and Q4 2022 was characterised by hikes in interest rates by the Fed. Until the end of 2022, the Fed hiked the policy rate by a cumulatively 425 basis points to try to tame inflation. In a rising interest rate and bond yields environment, GDP in the U.S. remained resilient. Following the pandemic, U.S. citizens engaged in consumption, while investors' risk sentiment stabilised. Concurrently, equity and bond returns fell, characterised by a sell-off in the secondary market. Thus, the dominant factor during this period were the interest rate increases adopted by the Fed due to high inflation.

Then, the period starting Q4 2023 was characterised by a dovish Fed and yields peaking in October 2023. Thereafter, when the Fed signalled three rate cuts in 2024, yields declined significantly. Again, from Q4 2023 till Q1 2024, there was a specific period where bond and equity returns rose in tandem, exhibiting a positive correlation. This period was between, 16 October and 26 December 2023.

What is interesting is that during Q1 2024, equity returns continued their upward trajectory, but bond returns fell slightly, with the U.S. Government Bond Return index dropping from 469.57 on the 26 December 2023 to 458.72 on the 28 March 2024.

During this specific period, interest in equities remained strong while investors sold bonds. As a result, bond yields surged with the yield on the U.S. 10-year Treasury note rising by 30 basis points. This rise in bond yields was primarily led by better-than-expected macroeconomic data released by various authorities in the U.S. This indicated that the downward trajectory in inflation towards 2% target might take longer than expected by the Fed.

VIX, equities and bonds performance

As described above, the drop in VIX coincided with an upturn in equity returns. Moving over to bond returns, a drop in VIX was also characterized by a corresponding rise in bond returns.

It can be noted in *Figure 3* above, that in two instances, after the VIX reached its peak on 30 November 2018 and on 20 October 2023, it started declining whilst bond returns increased. Bond returns rose at a faster pace on 20th October 2023. This is shown by the steeper gradient in the U.S. Government bond return graph (as shown in the blue line in *Figure 4*).

Thus, one can deduce that the prevailing market conditions, with the most emphasis being made on the significant progress that the Fed has made in taming inflation and that no more interest rate hikes will be needed, was the primary focus that led to both a rise in equity and bond returns throughout the mentioned period.

[17], US GDP rebounded between Q3 2020 and Q4 2021 from a downturn at the beginning of the pandemic (Q1 and Q2 of 2020).

[18] This may have been due to higher demand for technology during the pandemic lockdowns and higher personal savings. This is especially noticeable by the surge in the NASDAQ during this period as shown in Figure 2.

5.0 Comparing the risk – adjusted return on different portfolio allocations

In this section we seek to compare the risk-adjusted return under three specific scenarios, in order to assess whether diversification pays-off. To assess this, the Sharpe[19i] ratio was computed for 3 portfolios as per below.

i) Portfolio 1: 100% U.S. government bonds

ii) Portfolio 2: 100% U.S. Equities

iii) Portfolio 3: 60% U.S. Equities, 40% US government bonds

The period analysed to compare the return on investments versus their risk is the 23-year period between 2000 and 2023, as data for the full-year 2024 was not available. For the purpose of this exercise, equity returns were proxied by returns on the S&P 500, whereas those for bonds were proxied by US government bond returns. From workings which can be found in Appendix B of this paper, the Sharpe ratios for the three scenarios listed above are (i) 0.36, (ii) 0.31, and (iii) 0.33, respectively[20].

To check for statistical differences amongst the 3 scenarios, a t-test was computed using 95% confidence interval (i.e. a confidence interval of 0.05) for a two-tail test comparing the mean returns of the 3 scenarios. The P values of the 3 tests can be found in Annex C of this paper. All the returns are considered statistically significant given that the p-values are less than 0.05.

Specifically for the period 2000-2023, the optimal Sharpe ratio amongst the three portfolios analysed emanates from a portfolio composed solely of US government bonds. Despite this, benefits from diversification still stand out, as a superior risk-adjusted return is still enjoyed if the investor moves from holding solely equities to including bonds in his portfolio. According to these calculations, if bonds are added to an equity portfolio in the ratio 60/40, the risk-adjusted return improves from 0.31 to 0.33. Given that the Sharpe ratios for the three scenarios were below 1, the 3 portfolio investments are considered as suboptimal investment strategies specifically for the period under review, that is, for 2000 – 2023.

