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Determinants of European Corporate Bond Funds' Risk Premiums

A comparative analysis of Financial and Economic models

Beatriz Isabel Capucho Costa

Master Thesis

presented as partial requirement for obtaining the Master Degree in Statistics and Information Management

NOVA Information Management School
Instituto Superior de Estatística e Gestão de Informação

Universidade Nova de Lisboa

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by

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Master Thesis presented as partial requirement for obtaining the master's degree in Statistics and Information Management, with a specialization in Risk Analysis and Management

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STATEMENT OF INTEGRITY

I hereby declare having conducted this academic work with integrity. I confirm that I have not used plagiarism or any form of undue use of information or falsification of results along the process leading to its elaboration. I further declare that I have fully acknowledged the Rules of Conduct and Code of Honor from the NOVA Information Management School.

[Quinta do Conde, July 13th,2024]

DEDICATION

Em primeiro lugar, um agradecimento muito especial à minha família, cujo amor, incentivo e força foram fundamentais para o meu desenvolvimento pessoal e académico.

Aos meus pais, que sempre trabalharam arduamente para me proporcionar a melhor educação possível.

Ao meu irmão, pela cumplicidade diária e apoio incondicional.

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Muito obrigada.

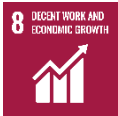
ABSTRACT

This thesis explores the determinants of risk premiums in European corporate bond funds through a comparative analysis of financial and economic models. Making use of an extensive data set and panel data analysis, this study evaluates the influence of both financial factors and macroeconomic variables on the risk premiums of selected bond funds. The financial model applied is the Fama and French Six Factor model, while the economic model encompasses variables like GDP growth, exchange rates, inflation, etc. Econometric testing and forecasting provide significant insights into the dynamics driving risk premiums. The findings underscore the pivotal role of macroeconomic conditions in shaping investor perceptions and market outcomes. These results offer valuable guidance for investors and policymakers aiming to enhance market efficiency and stability in the European corporate bond market.

KEYWORDS

Corporate Bond Funds; Investment Portfolios; Macroeconomic variables; Financial Factors; Panel Data analysis; Forecasting

Sustainable Development Goals (SDG):



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LIST OF ABBREVIATIONS AND ACRONYMS

APT	Arbitrage Pricing Theory
BtM	Book to Market
CAPM	Capital Asset Pricing Model
CMA	Conservative Minus Aggressive
CPI	Consumer Price Index
FF3F	Fama and French 3 Factor Model
FF5F	Fama and French 5 Factor Model
FF6F	Fama and French 6 Factor Model
GDP	Gross Domestic Product
GRS	Gibbons, Ross, and Shanken Statistic
HAC	Heteroskedasticity and Autocorrelation Consistent
HML	High Minus Low
IPS	Im, Pesaran, and Shin test
LLC	Levin, Lin, and Chou test
LM	Lagrange Multiplier
MPT	Modern Portfolio Theory
OLS	Ordinary Least Squares
POLS	Pooled Ordinary Least Squares
R/V	Return/Variance
RMW	Robust Minus Weak
SMB	Small Minus Big
UMD	Up Minus Down
VAR	Vector Autoregressive Model
WML	Winners Minus Losers

1. INTRODUCTION

Corporate bond funds constitute a critical element of modern investment portfolios, offering stability and income generation while facilitating capital flow to corporations. These funds have gained particular attention due to their consistently higher returns, which average between 6-8%, compared to other bond types. This superior return profile is complemented by the added benefit of high liquidity, making corporate bond funds a versatile option for a wide range of investors. Furthermore, these funds provide a diverse array of investment choices, each tailored to meet various financial objectives, from conservative income generation to more aggressive growth strategies. By investing in corporate bond funds, investors can achieve a balanced approach that enhances their portfolios with both security and growth potential, making these funds a cornerstone of prudent financial planning and investment management.

Despite their prominence, understanding the intricacies of corporate bond funds and accurately predicting their future returns pose significant challenges. Economic factors like GDP, inflation, and exchange rates play a big role in determining bond prices. However, the exact way these variables affect bond fund performance is still not fully understood, calling for a deeper dive into their underlying dynamics. Additionally, while financial models have been used for a long time to predict returns in the stock market, their use in the bond market, especially for corporate bond funds, hasn't been thoroughly investigated yet. This gap in research underscores the need for a comprehensive investigation into the predictive efficacy of specific macroeconomic variables and financial factors within the corporate bond market.

Therefore, the research question driving this study revolves around the predictive capacities of specific macroeconomic variables and financial factors in forecasting risk premiums within European corporate bond funds. The hypothesis posits that an economic model will demonstrate superior predictive power compared to the widely recognized six-factor financial model proposed by Fama and French. Navigating the complexities of the bond market, it's crucial for investors and fund managers to grasp how economic indicators and financial models impact bond fund returns. This study tackles this issue by comparing the effectiveness of these models. The main aim is to evaluate how these variables and models affect corporate bond fund returns, aiming to offer insights that can improve investment decisions and risk management strategies.

To reach its goals, this study uses panel data analysis, combining both cross-sectional and time-series dimensions. This methodological choice offers several advantages, including enhanced precision in predictions, robust insights into dynamic relationships, and flexibility in accommodating variations in fund lifespans. A random effects model was applied based on the results of several tests, allowing for variability across different funds while maintaining consistency within each fund over time. Following the initial estimation and interpretation of the impact of each variable, the models are used to forecast bond fund risk premiums to

determine which model possesses superior predictive power. The forecasting process begins with estimating model parameters and coefficients up to June 2022, which serves as the basis for predicting the risk premium for the subsequent quarter. Utilizing a rolling window approach, the estimation period extends by one quarter each time, generating new forecasts for the following quarter. The accuracy of these forecasts is evaluated by comparing predicted values against actual observations, using confidence intervals to assess the alignment between forecasted and observed returns, thereby facilitating a thorough evaluation of each model's performance.

Through initial estimations, the economic model demonstrated an explanatory power 10.8% higher than that of the financial model in explaining the variance in the funds' risk premiums. Furthermore, the explanatory power of the economic model increased when accounting for temporal dynamics. In line with these results, it was observed that the economic model provides forecasts that are more reliably aligned with observed values. This makes the economic model a more dependable framework for decision-making and a more reliable predictive tool for stakeholders seeking accurate insights into corporate bond market risk premiums. This study makes contributions to the field of corporate bond fund risk premiums. Firstly, it provides a comprehensive comparative analysis of an economic model and the widely recognized six-factor financial model proposed by Fama and French, highlighting the superior predictive power and explanatory capacity of the economic model. By incorporating both contemporaneous and lagged macroeconomic variables, this research offers deeper insights into the temporal dynamics affecting bond fund returns. Moreover, this study applies advanced estimation methods like the Newey-West technique to enhance the reliability of its findings, revealing significant relationships that were previously overlooked¹. The study's findings are relevant for investors and fund managers, offering a solid basis for making decisions and managing risks in the corporate bond market. Moreover, the methodological improvements introduced in this research contribute to the larger academic conversation on financial modeling and forecasting, setting the stage for future studies in this field.

The following chapter of this master thesis delves into the "Literature Review," which investigates the theoretical framework, traces the evolution of the models, and scrutinizes empirical studies to draw practical conclusions. Subsequently, the "Database" chapter offers an overview of the data sources utilized to gather fund and variables data, along with an outline of the data treatment procedures. In the next "Methodology" chapter, the models and statistical tests employed are described, while the ensuing "Empirical Analysis" chapter delves into the estimation results, emphasizing key findings regarding the influence of each variable and the outcomes of statistical analysis. After that, the "Post Estimation Analysis" chapter includes robustness tests and the results of the forecasting process.

Finally, the "Conclusions and Future Works" chapter contemplates the project's implications, limitations, primary conclusions, and potential avenues for future research.

¹ It is important to note that while this method ensures more robust standard errors, it does not affect the coefficient estimates themselves.

2. LITERATURE REVIEW

This literature review is divided into two principal sections: the theoretical framework (subsection 2.1) and empirical studies (subsection 2.2). The theoretical framework explores the evolution of financial models and those integrating macroeconomic variables, which have been instrumental in assessing investment fund performance. Subsequently, the Empirical Studies section delves into the practical implications within financial markets, with a particular focus on the returns of European corporate bond funds. This section aims to offer an analysis of the interplay between financial factors and macroeconomic influences, thereby bridging theoretical constructs with real-world applications.

2.1. THEORETICAL FRAMEWORK

This section sets out an investigation, following the developmental trajectory of models that have not only influenced but also completely transformed the evaluation of investment fund performance. The exploration embarks on an inquiry into the evolutionary trajectory of financial models (subsubsection 2.1.1.), which have not only played a significant role in shaping but also revolutionizing the evaluation of investment fund performance. After delving into these financial models, the narrative shifts towards scrutinizing models that integrate and employ macroeconomic variables (subsubsection 2.1.2.).

2.1.1. FINANCIAL MODELS

The 20th century witnessed a transformative journey in investment fund performance assessment. Pioneering research by Markowitz (1952), Sharpe (1964, 1966), Jensen (1968) and subsequent scholars led to the development of various models, culminating in the Fama and French Six-Factor Model (FF6F) (Fama & French, 2018). This literature review traces the evolution of these models, highlighting key insights and paradigm shifts.

Before delving into this evolution, it is crucial to understand the pivotal role financial models play in investment analysis. These mathematical frameworks provide structured insights into complex financial dynamics, aiding decision-making. Models like Modern Portfolio Theory (MPT) and the Capital Asset Pricing Model (CAPM) highlight the power of such frameworks in guiding investment strategies.

MARKOWITZ'S VISION: PIONEERING MODERN PORTFOLIO THEORY AND THE EXPECTED RETURN-VOLATILITY RELATIONSHIP

Marking a significant milestone as one of the pioneering studies in this field, Markowitz (1952) introduced the Modern Portfolio Theory, which marked a pivotal moment, establishing the principle of risk-return proportionality. Recognizing the inherent trade-off between maximizing returns and minimizing variance, the author laid the groundwork for subsequent advancements in portfolio analysis. It was verified right away that there was no one perfect portfolio that mathematics could find; rather, it could only identify a collection of efficient

portfolios. Second, portfolio risk was the right kind of risk for an investor to take, which brings up a critical point: riskiness ought to be assessed using both variance and covariance (Markowitz, 1952). Until this discovery, investing decisions were frequently determined by trial and error.

First, Markowitz (1952) acknowledged that opinions regarding the potential performance of the available assets would influence the selection of a portfolio. In this instance, the performance makes sense in return. The manager must do more than just aim to maximize the discounted expected return. Since this is a risky condition, it is also vital to minimize the fluctuation in portfolio returns. There is a clear duality: although the variance of the return must be minimized, the expected return must be maximized. At the time, the author stated that because there is a trade-off involved, it is not possible to maximize expected return and simultaneously reduce variation.

These advancements revolutionized investment theory, introducing portfolio optimization. Markowitz (1952) argued that effective portfolio management requires a trade-off between maximizing expected return and minimizing variance. This trade-off highlights the rate at which an investor must balance expected return and variance. The "Expected return -Volatility Relationship" between expected return and variance should guide investor behavior, focusing on the right type of diversification for risk reduction.

Moreover, the author emphasized the importance of diversification, not just in the number of assets but across different sectors to avoid simultaneous poor returns. He urged investors to avoid assets with high covariances to prevent concentration in the same industry and advocated disciplined diversification to reduce variance, contrasting it with random asset increase.

His approach was more aligned with investment behavior than speculation, differentiating between passive and active management. Markowitz (1952) excluded the third moment (co-asymmetry), associated with speculation, promoting a rational and disciplined approach to portfolio management.

FROM MARKOWITZ TO CAPM: REVOLUTIONIZING FUND ANALYSIS AND PERFORMANCE MEASUREMENT

Tobin (1958), in turn, through Keynesian theory, explored and extended Markowitz's optimal portfolio theory, utilizing the principle of Markowitz's Efficient Frontier concept. The author argued that investors prefer an investment situation between total liquidity and total investment in risky products, grounded in interest rate elasticity concerns and investor uncertainty. The author proposed that investors combine a risk-free asset with a portfolio situated on the Efficient Frontier, regardless of investor preferences, forming the basis of Tobin's Separation Theorem. This theory allows for the creation of an efficient risk portfolio, enabling investors to allocate proportions of risk-free and risky assets according to their preferences.

Building upon Tobin's framework of optimal portfolio theory, Lintner (1965) further refined the understanding of portfolio construction by emphasizing the importance of short selling and the implications of zero covariances in portfolio optimization. By elucidating the simplicity of obtaining optimal portfolio combinations through straightforward simultaneous equations, Lintner extended Tobin's vision of efficient portfolio allocation. Moreover, Lintner's insights into dividend policy and capital structure underscore the interplay between corporate financial decisions and asset risk and return, echoing Tobin's concerns about investor preferences and uncertainty. Just as Tobin advocated for the creation of efficient risk portfolios based on investor preferences, Lintner's concept of adjusting beta highlights the dynamic nature of risk management strategies within corporate finance, reinforcing the notion of aligning asset risk profiles with overarching financial objectives. Thus, Lintner's contributions not only complement Tobin's Separation Theorem but also enrich the understanding of portfolio optimization in the face of evolving market dynamics and investor behavior.