[19] The Sharpe ratio is often used as a measure for the risk adjusted return. It computes the excess return from the investment deflated by the volatility of that investment proxied by the standard deviation of the expected return of the investment (refer to Appendix B for the formula). The computation of the Sharpe ratio for different portfolio allocations can provide guidance to portfolio managers in their investment decisions.

[20] Given that all three Sharpe ratios are below 1.0, the performance of each investment scenario, either being fully invested in bonds, equities or the 60-40 equity-to-bond ratio, do not render a good absolute performance during the period under review when measured against the 90-day U.S. treasury bill rate.

6.0 Conclusion

The correlation between bond and stock returns has been challenging to comprehend, especially due to abrupt movements throughout the years. However, combining all relevant factors can aid the investor understand why the correlation between the two variables changes over time.

As shown in section 4, one could opt to monitor the volatility in the S&P 500 as measured by the VIX in order to try to anticipate movements in bond and equity returns. As described, in periods of lower volatility could lead to gains in returns of equities and bonds, alike leading to, a positive correlation between the two asset classes and vice-versa.

Another predominant market factor is inflation. Persistently lower inflation releases could lead to a reduction in inflation expectations by consumers which could affect this correlation. For instance, cooling inflation and more dovish central bank rhetoric could lead to a positive correlation between the two variables. This is because investors would invest both in equities and bonds. Interest in the former is expected to increase more than in the latter since expected future cash flows from corporations are envisaged to be higher as the central banks start to lower interest rates, while in the case of the latter, the dovishness could lead to decreased bond yields in the future so investors would opt to buy bonds now at cheaper levels, prior to when yields start declining.

As shown in section 5, the relationship between bond and equity returns is particularly useful for portfolio managers when constructing portfolios. A non-perfect correlation between these two asset classes offers diversification benefits to the investor. As the results illustrate, during the period 2000 till 2024, the risk-adjusted return generally improved when adding bonds to an equity portfolio.

However, the correlation between the two variables could change from positive to negative and vice-versa in a short period of time such as from one quarter to the next quarter of the same year, as shown in the Appendix of this paper. This is because short-term factors could affect the correlation coefficient between the two variables. The periodic release of macroeconomic data by various government bodies and statistics authorities could prove an important factor which affects the correlation between equity and bond returns. As an example, the release of higher-than-expected CPI data could imply that central banks might defer interest rate cuts, which in turn could lead to lower both stock and bond returns due to higher-for-longer interest rate scenario and thus in such instance a positive correlation would exist.

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Introduction to the Sharpe Ratio as can be found in https://gocardless.com/

8.0 Appendix A

Quarterly correlation and R^2 between U.S. Government Bond Return Index and the S&P 500