Later, Mossin (1966) formalized the relationship between an asset's systematic risk and its expected return. The author developed a version of the Capital Asset Pricing Model (CAPM) that considered only systematic risk, also known as non-diversifiable or market risk. Mossin's primary contribution was to propose that the premium for systematic risk, i.e., the difference between an asset's expected return and the risk-free return, be directly proportional to the asset's beta. Beta is a measure of an asset's sensitivity to the overall market return. Thus, according to Mossin, assets with higher betas would have higher expected returns to compensate investors for the additional risk they assume compared to the market. This mathematical relationship between an asset's expected return, risk-free return, market risk premium, and beta was fundamental to the formulation of modern CAPM, which stands as one of the most important theories in finance for asset valuation and determining the cost of capital.

Emphasizing the importance of the risk premium, Sharpe introduced a new model with a framework for evaluating fund performance (Sharpe, 1966).

Hence, Sharpe (1966) acknowledged the possibility of identifying underpriced assets that can enhance portfolio returns without increasing risk. However, this author noted that the challenging and expensive nature of finding such assets might offset the benefits, resulting in a net return reduction due to brokerage expenses. The author argued that the absence of consistently underpriced assets is indicative of an efficient market, attributing it to analysts' competence rather than their failure. Notably, Sharpe (1966) was the first to focus on investment funds, questioning their functions. He pointed out that the model involves predictions about fund behavior that cannot be empirically tested, necessitating the use of ex post values—past returns of investment funds. To validate this, his study analyzed returns from 34 investment funds between 1954 and 1963. Results confirmed a relationship between return and variance, establishing what would later be termed the Sharpe Ratio. However, he

observed that the relationship is not precisely proportional, with significant variations in the Return/Variance (R/V) ratio among funds.

Using the same sample, Treynor (1965) had previously demonstrated that the movement of the return on the thirty securities accounted for about 90% of the variation in the return on the typical fund. He introduced the Treynor Index, measuring a fund's risk based on its volatility. This index, akin to the R/V ratio, gauges overall variability by assessing how changes in the market align with shifts in the fund's return. However, it does not consider the impact of a lack of diversity on variability, potentially yielding different outcomes if undiversified or privately owned portfolios were included.

In line with past studies, Treynor (1965) and Sharpe (1966) brought up investment fund performance, whereas earlier research addressed strategies for putting together an effective portfolio. Expanding on the performance topic, Jensen (1968) presented novel models.

Indeed, critiques have arisen regarding the predominant focus of existing performance measures on their relative nature, underscoring the need to establish an absolute measure of performance. So that, it raised the necessity of determining a benchmark that managers must surpass to be deemed successful, irrespective of the performance of other investment funds (Jensen, 1968).

In contrast to his predecessors, Jensen (1968) acknowledged two types of risk: portfolio risk, which is manageable through efficient diversification, and systematic (market) risk, that is external to fund management. Assuming effective minimization of portfolio risk, the return of an investment fund can be explained by the covariance between its returns and those of the market, divided by the variance of the market return. In this way, the author introduced the concept of Alpha (α), later termed Jensen's Alpha, as a linear coefficient representing the portion of the fund's return unrelated to the variation in excess market return.

This mentioned findings significantly enhanced the pricing model that would eventually be known as the single-period and one-factor Capital Asset Pricing Model, becoming the simplest and most common asset pricing model, uniting contemporary Portfolio Theory.

The CAPM, a cornerstone in modern financial economics, serves as a precise tool for predicting the relationship between an asset's risk and its anticipated return. This model plays a dual role: firstly, it establishes a benchmark return for assessing potential investments. For instance, when analyzing securities, it helps determine if the projected return for a stock aligns with its "fair" return based on its risk. Secondly, the CAPM aids in estimating the expected return for assets that have not yet entered the market, such as initial public offerings or new investment projects (Bodie, Kane & Marcus, 2009).

Despite not entirely passing empirical tests, the CAPM remains widely utilized due to the valuable insights it provides. The model's overarching conclusion persists across its various adaptations – systematic risk is the sole factor rewarded with a risk premium. While measuring

this systematic risk can be nuanced, the more intricate versions of the CAPM can be seen as variations built upon this fundamental theme (Bodie et al., 2009).

FROM CAPM TO MULTIFACTOR MODELS: THE JOURNEY OF FACTOR-BASED ASSET PRICING

In continuation of this evolution, Ross (1976) proposed the Arbitrage Pricing Model (APT) as an alternative to the mean-variance Capital Asset Pricing Model. Unlike the CAPM, the APT introduced macroeconomic factors as separate sources of systematic risk, influencing portfolio's expected returns. Both models demonstrate a linear relationship between asset returns and covariance with other variables, having the covariance representing unavoidable risk.

The APT operates on the premise that mispriced securities can be exploited for profit through arbitrage. This theory argues that expected returns on financial assets are influenced by two factors: macroeconomic conditions and the asset's response to these conditions (Bodie et al., 2009). Building on CAPM and Efficient Markets assumptions, the APT posits that prices of risky assets adhere to the law of no arbitrage (Rasiah & Kim, 2011).

In line with the APT's principles, the financial performance of mutual funds can be elucidated by examining changes in macroeconomic variables. The APT predicts that equity returns are impacted by specific state variables, such as Gross Domestic Product (GDP), inflation, or interest rates, offering a comprehensive framework for understanding the dynamics of asset returns in response to macroeconomic shifts (Bodie et al., 2009).

Later, Fama and French (1992) criticized the model proposed by Jensen (1968), finding that while beta (β), as a measure of systematic risk, was significant for explaining a sample of returns between 1926 and 1968, this association disappeared in the same returns between 1963 and 1990. Instead, factors like size and the book-to-market ratio (BtM) gained prominence in influencing fund returns. Hence, Fama and French (1993) introduced the "Three-Factor Model" adding High Minus Low (HML) and Small Minus Big (SMB). In most of the empirical tests, this model surpassed the traditional CAPM in explanatory power (Brandão, 2013). A study made by Milani and Ceretta (2012) revealed that companies with a higher BtM ratio tended to have lower earnings, persisting for about five years. This finding underscored the enduring impact of the book-to-market ratio on company earnings.

Thereafter, based on Jegadeesh and Titman (1993) discovery of one-year momentum in investment funds, Carhart (1997) added a momentum factor to the Fama and French (1993) model. This phenomenon showed that, with U.S. stock return data from 1965 to 1989, funds had better return in a semester tended to maintain this pattern in the following semester but not beyond. The average return of the top 30% of assets over the previous 11 months less the average return of the bottom 30% of assets over the same period is Carhart's momentum factor. This sought to improve the model by including the recognized momentum effect in stock returns (Milani & Ceretta, 2012).

The models proposed by Carhart (1997) and Fama and French (1993) achieved prominence and recognition in the academic finance community as two distinct alternatives to the CAPM model.

THE EMERGENCE OF FF6F - A COMPREHENSIVE FRAMEWORK

Researchers initially asserted that the Fama-French Three-Factor Model (FF3F) could provide a more comprehensive explanation for the relationship between the market and stock returns compared to the Capital Asset Pricing Model (Fama & French, 1996). Subsequent studies revealed that stock returns were also influenced by a firm's profitability and investment (Fama & French, 2006, 2008). Building on this insight, Fama and French (2015, 2017) expanded the FF3F by introducing two additional factors: profitability, represented by Robust Minus Weak (RMW), and investment, Conservative Minus Aggressive (CMA), resulting in the development of the Five-Factor Model (FF5F). Their research demonstrated that, in general, the FF5F outperformed the FF3F in explaining stock returns, as indicated by the FF5F's lower Gibbons, Ross, and Shanken (GRS) statistic compared to the FF3F.

Other studies, like Barillas and Shanken (2016), included a momentum factor in the FF3F, having a four-factor model. This four-factor model showed a much better job of pricing excluded factors and a standard likelihood ratio in its favor. In subsequent work, Fama and French (2018) further enhanced the Five-Factor Model by incorporating one more factor—momentum, Up Minus Down (UMD), also known as Winners Minus Losers (WML), based on momentum factor-affected stock returns earlier identified in the literature. This refinement resulted in the Fama-French Six-Factor Model.

The subsequent analysis undertaken by Fama and French (2018) found that FF6F, including the momentum factor, outperformed FF5F, as shown by a reduced GRS statistic or a higher maximum squared Sharpe ratio. Therefore, the authors argued that, compared to FF5F, FF6F offered a better framework for explaining returns. Furthermore, newer research, such as those by Ben Mrad Douagi, Chaouachi and Sow (2021), has shown that the six-factor model can explain variations in portfolio returns more effectively than conventional models like the CAPM or even the five-factor model alone in various market contexts.

2.1.2. ECONOMIC MODELS

The investigation into economic models has been crucial in deciphering the complex connections between macroeconomic factors and diverse financial markets worldwide. Scholars and researchers have utilized various econometric methods to analyze how these factors influence specific financial instruments like equity markets and mutual funds. These studies deepen the understanding of the assessment of economic variables scrutinizing their effects on market dynamics.

In the realm of exploring macroeconomic models, it is imperative to note that a universally accepted or proven best model has yet to emerge. Instead, researchers have adopted diverse approaches, each offering unique insights and nuances.

In elucidating the nuanced impact of macroeconomic variables, a seminal study by Nishat, Chaouachi and Tahir Hijaz (2004) serves as a foundational exploration. This study employed a Vector Error Correction Model to scrutinize the long-term equilibrium connections between macroeconomic factors and the Pakistani Equity Market spanning the period from 1973 to 2002. According to this study, industrial production is the primary positive determinant of stock prices in Pakistan, whereas inflation is the primary negative factor of stock prices in the country. They also found that there is a "causal" relationship between the economy and the stock market.

Expanding the scope to India, Kumar, and Dash (2008) explored the impact of macroeconomic factors on the returns and volatility of mutual fund schemes over a ninety-one-week period from October 2006 to June 2008. Key factors influencing the performance of the schemes under study include the rate of inflation, oil prices, interest rates, and currency rates. The macroeconomic variables taken into consideration explained the variation in returns of the sample schemes.

Ansong (2013) extended this exploration to Ghana, focusing on the largest equity mutual fund. To examine this link, the Vector Autoregressive Model (VAR) was employed in 190 observations from 1997 to 2012. It was verified that the price of the fund and inflation had a positive short-term association, according to the level series regression results. However, there was not any connection between exchange rates and fund pricing.

Still building on econometric models, a study made by Pattitoni, Petracchi and Spisni (2014) explored profitability factors in the EU-15 region, revealing nonlinear impacts. Distinguishing their work, they found linear models insufficient and identified nonlinear effects for debt, growth, and size. It highlighted debt and liquidity's impact on profitability and suggested that despite investment opportunities, competition may not quickly reduce excess profits.

Turning attention to Kenya, Kariuki (2014) adopted a causal research design, employing multiple linear regression to analyze the impact of determinant variables on the mutual funds industry. The study's findings, covering the period from January 2009 to December 2013, revealed a substantial explanatory power of macroeconomic variables, including money supply, interest rates, GDP, inflation rate, and exchange rates.

As the previously mentioned study, Yadav, Sudhakar and Kumar (2016) resorted to multiple Regression models and Correlation tests to verify whether there is an impact of macroeconomic variables on 80 open-ended equity growth mutual fund schemes in India from June 2005 to June 2015. The study found significant relationships between economic factors (consumer price index, oil prices, exchange rates, and foreign exchange reserves) and fund returns. Notably, the Consumer Price Index (CPI) and exchange rates had negative effects,

while oil prices and foreign exchange reserves positively influenced returns. The results, validated at a 95% confidence level, offered concise insights into the intricate dynamics shaping mutual fund performance in the Indian market.

Coffie (2019) took a unique approach comparing to the ones mentioned previously, exploring Arbitrage Pricing Theory (APT) to check the impact of macroeconomic factors on open-end mutual fund prices in Ghana. This research used quarterly data from 2007 to 2017 of macroeconomic variables and highlighted the significance of lagged values in both fund prices and exchange rates as crucial factors influencing mutual fund prices in Ghana, providing nuanced insights into the specific determinants of pricing dynamics.

Furthermore, a panel data approach was employed by several studies, such as the investigation by Ichiue and Shimizu (2015) into the determinants of long-term bond yields. Their findings suggested that the partial effects of government and foreign debt on long-term interest rates are significantly positive. Additionally, the study indicated that expectations regarding an aging population tend to lower yields, while the impact of the primary balance is found to be insignificant. The current account balance does not provide additional information beyond what is indicated by net foreign debt.

Conclusively, the econometric investigations conducted by various scholars provide a comprehensive overview of the intricate relationships between macroeconomic factors and financial markets in diverse global contexts. These studies not only enhance the understanding of market dynamics but also underscore the importance of employing varied models and methodologies to capture the nuanced influences of economic variables on financial instruments.

2.2. EMPIRICAL STUDIES

This literature review section examines empirical studies on European corporate bond fund returns, focusing on the relationships between macroeconomic variables, financial factors, and bond fund performance. The findings provide practical insights for investors and policymakers, linking theoretical frameworks to real-world applications.

It is noteworthy that this study will further categorize this literature review section into two distinct parts: Financial Factor Influences (subsubsection 2.2.1) and a Macro-Economic Perspective (subsubsection 2.2.2). This division allows for a more focused examination of the nuanced aspects related to each category, offering a comprehensive analysis of their respective contributions to the broader understanding of financial markets.

2.2.1. FINANCIAL FACTORS INFLUENCES

This exploration examines asset pricing models and the intricate links between financial factors and expected returns in diverse contexts. Combining essential findings helps untangle the complexities of systematic risk, bond attributes, and macroeconomic influences on

returns, highlighting the nuanced dynamics between financial factors, market forces, and regional variations.

Gebhardt, Hvidkjaer and Swaminathan (2005) conducted an in-depth analysis of corporate bond returns using betas and bond characteristics, focusing on the debate between betas and characteristics in asset pricing literature. The study, based on data spanning 1973 to 1996, found that default betas significantly influence expected bond returns, surpassing the impact of bond ratings. Even when considering yield-to-maturity, default betas remained crucial. Additionally, term betas proved more effective in explaining average bond returns than duration, suggesting their importance. This study indicated that default and term betas provide better pricing insights for beta-sorted portfolios than for yield-sorted ones, revealing potential mispricing in the latter. The practical implications highlighted the significance of default and term betas in computing the cost of debt, challenging conventional approaches relying on ratings and maturity or duration. This perspective contributes valuable insights to the ongoing betas versus characteristics debate in asset pricing literature.

The research conducted by Fama and French (2006), covering the period from 1963 to 2003, is widely recognized as a pivotal study in financial models. This research explored the connection between anticipated stock returns and various financial metrics, emphasizing the book-to-market ratio, expected profitability, and projected investment. By valuation theory, the key determinants of expected stock returns are identified as the book-to-market equity ratio, expected investment, and anticipated profitability. The study's results indicate that companies with higher profitability and a higher BtM tend to exhibit increased expected returns, especially when controlling for specific variables. This alignment with valuation theory underscored the predictive importance of these factors in anticipating stock returns. Despite recognizing the significance of the book-to-market ratio, the study acknowledged challenges associated with fitted values, emphasizing the need for a nuanced consideration of measurement inaccuracies. Crucially, the study's outcomes align with previous research, reinforcing the enduring importance of the book-to-market ratio as a pivotal factor, even within the context of substantial realized return spreads.

With the main objective of examining the size, value, and momentum effects Cakici, Fabozzi and Tan (2013) chased 18 emerging markets divided into three regions: Asia, Eastern Europe, and Latin America from January 1990 to December 2011. Using two sets of portfolios sorted on size-BtM and size-momentum, the researchers applied the CAPM, Three-factor model, and Carhart model. Results revealed a significant value effect in all three regions, with big-sized value premia slightly surpassing small-sized value premia. Unlike U.S. and global developed markets, where small-sized value premia were larger, this reverse pattern was observed in emerging markets. Momentum was significant in all regions except Eastern Europe, with momentum premia larger in small-sized stocks, consistent with developed markets. This study suggested that global and U.S. factors diminish the explanatory power of local returns in emerging markets, indicating a lack of full integration. The Carhart model, incorporating the

momentum factor, was successful in explaining returns, especially in Asia. However, overall, the momentum factor did not significantly enhance explanatory power.

Subsequently, tests proved that overall, five-factor model surpassed Fama and French's three-factor model, capturing size, value, profitability, and investment patterns (Fama & French, 2015). Although the model struggled with low returns on small stocks with high investment and low profitability, it explained a sizable portion of variance in expected returns. With average monthly excess returns for portfolios, between July 1963 to December 2013, different factor specifications showed similar performance, with no clear advantage. The value factor was deemed redundant when profitability and investment are added, but the five-factor model was preferred for portfolio tilts. Small stocks with negative exposures posed a significant asset pricing challenge. The study of Fama and French (2015) challenged behavioral explanations for low average returns in such stocks and compared with related studies, emphasizing the focus on small stocks.

Conducting a comprehensive global investigation, Fama and French (2017) analyzed average stock returns across North America, Europe, Asia Pacific, and Japan during period from 1990 to 2015. The five-factor model in this research incorporated book-to-market ratio (B/M), profitability, and investment factors. The study revealed that BtM and profitability significantly influenced returns in North America, Europe, and Asia Pacific. Like their previous study, Fama and French asserted that the main limitation of the Five-factor model is its inability to account for the returns of small stocks exhibiting comparable performance to those with low profitability and high investment. The findings led to conclusions emphasizing region-specific patterns in average returns, particularly noting the greater impact of BtM and profitability on small stocks. The study indicated that local models surpassed global ones in predictive accuracy, and it suggested redundancy in the investment and size factors for Europe and Japan. Fama and French stressed the need for a nuanced understanding of regional nuances when employing theoretical frameworks to capture global stock return intricacies.

One explored version of the Fama-French six-factor model incorporates an additional liquidity factor proposed by Pástor and Stambaugh (2003) alongside the traditional market, size, value, profitability, and investment factors. This model aimed to provide a more comprehensive framework for understanding asset prices by addressing liquidity, which has been identified as a significant determinant of returns. In their study, Racicot and Rentz (2016) employed a robust generalized method of moments (GMM) approach to test the effectiveness of the Fama-French six-factor model, revealing that the market factor remains consistently significant across various datasets. This addition of the liquidity factor was particularly relevant in corporate bond funds, where liquidity plays a critical role in influencing risk premiums. The augmented model's ability to capture these nuances offers valuable insights for investors and portfolio managers in managing risk and optimizing returns in the bond market.

Other study by Fama and French utilized the maximum squared Sharpe ratio as a benchmark for assessing asset pricing models (Fama & French, 2018). This study, covering monthly factor returns from July 1963 to June 2016, considered nested models such as the CAPM, Fama and French, their five-factor extension, and a six-factor model with a momentum factor. Furthermore, an alternative specification of the profitability factor was examined, substituting operating profitability with cash profitability in the analysis. Non-nested models were also explored, with a specific focus on factors relevant to the six-factor model's selection. The research recommends assessing models by their Sharpe ratio and determines that a six-factor model, incorporating both market and size factors along with small stock spread factors (constructed exclusively from small-sized companies) exhibits superior performance compared to alternative models. The factor-spanning regressions revealed that the momentum factor contributed additional explanatory power to the Five-factor model. In this study it is emphasized the importance of model robustness, theory-based restrictions, and a concise selection of evaluated models to mitigate data dredging risks. While recognizing challenges in statistical inference due to issues with multiple comparisons in asset pricing, the study refrains from recommending a shift in these aspects.

Leite, Klotzle, Pinto, and Silva (2018) analyzed 12 countries in the emerging markets from three different continental regions: Latin America, Eastern Europe, and Asia with a sample from January 2009 to February 2017. Results showed that local factors performed better than U.S. or global factors, indicating limited integration of emerging markets with international markets. In their analysis, the four- and five-factor models outperformed the three-factor model. However, the authors noted that the value factor became redundant when profitability and investment factors were included. In emerging markets, the size effect was prominent, but the value and profitability effects were unclear, and the investment effect was weak. These results diverge from patterns observed in developed markets, highlighting the distinct factor effects in emerging markets.

Later, Foye and Valentinčič (2019) conducted a study on the Indonesian stock market spanning from December 1996 to May 2017. Their research methodology, akin to that of Fama & French (2015), differed by including the momentum factor in their analysis. The study evaluated sixteen models, ranging from the CAPM + SMB to the Six-factor model, and compared their performance. The study found that the momentum effect was weak and statistically insignificant. The momentum factor did not contribute explanatory power to the Five-factor model. Notably, both the Three-factor and Five-factor models produced substantial intercepts for all portfolios, and the Five-factor model did not demonstrate improvement over the Three-factor model. The authors argue that Indonesia's unique financial reporting environment and low earnings quality may underlie these results. This discrepancy highlights the complexity of factors influencing the performance of asset pricing models in different markets and underscores the need for a nuanced understanding of local financial contexts.

In the context of existing research, the insights from Papík and Papíková (2021) build upon and broaden previous studies by highlighting the significant impact of regulatory factors on

financial performance. Their findings complement the literature by introducing a regulatory perspective that affects evaluations in both equity and bond markets. This study utilized various financial models, including the Fama and French five-factor model to emphasize how government interventions influence fund yields. Moreover, in a comparative analysis, Doğan, Kevser and Leyli Demirel (2022) compared the explanatory power of the CAPM, the Fama-French three-factor model, and the five-factor model, finding statistically significant coefficients for market, size, and value factors across these models. This analysis underscores the enhanced predictive capability of multifactor models in capturing the complexities of asset returns beyond the traditional CAPM framework.

At last, Anuno, Madaleno, and Vieira (2023) demonstrated Fama and French six-factor model's utility in diverse markets, showing how these factors influence the excess returns of bond portfolios. Empirical evidence suggested that while the market factor (MKT) remains significantly associated with returns, the inclusion of size (SMB), value (HML), profitability (RMW), investment (CMA), and momentum factors enhance the explanatory power of the model.

2.2.2. A MACRO-ECONOMIC PERSPECTIVE

The following collection of studies contribute to the understanding of the varying weights assigned to criteria in the corporate bond market, the macroeconomic determinants of corporate debt, and the factors influencing government bond yield spreads. This overview sets the stage for an exploration of the landscape and determinants of debt markets.

Concerning the corporate bond market, some studies shed light on the macroeconomic and financial factors influencing corporate debt securities in the euro area and other regions (Aman, Isa & Naim, 2023; Ansong, 2013; Bondt, 2005; Eichengreen & Luengnaruemitchai, 2004; Park & Shenoy, 2002). These studies both considered that different criteria may have different weights when it comes to long-term and short-term corporate debt securities.

Park and Shenoy (2001) addressed the relationship between aggregate capital expenditures, stock market returns, interest rates and the dynamic behavior of aggregate bond and stock issuance. Using a sample of stocks and corporate bonds issues from January 1967 to December 1988, it stated that, over a full year, a decline in interest rates is accompanied by an increase in bond offerings. Bond concerns are impacted immediately by aggregate capital expenditures, but not over an extended period.

In the broader Asian context, Eichengreen and Luengnaruemitchai (2004) found a positive relationship between fund prices and inflation rates, suggesting that inflationary expectations are crucial for mutual fund valuation. However, the exchange rate did not show a significant direct influence on fund prices, although it did affect inflation, which in turn influenced fund prices. This indirect relationship underscores the complex interplay between macroeconomic variables and financial market instruments. Additionally, the study's use of Vector Auto Regression (VAR) models and Granger causality tests further substantiated these findings,

emphasizing the importance of considering both short-term and long-term interactions in economic modeling.

Furthermore, Bondt (2005) investigated macroeconomic determinants of corporate debt securities in the euro area with two samples: one starting in February 1991 and the other starting in January 1999. Both samples ended in September 2003. Findings indicated that financing demands, as measured by mergers and acquisitions and the gross domestic product, and financing costs, measured by the cost of debt securities relative to other corporate funding sources, are key factors both in the short and long term.

Burger and Warnock (2007) underscored that macroeconomic instability is a critical factor deterring investment, as evidenced by the higher volatility and negative skewness in the returns of bonds from emerging markets compared to those from developed countries. This instability often stems from fluctuations in key economic indicators such as GDP growth, Consumer Price Index (CPI), unemployment rates, and exchange rates. These authors argued that these indicators are pivotal in shaping investor perceptions of risk and return. For instance, higher inflation can erode real returns and lead to higher demanded risk premiums, while economic growth can enhance investor confidence, potentially lowering risk premiums.

Some other studies examined government long-term sovereign bond yield spreads, have focused on three main risk drivers of government bond yields: credit risk, global risk aversion and liquidity risk (Afonso, Arghyrou & Kontonikas, 2012; Arghyrou & Kontonikas, 2012; Pinho & Barradas, 2020).

Building on this line of research, Arghyrou and Kontonikas (2012) investigated the European sovereign debt crisis, observing a shift in market behavior from a pre-crisis 'convergence-trade' model to one driven by macro-fundamentals and international risk after August 2007. The crisis was divided into early (August 2007 to February 2010) and ongoing periods. Multiple contagion sources emerged, including Greece, Ireland, Portugal, and Spain, with increased sensitivity of sovereign bond spreads to fundamentals and contagion during the ongoing crisis. The study highlighted the escalation of the Greek debt crisis in late 2009 to early 2010 due to adverse shifts in market expectations. To reduce periphery spreads, the study recommended substantial improvements in fiscal position, macro-fundamentals, and a reversal of private expectations through credible reform strategies.

Thereafter, using a panel of ten-euro area countries with monthly data over January 1999 to December 2010, Afonso et al. (2012) stated that European government bond yield spreads are well explained by macro and fiscal fundamentals. Even though macro and fiscal fundamentals were the most significant when it comes to explaining spreads, credit ratings were also verified as a factor to consider. However, it was concluded that the determinants of government bond spreads in the euro area have changed significantly over time.

Following this line, Poghosyan (2012) examined the factors influencing sovereign bond yields in 22 advanced economies between 1980 and 2010, using panel cointegration techniques.

Here, the macroeconomic performance was assessed using the potential growth of the gross domestic product. The utilization of cointegration approach facilitated the differentiation of long-term factors influencing sovereign borrowing costs, such as the debt-to-GDP ratio and prospective growth, from short-term factors like inflation and short-term interest rates. In the long-run, a rise in the government debt-to-GDP ratio and a rise in the potential growth rate caused government bond rates to rise. In the short-run, changes in the debt-to-GDP ratio, money market rate (monetary policy effect), and inflation (nominal shocks) all had an impact on changes in government bond yields, while growth rates and primary balance ratios had less of an impact.