Year	Correlation between US Government Bonds Return Index and S&P 500*	R^2	Correlation between US Government Bonds Return Index and S&P 500 Q1	Correlation between US Government Bonds Return Index & S&P 500 Q2	Correlation between US Government Bonds Return & S&P 500 Q3	Correlation between US Government Bonds Return & S&P 500 Q4
2000	-0.073	0.0053	-0.046	0.608	0.835	0.913
2001	-0.658	0.4330	0.636	0.054	-0.772	-0.706
2002	-0.927	0.8593	-0.042	-0.907	-0.264	0.265
2003	0.769	0.5914	-0.624	0.834	0.195	0.802
2004	0.692	0.4789	0.127	0.429	0.276	0.858
2005	-0.568	0.3226	0.366	-0.701	0.015	-0.272
2006	0.759	0.5761	-0.375	-0.033	0.85	0.79
2007	0.188	0.0353	-0.352	-0.579	-0.184	-0.835
2008	0.598	0.3576	-0.653	0.223	0.34	-0.157
2009	0.954	0.9101	0.749	0.797	0.872	0.057
2010	0.33	0.1089	-0.205	0.307	0.652	-0.363
2011	-0.563	0.3170	0.052	-0.087	0.212	0.414
2012	0.746	0.5565	0.127	0.522	0.844	0.547
2013	-0.202	0.0408	-0.723	-0.51	0.804	-0.386
2014	-0.064	0.0041	0.346	0.692	-0.465	-0.915
2015	-0.17	0.0289	-0.478	0.104	-0.809	-0.444
2016	0.403	0.1624	0.547	-0.018	0.178	-0.878
2017	0.825	0.6806	0.271	0.771	0.382	0.642
2018	-0.207	0.0428	0.134	-0.751	-0.607	-0.753
2019	0.746	0.5565	0.672	-0.021	-0.747	-0.265
2020	0.795	0.6320	0.309	0.886	0.724	0.909
2021	-0.607	0.3684	-0.674	0.601	0.231	-0.344
2022	0.862	0.7430	0.421	0.702	0.619	0.774
2023	0.019	0.0004	0.319	-0.572	0.649	0.955
2024	0.141	0.0199	0.141	N/A	N/A	N/A

Source: Reuters, Central Bank of Malta workings.

* *Figures cover the whole year except for year 2024 which covers until end of Q1 2024.*

9.0 Appendix B

The Sharpe ratio is computed using the following equation:

$$Sharpe\ Ratio = \frac{\mathrm{R}_p - \mathrm{R}_f}{\sigma_p}$$

where R_p stands for portfolio return,

R_f stands for risk-free rate as measured by 90-day U.S. treasury bill rate,

σ_s stands for the standard deviation of the portfolio return

Scenario (i)

Portfolio composed of 100% Bonds				
Year	**Average Return for the year**	**Rp**	**Rf**	**Excess Return**
2000	211.57			
2001	222.58	5.20	1.49	3.71
2002	238.68	7.23	1.49	5.74
2003	274.83	15.15	1.49	13.65
2004	298.18	8.49	1.49	7.00
2005	311.92	4.61	1.49	3.12
2006	315.63	1.19	1.49	-0.31
2007	337.43	6.91	1.49	5.41
2008	365.56	8.34	1.49	6.84
2009	383.64	4.95	1.49	3.45
2010	410.15	6.91	1.49	5.41
2011	439.47	7.15	1.49	5.66
2012	457.52	4.11	1.49	2.61
2013	453.97	-0.78	1.49	-2.27
2014	466.03	2.65	1.49	1.16
2015	446.53	-4.18	1.49	-5.68
2016	468.78	4.98	1.49	3.49
2017	470.65	0.40	1.49	-1.10
2018	478.79	1.73	1.49	0.24
2019	499.18	4.26	1.49	2.76
2020	530.47	6.27	1.49	4.78
2021	541.85	2.14	1.49	0.65
2022	466.95	-13.82	1.49	-15.31
2023	451.08	-3.40	1.49	-4.89
	Average Expected Portfolio Return (Rp)	3.50		
	Risk Free Rate (Rf)	1.49		
	Standard Deviation of average Rp	5.63		
	Sharpe Ratio:	**0.36**		

Scenario (ii)

Portfolio composed of 100% Equities				
Year	**Average Return for the year**	**Rp**	**Rf**	**Excess Return**
2000	1427.22			
2001	1194.18	-16.33	1.49	-17.82
2002	993.94	-16.77	1.49	-18.26
2003	965.23	-2.89	1.49	-4.38
2004	1130.65	17.14	1.49	15.64
2005	1207.23	6.77	1.49	5.28
2006	1310.46	8.55	1.49	7.06
2007	1477.19	12.72	1.49	11.23
2008	1220.04	-17.41	1.49	-18.90
2009	948.05	-22.29	1.49	-23.79
2010	1139.97	20.24	1.49	18.75
2011	1267.64	11.20	1.49	9.71
2012	1379.35	8.81	1.49	7.32
2013	1643.80	19.17	1.49	17.68
2014	2061.07	25.38	1.49	23.89
2015	2094.65	1.63	1.49	0.13
2016	2094.65	0.00	1.49	-1.49
2017	2449.08	16.92	1.49	15.43
2018	2746.21	12.13	1.49	10.64
2019	2913.36	6.09	1.49	4.59
2020	3217.86	10.45	1.49	8.96
2021	4273.41	32.80	1.49	31.31
2022	4098.51	-4.09	1.49	-5.58
2023	4283.73	4.52	1.49	3.03
	Average Expected Portfolio Return (Rp)	5.86		
	Risk Free Rate (Rf)	1.49		
	Standard Deviation of average Rp	14.24		
	Sharpe Ratio:	**0.31**		