Ansong (2013) further distinguished between short- and long-term effects, showing that while the monetary policy rate had a negative effect on mutual fund performance, exchange rates, inflation, and GDP growth had significant long-run positive benefits. Furthermore, the findings showed a favorable correlation over the short term between inflation rates and mutual fund prices; however, no significant correlation was seen between exchange rates and fund prices. These results highlight how important macroeconomic stability and sensible policy choices are for improving financial market performance.

Added to that, Qureshi, Khan, Rehman, Qureshi and Ghafoor (2019) discovered that when market volatility and the economy were weak, investors typically bought more bonds. It also showed that bond flows had a positive correlation with fiscal factors such as public debt-to-GDP ratios and budget deficits, which are indicators of economic hardship that tend to nudge investors toward safer assets like bonds. These observations highlighted the significance of considering a wide range of macroeconomic variables when evaluating the risk premiums of corporate bond funds, offering a thorough understanding of the financial environment that affects bond market dynamics and investor choices.

Improvements upon the Capital Asset Pricing Model were made by introducing the Macro Asset Pricing Model (MAPM), incorporating three macroeconomic variables - U.S prime rate, the U.S. government long-term bond rate, and the exchange rate of USD/EUR (Pham & Phuoc, 2020). MAPM consistently outperformed CAPM, exhibiting better forecasting, explanatory power, and model adequacy with a larger U.S. stock sample. Statistically significant benefits linked to the USD/EUR exchange rate and U.S. government long-term bond rate challenged CAPM's market-dependency claim. These findings question CAPM's primary contribution, positioning MAPM as a more efficient and beneficial model in asset pricing, offering a fresh perspective on the interplay between macroeconomic factors and stock returns.

One of the most recent studies in this literature, developed by Pinho and Barradas (2020) highlighted that inflation rates and fiscal conditions, such as government debt levels, are critical in shaping bond yields. These factors directly impact the cost of borrowing and the risk premiums demanded by investors. Higher inflation can lead to increased yields as investors seek compensation for the erosion of purchasing power. Similarly, substantial government debt can elevate yields due to increased default risk perceptions. Still in this line, Gyimah,

Addai, and Asamoah (2021) found that exchange rate, inflation, and GDP growth have a long-run positive impact on mutual fund performance, while monetary policy rate exhibited a negative long-run effect. This insight aligns with the broader understanding that macroeconomic stability and growth are crucial for reducing risk premiums in bond markets.

As the most recent study in this review, Aman et al. (2023) investigated the macroeconomic and financial determinants of bond market development in 13 selected countries over the period 1993–2017. This study noticed that the growth of the bond market is positively and significantly impacted by the export of goods and services, economic size, government spending, current account balance, banking sector development, and stock markets. But still, bonds had a negative relationship with economic growth stage.

Collectively, these studies contribute significantly to the understanding of the multifaceted relationships between macroeconomic variables, financial factors, and various aspects of bond markets. Their findings not only enhance academic knowledge but also offer practical insights for investors and policymakers navigating the complexities of the financial landscape.

3. DATABASE

This study centers on 16 European fixed-rate corporate bond funds selected from FundsPeople (n.d.) with prices sourced from Bloomberg (Bloomberg Generic, BGN)—tailored for financial professionals, providing real-time market data, news, and interactive tools for comprehensive financial analysis.

FundsPeople, established in 2008, is a leading platform for asset management professionals in Spain, Portugal, Italy, and Andorra. It boasts the largest community of specialized experts in southern Europe, serving as a vital connection hub within industry. Continuously innovating to meet client needs, FundsPeople has earned the trust of 200,000 professionals from management firms and clients. Its credibility is attributed to both its dedicated team and industry stakeholders, making FundsPeople a reliable source for asset management insights. Within the scope of this research, the selected funds have been or currently are distinguished as Rating FundsPeople, holding a distinctive position. These funds have garnered attention for their notable consistency, their appeal among fund selectors, or the significant investment volume attributed to clients.

The meticulous selection of European fixed-rate corporate bond funds for this analysis is guided by a thoughtful consideration of various criteria, establishing a robust foundation for quarterly analysis. While prioritizing funds with modest historical track records offers insights into performance dynamics over time, the selection strategy also prioritizes funds with a significant allocation percentage to corporate bonds within their broader asset allocation, surpassing 90%. This deliberate approach enriches this analysis, providing a nuanced perspective on the funds' exposure to the corporate bond market and facilitating a comprehensive examination of their performance within the context of their specific investment allocations.

Furthermore, the inclusion of these funds is reinforced by their acknowledgment and categorization in the esteemed FundsPeople magazine. This external validation not only confirms their standing in the industry but also highlights the quality and performance they exhibit. Table 3.1 offers a transparent overview of the carefully selected funds, detailing their inception date, asset allocation, total assets, and fund management fee.

Following the same approach as Coffie (2019), Pinho and Barradas (2020) and Gyimah et al. (2021), in terms of frequency data, the analysis is conducted quarterly, a strategic choice based on the availability of crucial data. This research opted for a quarterly analysis, driven by the data availability of key variables such as the GDP, in the European Union context. According to data sources including Banco de Portugal, Instituto Nacional de Estatística (INE), Eurostat, OECD (Organization for Economic Co-operation and Development), Bloomberg and World Bank, GDP is reported at quarterly intervals. This strategic choice ensures a coherent and consistent analytical framework, aligning the valuation cycles of European fixed-rate corporate bond funds with the periodicity of pertinent economic data.

Table 3.1 - Corporate bond funds

Fund Name	Abbreviation	Inception Date	% Allocated to Bonds	Total Assets (Millions €)	Fund M. Fee
NB CORPORATE EURO	NB	03/05/1999	97.348%	77.330	0.60
INVESCO EURO CORP BOND-C	INV	31/03/2006	95.314%	3,315.240	0.65
FF-EURO CORP BN-A ACC EUR	FF	15/06/2009	92.508%	416.560	0.75
ROBECOSAM-EURO SDG CR-IEUR	ROB	18/05/2010	91.933%	1,225.060	0.35
ABR S II-EURO CPBDF-D A EUR	ABR	25/09/2003	99.702%	1,697.940	0.50
ABR S II-EU CP SU BDF-DACEUR	ABR-SU	17/10/2012	99.669%	1,845.750	0.55
BGF-EURO CORPORATE BOND-EA1	BGF	23/05/2003	91.925%	2,859.440	0.80
JAN HND HRZN EURO CO B-I2EUR	JAN	18/12/2009	97.522%	1,464.290	0.75
MORGAN ST-EURO CORP BD-A	MOR	04/09/2001	96.020%	3,394.250	0.80
SCHRODER INTL EURO CORP-CAC	SCHR	30/06/2000	92.545%	10,132.18	0.45
VONTOBEL-EUR CRP BOND-B	VON	27/09/2002	96.048%	1,603.820	1.10
AMUNDI-EURO CORP BD-I EUR C	AMU	09/04/2001	90.884%	852.690	0.35
BNP EURO CORPORATE BD-CLS C	BNP	17/07/2001	92.351%	1,076.740	0.75
DWS INVEST-EU COR BO-FC	DWS	21/05/2007	99.594%	1,895.600	0.60
FTIF-FRKN EUR COR BND-IAEUR	FTIF	30/04/2010	99.903%	46.290	0.40
BNYM-EUROPEAN CRED F-C EUR	BNYM	12/02/2013	98.681%	58.400	0.50

In conducting the analysis for coefficient estimation, the period spans from 2005 to 2022, addressing the period following the establishment and stabilization of the euro, marking a shift in the institutional landscape. However, it is important to acknowledge that some funds were launched after 2005. In these cases, the analysis starts from their respective launch dates, resulting in an unbalanced panel dataset. Furthermore, the primary estimation encompasses data until June 2022, facilitating further out-of-sample forecasting from September 2022 until the end of 2023, for six quarters.

3.1. DATA FOR FINANCIAL MODEL

When referring to the financial model in the context of this thesis, the application of the six-factor model, originally designed for the U.S. stock market, has been extended and tailored to suit the dynamics of the European fixed-rate corporate bond market. In this way, the factors employed in this thesis have been directly obtained from the Kenneth R. French Data Library (n.d.), which provides Fama/French European 6 Factors. Initially, this study commenced by constructing factors based on the portfolios available in the database. However, it was observed that the results obtained were consistent with those provided by the pre-established factors available in the database. Therefore, for the sake of confidence, reliability, and accessibility of the data, the pre-constructed factors available in the database were utilized. By utilizing these available factors, a more efficient and accurate analysis tailored to the European fixed-rate corporate bond market's dynamics is ensured. To align the analysis with quarterly data, monthly data sets from the Kenneth R. French Data Library were extracted and filtered to keep only the quarters' data. This approach provides a more relevant period for the study's objectives.

It should be emphasized that the database exclusively features returns denominated in dollars. As a result, factors expressed in dollars were adjusted to euros through exchange rate fluctuations to align them with the explained variable, which was the fund risk premium, obtained from the fund's Net Asset Value (NAV) that is priced in euros. Additionally, financial factors were divided by 100 to convert them to decimals, ensuring consistency with the metric used in the economic model.

3.2. DATA FOR ECONOMIC MODEL

The essential macroeconomic data, integral to this comprehensive analysis, was procured quarterly through the indexes in the Bloomberg platform within the framework of the European Union or Euro Area. Leveraging the robust and widely recognized Bloomberg platform ensured the reliability and accuracy of the macroeconomic factors under scrutiny. To ensure uniform treatment of macroeconomic variables and mitigate the impact of scale discrepancies on coefficients, a standard approach was adopted. This involved utilizing logarithmic variations for price data and percentage point changes for rates, including inflation rates, unemployment rates and government debt-to-GDP ratios. This strategy facilitated a more consistent analysis by accommodating variables expressed in different units, such as

millions for certain indicators and rates for others, thus minimizing the influence of disparities on the results.

The response variable in both models underwent a series of transformations. Initially, prices from the selected funds were collected through Bloomberg platform and then converted into returns using logarithmic differences. Subsequently, these returns were adjusted by subtracting the risk-free rate, resulting in the response variable, namely, the fund's risk premium. The risk-free rate utilized to calculate the dependent variable also underwent transformations based on the Euribor 3-month rate. Initially, the Euribor 3-month rate was transformed into an effective periodic rate. Subsequently, a series of zero-coupon bond prices was generated. The 'risk-free rate' utilized corresponds to the logarithmic differences of these bond prices. The panel data regressions and related tests were conducted using R.

4. METHODOLOGY

Aligned with the overarching goal of contrasting financial factors and economic variables, the research methodology is strategically divided into four distinct segments: the evaluation of the financial model, the assessment of the proposed economic model, the execution of statistical tests, and the forecasting process. This division enables a targeted examination of the factors specific to each domain before comparing. Accordingly, the ensuing discussion will unravel the intricacies of the framework governing the financial aspect (subsection 4.1), laying a foundation for an understanding of the relationships between key financial factors and bond risk premiums. Subsequently, the methodology will seamlessly transition to illuminate the economic approach (subsection 4.2), delving into the intricacies of the proposed economic model. Following these sections, the methodology will delve into the Statistical Tests (subsection 4.3), covering the tools and tests necessary for panel data analysis. It will then describe the forecasting process (subsection 4.4) that enables comparisons. This sequential structuring aims to provide clarity and facilitate a nuanced exploration of the distinct analytical pathways chosen for the financial and economic aspects of the study.

This study employs panel regressions, also known as longitudinal data analysis. Panel data analysis integrates both cross-sectional and time-series dimensions, enabling the examination of the same entities (e.g., funds) over multiple time periods. This methodological shift offers several advantages over relying solely on time-series data. Firstly, as highlighted by Hsiao (2014), panel data analysis enhances the precision and accuracy of predictions for individual outcomes compared to time-series data alone. By effectively addressing issues such as aggregation levels, inference methods across cross-sections or time-series, and mitigating estimation bias and multicollinearity, panel regressions provide robust insights into the relationships between dependent and independent variables. This assertion is supported by research from Baltagi (2008), Hsiao (2014), and Al-Awadhi, Alsaifi, Al-Awadhi and Alhammadi (2020), which emphasize the dynamic nature of these relationships over time. Furthermore, panel regressions offer flexibility in accommodating different fund launch dates and lifespans, thereby capturing evolving market conditions, and ensuring model stability across different temporal contexts.

Consequently, this research employs panel data methodologies, integrating both cross-sectional and time-series components for each fund. Given the varying durations of fund lifespans, the dataset comprises unbalanced panel data.

As articulated, the principal aim of this study is to evaluate the predictive efficacy of an economic model in comparison to the widely recognized six-factor financial model proposed by Fama and French. Thus, the central hypothesis under scrutiny in this investigation is:

H1: The economic model demonstrates superior predictive power in explaining the risk premium of the funds compared to the Fama and French six-factor financial model.

4.1. FINANCIAL MODEL

To comprehensively estimate the impact of financial variables on bond funds, this study employs the Fama and French Six-Factor Model, an extension of the well-established Fama and French five-factor model, with the inclusion of the momentum factor (Fama & French, 2018). The Six-Factor Model provides a refined framework for evaluating the performance of bond funds, considering additional factors beyond the traditional ones. This model aims to capture the intricate dynamics of the financial market by considering a broader set of variables compared to its predecessors. In this financial model, the factors extracted from the Kenneth R. French Data Library (n.d.) are already calculated as first differences, representing differences in returns as described in the following Table 4.1. Therefore, there is no need to calculate the first differences for these factors. The panel data regression for the resulting six-factor model is:

$$R_{it} - R_{ft} = \alpha_i + b_i Mkt_t + s_i SMB_t + h_i HML_t + r_i RMW_t + c_i CMA_t + m_i WML_t + e_{it} \quad (1)$$

Where R_{it} is the rate of return of the fund i at time t , R_{ft} is the risk-free rate represented by 3-month Euribor. So that, $R_{it} - R_{ft}$ is the excess return over the risk-free rate of the fund i at time t , also known as the risk premium of fund i at time t , which is the proxy for bond fund performance, the dependent variable in this study. Mkt_t gives the market excess return over the risk-free rate at time t , SMB_t relates to the size factor, which is based on the difference between the return of a portfolio of small stocks minus the return of a portfolio consisting of large stocks. The value factor is represented by HML_t , where the return difference between a portfolio with a high book-to-market ratio and a portfolio with a low BtM ratio is taken. On the other hand, RMW_t captures the potential profitability premium and is calculated as the return difference of two portfolios, which refer to high profitability and low profitability companies. The other introduced investment factor, CMA_t , measures the difference between the return of a portfolio of stocks with a low investment and the return of a portfolio consisting of stocks with a high investment, while WML_t refers to winners and losers with respect to past performance. The e_{it} is the error term. As indicated in the Database chapter, all data pertaining to these factors can be found in the Kenneth R. French Data Library (n.d.)

Table 4.1 - Financial factors

Factor	Description	Formula	Exp. Sign
Mkt_t Market Factor	Return on a region's value-weight market portfolio minus the U.S. one month T-bill rate. Risk premium of the market portfolio.	$R_m - R_f$	(+)
SMB_t Size Factor	The average return on the nine small stock portfolios minus the average return on the nine big stock portfolios.	$1/3 (SMB(BtM))^2 + SMB(OP)^3 + SMB(INV)^4$	(+)
HML_t Value Factor	Average return on the two value portfolios minus the average return on the two growth portfolios.	$\frac{1}{2}(SmallVal + BigVal) - \frac{1}{2}(SmallGrow + BigGrow)$	(-)
RMW_t Profitability Factor	Average return on the two robust operating profitability portfolios minus the average return on the two weak operating profitability portfolios.	$\frac{1}{2}(SmallRob + BigRob) - \frac{1}{2}(SmallWeak + BigWeak)$	(+)
CMA_t Investment Factor	Average return on the two conservative investment portfolios minus the average return on the two aggressive investment portfolios.	$\frac{1}{2}(SmallConserv + BigConserv) - \frac{1}{2}(SmallAggress + BigAggress)$	(-)
WML_t Momentum Factor	Equal-weight average of the returns for the two winner portfolios for a region minus the average of the returns for the two loser portfolios.	$\frac{1}{2}(SmallHigh + BigHigh) - \frac{1}{2}(SmallLow + BigLow)$	(-)

² $SMB(BtM) = 1/3(SmallValue + SmallNeutral + SmallGrowth) - 1/3(BigVal + BigNeutral + BigGrow)$

³ $SMB(OP) = 1/3(SmallRob + SmallNeutral + SmallWeak) - 1/3(BigRob + BigNeutral + BigWeak)$

⁴ $SMB(INV) = 1/3(SmallConserv + SmallNeutral + SmallAggress) - 1/3(BigConserv + BigNeutral + BigAggress)$

Concerning expected signals, it is commonly anticipated that increased market returns align with higher bond fund returns. Also, Papík and Papíková (2021) identified a modest yet positive market coefficient when analyzing its effect on pension bond funds. However, it is common to observe the opposite effect, due to the inverse correlation between stock and bond prices during periods of rising interest rates. Typically, a robust stock market coincides with weaker performance in bond markets. Regarding the Size factor, historically, small-cap stocks have exhibited higher growth potential and greater volatility, leading to their outperformance relative to large-cap stocks over the long term, thus contributing positively to fund returns. Moreover, about the Value factor, higher returns on value stocks relative to growth stocks may indicate economic expansion, leading to higher interest rates and lower bond fund returns. Anuno et al. (2023), when employing the FF5F model, supported a positive size effect as well as a negative effect of the value factor. Still under this study, for the profitability factor, higher returns on robust profitability stocks relative to weak profitability stocks may reflect stronger economic conditions, potentially increasing bond yields and lowering bond prices. Lastly, coefficients for Investment and Momentum factors are also expected to be negative. Conservative investment strategies may lead to lower returns, and higher returns on winner portfolios relative to loser portfolios may indicate market inefficiencies or speculative behavior, potentially leading to higher bond yields and lower bond prices. It is worth noting that these expected signs, as for the economic model, are merely suppositions, the results can be divergent.

In selecting the Fama and French Six-Factor Model as the cornerstone of the analysis, this study aims to capture a nuanced perspective on market risks by incorporating key dimensions beyond market return, including size, value, profitability, investment, and momentum. This model's additional factors enhance its capacity to elucidate variations in bond returns, offering a superior fit compared to simpler models and holding practical significance for investors (Fama & French, 2015). A recent study conducted by Doğan et al (2022) supported the superiority of the FF6F model. The research found that the Fama and French Six-Factor Model is the highest indicating its superior explanatory power. The widespread popularity and acceptance of the Six-Factor Model within both academic and industry circles underscores its relevance.

4.2. ECONOMIC MODEL

An analysis regarding the performance of corporate bond funds by exploring the macroeconomic factors is conducted following the econometric methodologies outlined in the studies by Hussain and Haque (2016), Mobarek, Mollah and Keasey (2014) and Gyimah et al. (2021). Also, in the economic model, this study uses logarithmic differences of prices to calculate return rates and after the risk premiums. As for the macroeconomic variables, they

are also evaluated for quarterly variations, whether logarithmic or in basis points. These transformations were implemented to ensure stationary series.

The basic simplified model for the macroeconomic determinants of bond fund performance is outlined as follows:

$$R_{it} - R_{ft} = \beta_0 + \beta_1 GDP_t + \beta_2 CPI_t + \beta_3 Unemp_t + \beta_4 Exch_t + \beta_5 GovDeb_t + \beta_6 EconSent_t + e_{it} \quad (2)$$

In the above model, R_{it} is the rate of return on the bond fund i on time t , R_{ft} is the risk-free rate represented by 3-month Euribor. So, the dependent variable is given as $R_{it} - R_{ft}$, the excess return over the risk-free rate of the fund i at time t . GDP_t represents the quarterly logarithmic variation of the Gross Domestic Product prices; CPI_t is the quarterly variation, in basis points, of Inflation Rate, obtained through logarithmic variation of the Consumer Price Index; $Unemp_t$ is the quarterly variation, in basis points, of the unemployment rate; $Exch_t$ is the logarithmic variation of the EURUSD Spot Exchange Rate; $GovDeb_t$ is the quarterly variation, in basis points, of government debt as a percentage of GDP; and $EconSent_t$ represents the quarterly logarithmic variation of the economic sentiment indicator; e_{it} is the error term.

Table 4.2 - Macroeconomic variables

Variable	Index Description from Bloomberg	Index Used	Exp. Sign
GDP_t	Measures the final market value of all goods and services produced within a country. It is the most frequently used indicator of economic activity. The GDP by expenditure approach measures total final expenditures (at purchasers' prices), including exports less imports. Adjusted for inflation.	EUGNEU27 Index - European Union Gross Domestic Product	(+)
CPI_t	The harmonized index of consumer prices (HICP), used primarily within the European Union, is a measure of prices paid by consumers for a market basket of goods and services. It is calculated using the same methodology across countries to allow for comparable measures of inflation.	CPALEU Index - European Union Consumer Price Index	(-)
$Unemp_t$	Tracks the number of unemployed persons as a percentage of the labor force (the total number of employed plus unemployed). These figures come from a household labor force survey.	EHUPEUN Index - Eurostat Unemployment Eurozone	(-)
$Exch_t$	Represents the current market price of one euro in terms of U.S. dollars, indicating the relative value of the Euro against the U.S. currency	EURUSD BGN Currency - EURUSD Spot Exchange Rate	(+)
$GovDeb_t$	This concept includes all financial liabilities of a government (either central or central + local governments). These liabilities are typically in the form of government bills and bonds.	EUQDGE27 Index - Eurostat Government Debt to GDP European Union	(+)
$EconSent_t$	Composite index that gauges overall economic sentiment by combining various sector-specific confidence indicators, providing insight into the prevailing economic outlook within the Eurozone.	EUESEU27 Index - European Commission Economic Sentiment Indicator Eurozone	(+)

Regarding anticipated impacts, bond funds may be influenced by broader economic activity, as a growing economy might provide a favorable environment for investments. Eichengreen and Luengnaruemitchai (2004) observed a positive link between economic development and bond market expansion in Asia, suggesting a favorable impact from the GDP coefficient. In terms of Inflation, an increase in CPI can diminish the real value of fixed-income investments, such as bonds, resulting in lower bond returns (Burger & Warnock, 2007; Poghosyan, 2012). Conversely, elevated unemployment rates may signal economic downturns, potentially impacting bond fund returns due to increased economic uncertainty affecting investor behavior. Pinho and Barradas (2020) observed that lower unemployment rates positively affect government bond yields in Portugal. Furthermore, looking at exchange rate volatility, sensitivity suggests that as the euro appreciates against the dollar, investors demand higher risk premiums when investing in these bond funds. This reflects investors' perception of increased risk associated with euro-denominated assets, potentially due to changes in economic, political, or market expectations. This leads to the conclusion that a change in the exchange rate variation may positively impact bond funds (Qureshi et al., 2019). Moreover, higher government debt-to-GDP ratios typically correlate with higher interest rates, making government bonds comparatively more attractive to investors. Poghosyan (2012) noted an increase in government bond rates for an increase in the government debt-to-GDP ratio, while Hsing (2015) identified a positive association between government debt and Spanish government bond yields. Lastly, the economic sentiment indicator, often overlooked in the bond market context, may positively influence investment sentiment, potentially benefiting bond funds.

In building upon the methodologies employed by Hussain and Haque (2016), Mobarek et al. (2014) and Gyimah et al. (2021), this study seeks to provide a nuanced understanding of the performance of bond funds in the context of macroeconomic factors. However, this study introduces certain refinements and innovations to enhance the precision of the analysis. Specifically, this study extends the existing models by incorporating an economic sentiment indicator and the government debt to GDP ratio, which was not explored before in this context, underlining its potential significance in influencing bond fund performance. Moreover, this investigation emphasizes a European Union regional focus, recognizing the unique dynamics of the EU financial landscape. This nuanced approach aims to contribute to the existing body of literature by shedding light on previously unexplored dimensions of the complex interplay between macroeconomic factors and bond fund performance within the European Union.

4.3. STATISTICAL TESTS

4.3.1. PANEL UNIT ROOT TESTS

As part of the econometric analysis, Levin, Lin, and Chu (2002) and Im, Pesaran, and Shin (2003) tests are applied, following the methodology employed by Oliveira, Curto and Nunes (2012). These tests are widely recognized time-series analysis tools employed to evaluate the

presence of unit roots in each dataset. These tests assist in discerning whether a variable demonstrates a unit root, indicating non-stationarity, or if it remains stationary over time. Stationarity indicates that the distribution of the specified variable remains constant over time. Conversely, when the distribution is time-dependent, non-stationarity emerges as the primary cause of unit roots. The decision to utilize these tests is driven by the imperative to validate the adherence of time-series data to the assumptions of stationarity.

Levin et al. (2002) and Im et al. (2003) tests both enable the evaluation of a null hypothesis, H_0 , that a unit root is present against the alternative hypothesis, H_1 , of stationarity. Formally, H_0 : there exists a unit root, and H_1 : there is no unit root. If the null hypothesis is rejected, it provides evidence in favor of stationarity, indicating that the variable under consideration does not possess a unit root.

This strategy adheres to recognized norms in time-series analysis, highlighting the importance of confirming stationary assumptions before embarking on complex econometric modeling. Employing the Im et al. (2003) test in the study, fortifies the robustness of the econometric approach, supported by results obtained by Levin et al. (2002), thus reinforcing the reliability of conclusions and maintaining fidelity to rigorous statistical standards.

4.3.2. MODEL SPECIFICATIONS

In the examination of panel data, three distinct models emerge: Pooled Ordinary Least Squares (POLS), Fixed Effects (FE), and Random Effects (RE). Determining the most suitable model involves conducting three key statistical tests: the F test, Hausman test (1978), and the Breusch Pagan Lagrange Multiplier test. Nonetheless, prior to conducting these tests, it is imperative to estimate the regressions with each of the three models using R studio.

Although the primary objective of this study is not to delve into the details of each model, it is essential to ascertain the model that best aligns with the dataset when analyzing panel data. According to Baltagi (2005), the Fixed Effects model is appropriate when the analysis pertains to a specific subset of individuals rather than the entire group, precluding generalizations about the entire sample population. Conversely, Hsiao (2014) argues that the Random Effects model is suitable when inferences about a population are drawn from a randomly selected sample of individuals. The Ordinary Least Squares (OLS) model, also known as the homogeneous model, maintains constant slope coefficients across individuals, effectively pooling all individuals together and suggesting no significant differences across them.