Scenario (iii)

Portfolio composed of 60% Equities – 40% Bonds				
Year	**Average Return for the year**	**Rp**	**Rf**	**Excess Return**
2000	940.96			
2001	805.54	-14.39	1.49	-15.89
2002	691.83	-14.12	1.49	-15.61
2003	689.07	-0.40	1.49	-1.89
2004	797.66	15.76	1.49	14.27
2005	849.11	6.45	1.49	4.96
2006	912.53	7.47	1.49	5.98
2007	1021.28	11.92	1.49	10.42
2008	878.25	-14.01	1.49	-15.50
2009	722.29	-17.76	1.49	-19.25
2010	848.04	17.41	1.49	15.92
2011	936.37	10.42	1.49	8.92
2012	1010.62	7.93	1.49	6.44
2013	1167.87	15.56	1.49	14.07
2014	1423.05	21.85	1.49	20.36
2015	1435.40	0.87	1.49	-0.63
2016	1444.30	0.62	1.49	-0.87
2017	1657.71	14.78	1.49	13.28
2018	1839.25	10.95	1.49	9.46
2019	1947.69	5.90	1.49	4.40
2020	2142.90	10.02	1.49	8.53
2021	2780.78	29.77	1.49	28.28
2022	2645.89	-4.85	1.49	-6.34
2023	2750.67	3.96	1.49	2.47
	Average Expected Portfolio Return (Rp)	5.48		
	Risk Free Rate (Rf)	1.49		
	Standard Deviation of average Rp	12.26		
	Sharpe Ratio:	**0.33**		

10.0 Appendix C

Testing for statistical significance using the t-test with a degree of confidence of 0.05 level

Scenario 1: Comparing the mean returns of holding only bonds with the mean returns of holding only equities.

t-Test: Two-Sample Assuming Unequal Variances

	Variable 1	*Variable 2*
Mean	397.5598	1980.728
Variance	9719.757	1155332
Observations	24	24
Hypothesized Mean Difference	0	
df	23	
t Stat	-7.18555	
P(T<=t) one-tail	1.29E-07	
t Critical one-tail	1.713872	
P(T<=t) two-tail	2.57E-07	
t Critical two-tail	2.068658	

Scenario 2: Comparing the mean returns of holding only bonds with the mean returns of holding a portfolio with 60% equities and 40% bonds.

t-Test: Paired Two Sample for Means

	Variable 1	*Variable 2*
Mean	397.5598	1347.461
Variance	9719.757	452470.7
Observations	24	24
Pearson Correlation	0.718267	
Hypothesized Mean Difference	0	
df	23	
t Stat	-7.68238	
P(T<=t) one-tail	4.27E-08	
t Critical one-tail	1.713872	
P(T<=t) two-tail	8.53E-08	
t Critical two-tail	2.068658	

Scenario 3: Comparing the mean returns of holding only equities with the mean returns of holding a portfolio with 60% equities and 40% bonds.

t-Test: Paired Two Sample for Means

	Variable 1	*Variable 2*
Mean	1980.728	1347.461
Variance	1155332	452470.7
Observations	24	24
Pearson Correlation	0.999095	
Hypothesized Mean Difference	0	
df	23	
t Stat	7.682378	
P(T<=t) one-tail	4.27E-08	
t Critical one-tail	1.713872	
P(T<=t) two-tail	8.53E-08	
t Critical two-tail	2.068658	