Given this study is drawing inferences on the impact of macroeconomic variables and financial factors on risk premium of funds, random effects may be relevant, especially if there are unobserved individual-specific factors (such as fund-specific characteristics) that could influence the relationship being studied.

The analysis commences with the F-test, where the null hypothesis posits the validity of the pooled regression, and the alternative hypothesis suggests the superiority of the Fixed Effects model. Consequently, rejecting the null hypothesis in this test indicates that the Fixed Effects

model is better suited to the data. The subsequent test is the Breusch Pagan Lagrange Multiplier test, which is employed to confirm or reject the presence of the Random Effects model. With the null hypothesis suggesting a pooled regression and the alternative hypothesis favoring Random Effects, rejecting the null hypothesis signals the appropriateness of employing the Random Effects regression. If, in both cases, the H₀ is rejected, then the Hausman specification test (1978) is performed. This test compares the estimates between Random Effects and Fixed Effects, with the null hypothesis favoring Random Effects and the alternative hypothesis favoring Fixed Effects. Rejecting the null hypothesis implies that the Random Effects estimators lack consistency.

4.3.3. SERIAL CORRELATION IN THE IDIOSYNCRATIC ERROR TERM

Assessing serial correlation in the idiosyncratic error term is a crucial step in panel data analysis, as it determines whether errors exhibit correlation over time, a phenomenon also referred to as autocorrelation (Wooldridge, 2012). Autocorrelation arises when errors in a panel dataset consistently contain a time-invariant omitted factor across all periods (Wooldridge, 2010). To investigate this, the Breusch-Godfrey test is commonly employed in panel models, focusing on the idiosyncratic component of errors, and testing the following hypotheses:

H₀: There is no serial correlation/autocorrelation in the idiosyncratic errors.

H₁: Serial correlation/autocorrelation exists in the idiosyncratic errors.

As such, rejecting the null hypothesis indicates that there is evidence of serial correlation in the idiosyncratic errors. Although serial correlation does not affect the unbiasedness or consistency of estimators, it significantly impacts their efficiency. This inefficiency leads to underestimation of standard errors, resulting in significance tests indicating higher significance levels than they truly possess. Furthermore, serial correlation inflates the R-squared value, suggesting a better model fit than reality, which creates the illusion of greater precision in estimated parameter values.

4.3.4. NORMALITY OF THE ERROR TERM

When delving into dataset analysis, it is imperative to examine the relationship between errors in population data and explanatory variables and assess their adherence to a normal distribution. The Jarque-Bera test emerges as a pivotal tool in this endeavor, serving to scrutinize two fundamental hypotheses:

H₀: The population distribution adheres to a normal distribution.

H₁: The population distribution deviates from a normal distribution.

If the null hypothesis is rejected, it suggests that the population data may deviate from a normal distribution. This rejection can influence the interpretation of coefficient estimates,

leading to misinterpretations. Nonetheless, the validity of these interpretations may still hold, particularly depending on the sample size.

4.3.5. HOMOSKEDASTICITY IN THE ERROR TERM

Understanding whether the assumption of homoskedasticity holds true requires a specific test designed for this purpose. One such test, widely used, is the Breusch-Pagan test, developed by Breusch and Pagan (1979). It revolves around two hypotheses:

H0: The error term demonstrates homoskedasticity.

H1: The error term exhibits heteroskedasticity.

If the null hypothesis stands, it suggests that there's insufficient evidence to support the presence of heteroskedasticity in the dataset. This suggests that the residuals maintain a consistent variance, regardless of the independent variables' values. Conversely, if the variance is inconsistent, it indicates the presence of heteroskedasticity.

Although estimators retain their unbiasedness and consistency in the face of heteroskedasticity, they may not be the most efficient option available. Alternative estimators, with lower variance, could be preferable. Furthermore, because of biased and inconsistent estimators for variances and covariances, standard t and F tests may yield inaccurate results. Therefore, implementing corrective measures becomes crucial to ensure precise inferential outcomes from regression analyses (Wooldridge, 2010).

4.4. FORECASTING FUND RETURNS: MODEL ESTIMATION AND COMPARATIVE ANALYSIS

Initially, the model estimation process spans until June 2022, which means that the model is initially estimated up to that quarter, involving the compilation of parameters and model coefficients. Subsequently, the estimated coefficients from this model are then employed to forecast the risk premium for the subsequent quarter. So that, this rolling window process is repeated each quarter, ensuring that the estimation period extends by one quarter each time, and a new forecast is generated for the following quarter. When extending the estimation period by one quarter, the first quarter of the previous estimation is removed, ensuring that the number of observations remains constant. It is crucial that the out-of-sample forecast period remains outside the estimation period. This approach allows for a continuous assessment of the model's forecasting accuracy. In this study, forecasts were conducted for six quarters: from September 2022 to December 2023.

The accuracy of these forecasts was evaluated by comparing the predicted values against actual observed values. The key metric for evaluation is whether the observed values align with a 90%, 95%, or 99% confidence interval of the forecasted values. This assessment provides insights into the concordance between the forecasted returns and the actual returns observed, facilitating an evaluation of each model's performance.

To calculate this confidence interval, the first step consists in obtaining the Residual Variance of each estimation, through the formula:

$$\sigma^2 = \frac{\text{Residual Sum of Squares}}{n - k - 1} \quad (3)$$

Where σ^2 is the Residual Variance for the estimation; Residual Sum of Squares is given by RStudio for each estimation; n is the number of observations and k is the number of predictors.

Afterwards, the standard error of the prediction, calculated through formula (4), was determined by incorporating the standard errors of each coefficient and the residual variance calculated above.

$$SE(Y) = \sqrt{\sigma^2(1 + x^T(X^T X)^{-1}x)} \quad (4)$$

Where σ^2 is the Residual Variance calculated through formula (3), x is the vector of new predictor values, X is the matrix of observed predictor values, and $(X^T X)^{-1}$ is the inverse matrix X transposed and multiplied by X .

At last, the 95% confidence interval for the forecasted values was calculated using the formula:

$$y_{new} \pm t_{\frac{\alpha}{2}, n-k-1} \times SE(Y) \quad (5)$$

Where y_{new} is the predicted value, $t_{\frac{\alpha}{2}, n-k-1}$ is the critical value from the t-distribution with $n-k-1$ degrees of freedom and $SE(Y)$ the standard error of the prediction calculated through formula (4).

As mentioned, after calculating the confidence intervals for all predictions, the objective is to determine whether the actual values fall within the 90%, 95%, or 99% confidence intervals. This analysis aims to answer the hypothesis of this study regarding which model is best at predicting corporate bond funds' risk premiums. In this context, the model—whether economic or financial—that has its confidence intervals encompassing the observed value in a greater number of predictions will be considered the one with the highest predictive capacity. By comparing the proportion of predictions where the observed values fall within the 90%, 95%, or 99% confidence intervals, the model that demonstrates superior predictive performance can be identified. This approach ensures that the model providing the most reliable predictions is selected based on its ability to accurately capture the range within which the actual values are likely to fall.

5. EMPIRICAL ANALYSIS

This chapter begins by analyzing data's characteristics, including descriptive statistics (section 5.1) and correlation matrix (section 5.2). It proceeds to evaluate stationarity, the optimal model and the efficiency of estimators to ensure their suitability for regression models (section 5.3). Prior to executing regressions and tests on the panel dataset, the data was formatted using Excel. Subsequently, all regressions and statistical tests were conducted in RStudio. Ultimately, results from both model's estimations are discussed and contextualized within the framework of empirical literature (section 5.4).

5.1. DESCRIPTIVE STATISTICS ANALYSIS

To compute the descriptive statistics, three distinct datasets were utilized, each focusing on distinct aspects: financial factors, economic variables, and the risk premiums of the 16 selected funds, both individually and collectively. Consequently, the descriptive statistics for each dataset are presented in the following tables: Table 5.1 for financial factors, Table 5.2 for economic variables, and Table 5.3 for fund's risk premiums.

Table 5.1 - Financial factors descriptive statistics

	Obs.	Mean	Standard Dev.	Median	Min.	Max.	Skew.	Kurtosis	Jarque-Bera
Mkt	70	0.0045	0.0501	0.0020	-0.1519	0.1288	-0.6339	1.0454	8.8431**
SMB	70	-0.0005	0.0179	-0.0016	-0.0498	0.0467	-0.1023	0.2213	0.4175
HML	70	-0.0005	0.0228	0.0019	-0.1112	0.0420	-1.5212	6.0141	143.163** *
RMW	70	0.0033	0.0121	0.0028	-0.0228	0.0317	0.1176	-0.4925	0.6813
CMA	70	0.0018	0.0134	0.0014	-0.0299	0.0486	0.5865	1.5330	12.2781***
WML	70	0.0139	0.0278	0.0155	-0.0978	0.0947	-0.4465	2.9207	30.3408***

Note: *p<0.1; **p<0.05; ***p<0.01

Starting with an analysis of the statistics concerning financial factors, the average market risk premium is observed to be positive, standing at 0.0045. This indicates that investors typically anticipate returns exceeding the risk-free rate as compensation for assuming market risk. However, the standard deviation of 0.0501 implies potential volatility in investment

outcomes. The distribution displays a slight negative skew (-0.6339), suggesting a subtle asymmetry towards lower returns, potentially indicating instances where the risk-free asset premium surpasses the market risk premium. The excess kurtosis value of 1.0454 suggests slightly heavier tails.

Moving on to the small-minus-big portfolio, it exhibits average returns below zero, with a mean of -0.0005 and a standard deviation of 0.0179. This outcome suggests that, on average, the assets of smaller companies underperformed those of larger companies during the period analyzed. The skewness, slightly negative at -0.1023, hints at a left tail in the distribution, indicating a higher occurrence of larger negative returns.

Similarly, the high-minus-low portfolio demonstrates negative average returns, with a mean of -0.0005 and a standard deviation of 0.0228. This suggests that, on average, value stocks (high book-to-market ratio) underperformed growth stocks (low book-to-market ratio). Notably, the skewness is significantly negative (-1.5212), indicating a pronounced left skew in the distribution, and the kurtosis value of 6.0141 suggests heavy tails and potentially outliers, reflecting heightened volatility in this portfolio.

Examining the high-minus-low profitability portfolio, average returns are positive, with a mean of 0.0033 and a standard deviation of 0.0121. This implies that, on average, stocks of less profitable companies underperformed those of more profitable ones, hinting at a potential premium associated with investing in more profitable companies. The slightly positive skewness (0.1176) indicates a subtle right tail in the distribution.

Conversely, the conservative-minus-aggressive investment portfolio records positive average returns, with a mean of 0.0018 and a standard deviation of 0.0134. This suggests that, on average, stocks of companies with conservative investment policies outperformed those with aggressive policies, implying potential benefits linked to conservative investment strategies. The positive skewness (0.5865) suggests a slight right skew in the distribution, indicating instances where returns exceed expectations.

Lastly, the winners-minus-losers portfolio exhibits positive average returns, with a mean of 0.0139 and a standard deviation of 0.0278, indicating that, on average, stocks with positive momentum (recent winners) outperformed those with negative momentum (recent losers). The negative skewness (-0.4465) suggests a slight skew left in the distribution, potentially indicating a higher frequency of extreme negative returns compared to positive ones. The kurtosis value of 2.9207 suggests heavy tails, although not as pronounced as observed in the high-minus-low portfolio.

Moreover, the Jarque-Bera test results suggest that several portfolios, particularly Mkt, HML, CMA, and WML, deviate from a normal distribution. This is consistent with observed skewness and kurtosis values, which indicate asymmetry and heavy tails in their distributions. In contrast, the SMB and RMW portfolios appear to follow a normal distribution, as the null

hypothesis was not rejected, indicating insufficient evidence to suggest deviation from normality.

Table 5.2 - Economic variables descriptive statistics

	Obs.	Mean	Standard Dev.	Median	Min.	Max.	Skew.	Kurtosis	Jarque-Bera
GDP	70	0.0033	0.0205	0.0050	-0.1155	0.1069	-1.0535	22.4565	1583.3460***
CPI	70	0.0003	0.0062	0.0002	-0.0129	0.0194	0.2077	0.0883	0.6185
Unemp	70	-0.0251	0.2639	-0.1000	-0.5300	0.8100	1.2027	1.4373	24.7810***
Exch	70	-0.0037	0.0453	-0.0001	-0.1199	0.1080	-0.3049	-0.0706	1.1333
Gov Deb	70	0.0027	0.0151	-0.0005	-0.0190	0.0810	2.2076	8.5910	291.9234***
Econ Sent	70	0.0004	0.0623	0.0026	-0.2418	0.2376	-0.4624	6.0267	118.0086***

Note: *p<0.1; **p<0.05; ***p<0.01

Analyzing the first differences in GDP reveals a positive average change over the period studied, indicating overall economic growth. The standard deviation of 0.0205 suggests low volatility in these changes. However, the skewness of -1.0535 indicates a significant negative skew in the distribution, suggesting a heavy leftward skew with more negative changes. Outlier events or structural factors may influence this asymmetry, while the kurtosis value of 22.4565 suggests a distribution with very heavy tails and a sharp peak, deviating significantly from a normal distribution.

Moving to inflation, the average change is approximately 0.0002, indicating minor inflationary pressures. The standard deviation of 0.0062 implies moderate variability in inflation rate changes, influenced by economic shocks, monetary policy changes, or external events. The skewness, close to zero at 0.0883, suggests a symmetrical distribution of inflation rate changes, with a kurtosis value indicating a distribution close to normal, with similar peakedness and tail thickness.

Regarding the unemployment rate, the negative mean suggests a decrease in the unemployment rate on average, indicating an improvement in labor market conditions over

the observed period. The standard deviation of 0.2639 indicates dispersed changes around the mean, with positive skewness suggesting a rightward skew in the distribution and a kurtosis indicating heavier tails, implying a higher likelihood of extreme changes.

Observing the changes in the EUR/USD exchange rate, the negative mean suggests a slight decrease in the exchange rate on average, indicating euro appreciation relative to the US dollar. The standard deviation of 0.0453 indicates considerable fluctuation in exchange rate changes, signifying potential instability or uncertainty in currency markets.

Analyzing changes in government debt to GDP ratio, the positive mean suggests an overall increase in the ratio, indicating growing government debt relative to GDP. The standard deviation of 0.0151 indicates considerable variability in these changes, with heavy tails in the distribution suggesting a higher likelihood of extreme changes.

In terms of the economic sentiment indicator, the small average change suggests relative stability in economic sentiment, while the standard deviation of 0.0623 indicates moderate variability in these changes. The negative skewness implies a leftward skew in the distribution, indicating more extreme negative changes in economic sentiment compared to positive changes.

Based on the Jarque-Bera test results, significant deviations from normality are verified in the distributions of GDP, the unemployment rate, the government debt to GDP ratio, and the economic sentiment indicator. This aligns with the observation that these variables show significant skewness and kurtosis, indicating asymmetrical and heavier tails. In contrast, the CPI and EUR/USD exchange rate changes do not significantly deviate from normality, suggesting that these variables follow a more symmetrical and normal distribution. These insights align with the observed distributional properties and provide a deeper understanding of the statistical behavior of these economic indicators.

Table 5.3- Funds descriptive statistics

	Obs.	Mean	Standard Dev.	Median	Min.	Max.	Skew.	Kurtosis	Jarque-Bera
NB	70	0.0042	0.0255	0.0058	-0.0875	0.0868	-0.6766	3.9209	55.1570***
INV	65	0.0091	0.0337	0.0090	-0.0725	0.1019	0.1292	1.1943	4.9544*
FF	52	0.0084	0.0322	0.0106	-0.1247	0.1109	-0.8056	5.3337	75.4630***
ROB	48	0.0052	0.0249	0.0096	-0.0762	0.0621	-0.9507	2.4453	22.0600***
ABR	70	0.0067	0.0262	0.0052	-0.0802	0.0795	-0.4546	2.4424	22.2530***
ABR-SU	38	0.0025	0.0277	0.0075	-0.0802	0.0655	-1.2650	2.4926	23.3340***
BGF	70	0.0064	0.0307	0.0071	-0.0888	0.1416	0.6012	5.0443	85.6890***
JAN	50	0.0086	0.0279	0.0110	-0.0800	0.0644	-0.8842	1.8471	15.6520***
MOR	70	0.0062	0.0302	0.0066	-0.0918	0.0900	-0.2118	2.3748	19.2400***
SCHR	70	0.0075	0.0290	0.0089	-0.1071	0.0656	-1.2702	3.1939	52.8730***
VON	70	0.0050	0.0317	0.0052	-0.0882	0.0949	-0.4506	2.1006	17.2330***
AMU	70	0.0058	0.0319	0.0059	-0.0946	0.1235	0.2618	3.2458	35.1130***
BNP	70	0.0047	0.0263	0.0038	-0.0853	0.0740	-0.5882	2.3459	22.4720***
DWS	60	0.0073	0.0296	0.0073	-0.0884	0.0785	-0.6416	1.9859	15.9540***
FTIF	48	0.0055	0.0273	0.0081	-0.0806	0.0662	-0.9079	1.5584	13.1800**
BNYM	36	0.0035	0.0294	0.0103	-0.0887	0.0694	-1.4355	3.1180	31.5430***
All funds	9571	0.006	0.0289	0.0073	-0.124	0.140	-0.4762	3.1979	447.3912***

Note: *p<0.1; **p<0.05; ***p<0.01

As observed in the table above, the length of data varies among the funds, with some having a higher number of observations, indicating a longer track record or history compared to others with fewer observations. It is crucial to consider the number of observations when assessing the performance of different funds. Funds with fewer observations, such as BNYM may exhibit less robust statistical measures, such as means and standard deviations, due to the limited data points available.

All funds display a positive Mean, indicating that, on average, bond funds have shown positive risk premium values over the analyzed period. The standard deviation ranges from 0.0249 to 0.0337, suggesting moderate to moderate-high volatility in the risk premium values of the bond funds. This level of volatility implies fluctuations in risk premium values around the mean, indicating variability in performance over time. Investments with higher standard deviations may be perceived as riskier due to the increased likelihood of significant fluctuations in risk premium values. Examining the minimum and maximum values allows the assessment of best- and worst-case scenarios. For example, FF and SCHR present lower risk premium values as minimum values, while BGF and AMU exhibit higher risk premium values as maximum values.

Negative skewness values observed in most funds including BNYM and ABR-SU indicate left bias, implying a greater frequency of lower risk premium values than higher ones. This suggests a higher likelihood of experiencing losses or lower-than-expected risk premium values. Conversely, funds like INV and BGF display positive skewness values. Evaluating kurtosis, higher values suggest that the distribution of risk premium values contains more extreme values than expected under a normal distribution. Distributions with higher kurtosis values have a higher probability of extreme events or outliers, implying higher risk for investors due to the increased likelihood of experiencing large gains or losses. Funds such as FF, BGF, NB, AMU, and SCHR exhibit higher kurtosis values in this sample.

Additionally, the Jarque-Bera test results indicate that almost all risk premiums of bond funds rejected the null hypothesis of following a normal distribution, which makes sense given the significant skewness and kurtosis observed. In fact, the complex interplay of market forces, investor behavior, economic events, and regulatory influences contributes to the non-normal distribution of bond fund risk premiums. The only exception was the INV fund which did not reject the null hypothesis at the 5% significance level, suggesting its distribution is closer to normal.

Furthermore, considering the panel data analysis, the statistics for the aggregated risk premiums across all 16 funds, which represent this study's dependent variable, provide additional insights. The overall mean risk premium of 0.0061 indicates consistent positive performance across the funds. The standard deviation of 0.0289 suggests moderate volatility, in line with the individual fund analyses. The tendency towards more frequent lower-risk premiums is highlighted by the negative skewness of -0.4762, consistent with the observed negative skewness in most individual funds. With a kurtosis of 3.1979, the probability of

substantial deviations in risk premiums is higher than with a normal distribution, indicating the occurrence of more extreme values. This is further supported by the Jarque-Bera test results, which reinforce the deviation of bond fund risk premiums from a normal distribution due to observed skewness and kurtosis, highlighting the non-linear and asymmetric nature of their risk premiums.

5.2. PEARSON CORRELATION MATRIX

As a second step of this analysis, the Pearson Correlation matrix is computed to examine the strength and direction of relationships among variables, particularly the independent ones. According to Woolridge (2012), multicollinearity arises when variables are highly, but not perfectly, correlated. Typically, a coefficient value exceeding 0.8 indicates the presence of multicollinearity issues (Kennedy, 2008).

Table 5.4 – Pearson correlation matrix

Panel A	(1)	(2)	(3)	(4)	(5)	(6)
Mkt.RF (1)	1	0.1840	0.5051***	-0.3788***	0.0214	-0.3881***
SMB (2)		1	0.1270	-0.0815	-0.1019	0.1030
HML (3)			1	-0.6224***	0.4616***	-0.4446***
RMW (4)				1	-0.3410***	0.1904
CMA (5)					1	-0.0075
WML (6)						1
Panel B	(7)	(8)	(9)	(10)	(11)	(12)
GDP (7)	1	-0.1908	-0.1898	0.0816	0.7580***	-0.5199***
CPI (8)		1	-0.0214	-0.0070	-0.1057	0.1100
UNEMP (9)			1	-0.1372	-0.0486	0.6329***
EXCH (10)				1	0.1870	-0.0043
ECONSENT (11)					1	-0.2304*
GOVDEB (12)						1

Note: *p<0.1; **p<0.05; ***p<0.01

Table 5.4 is divided into two panels: Panel A, which presents financial factors, and Panel B, which presents macroeconomic variables. This table displays the Pearson linear correlation coefficients and their statistical significance for all variables and subperiods. First, there appears to be no indication of multicollinearity in the data sample, as the correlation matrices show that all variable correlations are below the 0.8 threshold for collinearity. Nonetheless, GDP shows a statistically significant correlation of 0.7580 with Economic Sentiment at the 5% level, which is expected given their interconnected nature. Despite this, both variables are retained in the model as their inclusion enhances performance; removing either would significantly reduce the model's explanatory power.

5.3. STATISTICAL ANALYSIS

This section aims to present a set of statistical tests used to determine unit roots and identify the model specification that most closely fits the data. This analysis is conducted to ensure more quality in statistical inference.

PANEL UNIT ROOT TESTS

Table 5.5 - Unit root tests

Variables	IPS		LLC	
	Test Statistic	Probability	Test Statistic	Probability
VDEP	-9.96637	0.0000	-3.66863	0.0001
MKT	-16.9915	0.0000	-17.5214	0.0000
SMB	-19.3333	0.0000	-20.7131	0.0000
HML	-20.3517	0.0000	-9.35063	0.0000
CMA	-16.5318	0.0000	-19.0293	0.0000
RMW	-18.0199	0.0000	-12.7187	0.0000
WML	-19.4860	0.0000	-18.8836	0.0000
GDP	-23.3934	0.0000	-23.3369	0.0000
CPI	-31.2883	0.0000	-31.2883	0.0000
Unemp	-10.8703	0.0000	-9.18226	0.0000
Exch	-15.8283	0.0000	-7.30563	0.0000
GovDeb	-12.5085	0.0000	-12.8731	0.0000
EconSent	-16.3397	0.0000	-9.81474	0.0000

** Probabilities are computed assuming asymptotic normality

Building on the methodology outlined in the preceding chapter, the initial phase involves evaluating if panels exhibit unit roots. Since non-stationary prices are expected, the first differences were computed to derive returns. Subtracting the risk-free rate from these returns provided the fund's risk premiums for this study. Thus, the existence of unit roots is examined using the tests created by Levin et al. (2002) (LLC) and Im et al. (2003) (IPS).

Note that the total risk premiums of the 16 funds comprise the "VDEP" variable in Table 5.5, which stands for the dependent variable in this analysis. As indicated in the table, the p-values

obtained from the IPS test for the dependent and independent variables fall below the 5% significance level, leading to the rejection of the null hypothesis of unit root across all variables. Similarly, the LLC test, which examines the same null hypothesis with an alternative of stationarity, reaffirms this outcome, with all p-values below the 5% threshold, thus rejecting the null hypothesis for all periods and variables. These results indicate stationarity and the absence of unit roots. Both tests yield consistent outcomes, confirming the sample's stationarity and absence of unit roots.

MODELS SPECIFICATIONS

Determining the influence of macroeconomic variables or financial factors on fund risk premiums necessitates identifying the model (Pooled OLS, Fixed Effects, or Random Effects) that best suits the data for more accurate regression estimates. To achieve this, the F-test, the Hausman specification test (1978), and the Breusch Pagan Lagrange Multiplier (LM) test are employed for both models. The probabilities associated with these tests, as shown in Table 5.6 and Table 5.7, are obtained by initially conducting Pooled OLS, Fixed Effects, and Random Effects regressions. The default significance level considered is 5%.

Table 5.6 - Financial model specifications

Test	Test Statistic	P-value
F-test for individual effects	0.2276	0.9991
Hausman test (1978)	0.1124	1
Lagrange Multiplier Test - (Breusch-Pagan)	4.7683	0.0290

Based on the findings presented in table 5.6 and beginning with the analysis of the F-test, the obtained p-value of 0.9991 exceeds the 5% significance level, indicating the non-rejection of the null hypothesis, which supports the validity of the pooled regression. As such, the Pooled OLS model is favored in this scenario. In the case of the Hausman test (1978), where the p-value is 1, clearly surpassing 5%, the null hypothesis is not rejected. Thus, when comparing Fixed Effects and Random Effects, the Random Effects model emerges as the preferred choice. Thereafter, the Breusch-Pagan LM test serves to resolve the uncertainty between the Pooled OLS and Random Effects models. With a p-value of 0.02899 not exceeding the 5% significance level, it is possible to reject the null hypothesis that favors Pooled OLS model, indicating that Random Effects is the most suitable. To conclude, the most appropriate model for the Financial Model is the Random Effects model.

Table 5.7- Economic model specifications

Test	Test Statistic	P-value
F-test for individual effects	0.2271	0.9991
Hausman test (1978)	0.0498	1
Lagrange Multiplier Test - (Breusch-Pagan)	4.8007	0.0285

The findings from the Economic Model yield similar conclusions. Regarding the F-test, the associated p-value (0.9991) exceeds the 5% significance threshold, indicating a failure to reject the null hypothesis. Consistently, Pooled OLS remains the preferred model in this test. Similarly, the Hausman test (1978) yields a p-value (1) above the 5% significance level, suggesting a preference for the Random Effects model over Fixed Effects. At last, the Breusch Pagan LM test produces a p-value (0.0285) not surpassing the 5% significance threshold, indicating that the Random Effects model is also the most suitable. Consequently, Random Effects model emerges as the model that best fits the data once again.

Given these considerations, the Random Effects model is the more suitable choice for the data, indicating the presence of unobserved factors—both time-invariant and time-varying—that potentially impact the relationship between the explanatory and explained variables. The Random Effects Model accounts for unobserved effects in the error term, which are uncorrelated with all explanatory variables. This approach aligns with expectations as it accommodates unobserved distinctions among funds, such as management styles, fee structures, fund size, investor preferences, etc. These factors can affect risk premiums but might not be directly captured by explanatory variables. By acknowledging and incorporating these unobserved variations, the Random Effects model provides a more precise estimation of the relationship between macroeconomic variables, financial factors, and fund risk premiums, thereby enhancing insights into fund performance. This result is in line with both Bhattacharyay (2013) and Lemmen and Goodhart (1999).

SERIAL CORRELATION IN THE IDIOSYNCRATIC ERROR TERM

Table 5.8 - Breusch-Godfrey test results

Model	Test Statistic	P-value
Financial	221.46	0.0000
Economic	205.77	0.0000

From table 5.8, since p-values are lower than 5% significance level, the null hypothesis is rejected. This test's outcome indicates serial correlation in the idiosyncratic component of the

errors in panel models. This correlation violates the assumption of errors being independently and identically distributed (i.i.d.). As a result, the reliability of various statistical measures is compromised. While standard errors are underestimated, the R-squared value is overestimated, implying a higher explanatory power than it has. This inflation of model fit may lead to lower (more statistically significant) p-values associated with the estimators, making the model appear to fit better than it truly does. Consequently, parameter estimates may seem more precise than they are, resulting in less efficient estimators.

NORMALITY OF THE ERROR

Table 5.9- Jarque-Bera test results

Model	Test Statistic	P-value
Financial	360.26	0.0000
Economic	504.52	0.0000

Upon conducting the Jarque-Bera test, it becomes evident from Table 5.9 that all p-values fall below the 5% significance threshold, resulting in the rejection of the null hypothesis. Despite the deviation from normality in the errors, it is noteworthy that this study benefits from substantial sample sizes (N=957 for both models). Consequently, in accordance with the Central Limit Theorem, it is reasonable to assume that the estimators are asymptotically normally distributed.

HOMOSKEDASTICITY IN THE ERROR TERM

Table 5.10 - Breusch and Pagan test results

Model	Test Statistic	P-value
Financial	42.095	0.0000
Economic	51.094	0.0000

The final statistical test conducted on the dataset is a test for homoskedasticity. Analysis of the results presented in Table 5.10 reveals that the p-values corresponding to the Breusch-Pagan test fall below the 5% significance level for all models. As a result, the null hypothesis is rejected for both models. Consequently, it is evident that the variance is not consistent, indicating the presence of heteroskedasticity in the residuals of the dataset. This result was expected since both regressions include financial data and time-invariant variables, which are known to potentially introduce heteroskedasticity in the residuals of the dataset due to their inherent characteristics and varying impacts on risk premiums.

Mitigating this issue is essential because it can result in erroneous standard errors and introduce bias into the variance-covariance matrix, even though it does not always signify inconsistency or bias in estimated parameters. Moreover, conventional model testing methods like t and F statistics, along with p-values, lose their reliability, potentially leading to incorrect conclusions. Thus, addressing this matter is crucial.

After analyzing several factors, the dataset displays issues with both heteroskedasticity and autocorrelation.⁵ To tackle these concerns highlighted by statistical tests and ensure the accuracy of coefficient estimates in both models, employing a method for heteroskedasticity and autocorrelation consistent (HAC) covariance matrix estimation becomes imperative. Following the suggestion of Mobarek et al. (2014), who advocated for the use of the Newey-West (1987) estimator to attain consistent variances in regressions affected by heteroskedasticity and autocorrelation, this study also embraces the Newey-West (1987) estimator to ensure coherent variances in both equations.

5.4. EMPIRICAL RESULTS AND DISCUSSION

In this section, the objective is to examine the outcomes of regressions to draw insights regarding the influence of the Financial Factors proposed by Fama and French, along with selected Macroeconomic Variables, on the fund's risk premium. Utilizing the findings from various statistical tests detailed earlier, both equations are estimated using Random Effects and Random Effects robust techniques, the latter accommodating heteroskedasticity and autocorrelation using the Newey-West (1978) approach, as discussed earlier. While emphasis is placed on the robust estimators derived from Random Effects, this study provides results for both methods. The discussion concludes with an assessment of which factors/variables exhibit greater statistical significance in elucidating the funds' risk premium.

Estimations for the Financial Model are presented in models (1) and (2). In addition to the contemporaneous regression depicted in models (3) and (4) for the Economic Model, an alternative approach involving lagged CPI variable is examined, represented by models (5) and (6) and a third model, corresponding to models (7) and (8), including lagged CPI and excluding Unemployment. It is important to highlight those models corresponding to even numbers (2, 4, 6 and 8) are estimated using the Newey-West (1978) method.

⁵ Testing for cross-sectional dependence also indicated that the residuals exhibit cross-sectional dependence. However, this issue does not significantly impact the results.

Table 5.11 - Financial model estimations

Variables	(1) Random Effects	(2) Robust Random Effects - Newey-West
Mkt	0.237***	0.237***
SMB	0.313***	0.313***
HML	0.139**	0.139***
RMW	0.413***	0.413***
CMA	0.192**	0.192***
WML	0.063*	0.063***
Constant	0.003***	0.003***
Obs.	957	957
R2	0.242	0.242
Adjusted R2	0.238	0.238
F Statistic	303.863***	303.863***

Note: *p<0.1; **p<0.05; ***p<0.01

The primary conclusion one can infer from the results presented in the above table, as is expected for both models' estimations, is that coefficients are precisely equal in both Random Effects and Random Effects robust. However, the distinction between these two models is in the standard errors. Consequently, this affects p-values associated with each coefficient since it results from the ratio between the estimated coefficient and its standard errors, culminating in the amendment of p-values. Thereupon, both R-squared, F test, and the probability associated with it remain unchanged from Random Effects (model 1) to Robust Random Effects (model 2).

Regarding the examination of the Financial Model results, based on the sample of 957 observations from 16 European corporate bond funds two distinct equations emerge: the first, estimated through Random Effects, and the second, derived via Robust Random Effects employing the Newey-West (1978) approach. The holistic explanatory capacity of the model manifests in an adjusted R-squared value of 0.238, delineating that approximately 23.8% of the changes in risk premiums among the selected European corporate bond funds are explained by the six-factor model proposed by Fama and French. Moreover, the F-statistic of 303.863, statistically significant at 5%, demonstrates the statistical significance of the overall model at conventional thresholds, signifying that the amalgamated factors wield a substantial influence on the risk premiums of these funds.

Notably, the application of Robust Random Effects utilizing the Newey-West (1978) methodology renders all coefficients statistically significant at the 5% level (with p-values constantly below the 5% significance level), a feat not achieved under Random Effects estimation. Delving into the outcomes, foremost among them is the discernible impact of market risk, epitomized by Mkt, on risk premiums. The coefficient of 0.237 implies that for every incremental percentage point increase in market risk premium, European corporate bond fund risk premiums, on average, ascend by 0.237 percentage points, *caeteris paribus*. This significant coefficient is in line with previous studies conducted by Anuno et al. (2023), Doğan et al. (2022) and Leite et al. (2018). When regarding the impact on bond funds specifically, a study performed by Papík and Papíková (2021) also showed a positive relationship between bond funds and market risk.

Subsequently, the coefficient for Small Minus Big at 0.313 underscores the propensity for corporate bond fund risk premiums to rise by 0.313 units, on average, during periods when small-cap stocks outshine large-cap stocks by one percentage point, thus accentuating the role of company size in shaping bond market risk dynamics. This significant effect was also stated by other previous studies such as Ben Mrad Douagi et al. (2021) and Racicot and Rentz (2016).

Moreover, and contrarily to Anuno et al. (2023), the coefficient of 0.139 for HML clarifies how the outperformance of high book-to-market stocks compared to their low book-to-market counterparts results in a 0.139-unit increase in bond fund risk premiums. This highlights the influence of value-oriented factors on bond market valuations. This statistical relevant was also supported by Ben Mrad Douagi et al., (2021) and Doğan et al. (2022). Further, the coefficient for RMW at 0.413 underscores how the outperformance of companies with robust operating profitability vis-à-vis those with weaker profitability correlates with a 0.413-unit escalation in bond fund risk premiums, on average, thus underscoring the salience of profitability metrics in bond market risk evaluations. Additionally, the CMA coefficient of 0.192 accentuates how adopting a conservative investment approach yielding superior returns engenders a 0.192-unit increase in bond fund risk premiums, thereby underscoring the influence of investment strategies on perceptions of bond market risk. However, it is important to note that this result contradicts the expectations outlined in Chapter 4. The significance of both these two last mention factors are also supported in the studies of Doğan et al. (2022) and Racicot and Rentz (2016)

Lastly, contrary to expectations, the Winner Minus Loser (WML) coefficient of 0.063 delineates how sustained outperformance of winners over losers contributes to a 0.063-unit amplification in bond fund risk premiums. Notably, this coefficient attains statistical significance at the 5% level only under the Robust Random Effects method employing the Newey-West (1978) approach. Conversely, under Random Effects estimation, it failed to achieve statistical significance which is in line with Foye and Valentinčič (2019). However, removing the effects of heteroskedasticity and autocorrelation with a Robust estimation, the Momentum factor contributes to the explanatory power of the model, evidence already

supported in Fama and French (2018). Furthermore, the statistically significant constant term of 0.003 underscores the foundational level of risk premiums.

The significant coefficients for all the factors underscore their influence on bond fund risk premium, aligning with prior research. Importantly, robust estimation techniques unveil previously overlooked relationships, enhancing the understanding of bond market dynamics. This highlights the importance of employing robust methodologies for more informed investment decisions and risk management practices in the corporate bond market.

Table 5.12- Economic model estimations

Variables	(3) Random Effects	(4) Robust Random Effects - Newey- West	(5) Random Effects Lag	(6) Robust Random Effects Lag: Newey- West	(7) Random Effects Lag 2	(8) Robust Random Effects Lag 2: Newey- West
	Contemporaneous			Lagged		
GDP	-0.633***	-0.633***	-0.584***	-0.584***	-0.574***	-0.574***
CPI	-0.064	-0.064	-0.382***	-0.382***	-0.399***	-0.399***
Lag (CPI, 1)			-1.074***	-1.074***	-1.130***	-1.130***
UNEMP	0.011***	0.011***	0.002	0.002		
EXCH	0.131***	0.131***	0.128***	0.128***	0.128***	0.128***
GOVDEB	0.328***	0.328***	0.469***	0.469***	0.490***	0.490***
ECONSEN T	0.287***	0.287***	0.295***	0.295***	0.293***	0.293***
Constant	0.008***	0.008***	0.008***	0.008***	0.008***	0.008***
Obs.	957	957	941	941	941	941
R2	0.307	0.307	0.346	0.346	0.346	0.346
Adjusted R2	0.303	0.303	0.341	0.341	0.341	0.341
F Statistic	421.119** *	421.119** *	493.124** *	493.124* **	493.467* **	493.467***

Note: *p<0.1; **p<0.05; ***p<0.01

Consistent with the findings from the Financial Model estimations, an analysis of models incorporating the same variables reveals that the coefficients, R-squared values, F-tests, and their associated probabilities remain identical across both Random Effects and Random Effects robust specifications. The only observed variations occur in the associated p-values.

Alongside the contemporaneous regressions that consider the short-run impacts of macroeconomic variables, a second model was developed incorporating the lagged CPI by one period and a third considering lagged CPI and removing Unemployment. The inclusion of a

lagged CPI is made due to the lack of statistical significance of CPI verified in the contemporaneous model and due to the inherent delay in the availability of inflation data, which are typically known only 2 or 3 months after the fact. Moreover, the lag between the calculation and disclosure of these variables further exacerbates the issue of contemporaneity. By incorporating the lagged CPI by one period, this study aims to mitigate the effects of this temporal misalignment, allowing for a more accurate reflection of the relationship between inflation and fund's risk premiums. Furthermore, Gyimah et al. (2021) observed non-significant impact of CPI in short-term, as such, this study adopts the optimal lag for CPI suggested by Ansong (2013), which is one period. Following the inclusion of the lagged CPI in the second model, which aims to address the temporal delay in inflation data and enhance the accuracy of the relationship with risk premiums, unemployment was subsequently removed due to its lack of statistical significance originating the third economic model. This decision was influenced by the observation that the effect of unemployment was overshadowed by the lagged CPI impact, aligning with Phillips curve theory. Additionally, Okun's Law, which posits an inverse relationship between GDP and unemployment, also aligns with presented results.

Starting with an examination of the Contemporaneous Regression Models, represented by (3) and (4), both exhibit significant explanatory power. This is highlighted by the adjusted R-squared value of 0.303 and the statistically significant F-statistic of 421.119, indicating that approximately 30.3% of the changes in the funds' risk premiums can be explained by the included economic variables. In these models, the macroeconomic variables are incorporated without considering lagged effects, focusing solely on contemporaneous impacts. The difference between regression (3) and regression (4) lies in the estimation technique, with the latter using Random Effects with robust standard errors.

The negative, and statistically significant (at 1%), coefficient of -0.633 associated with GDP suggests that a one-percentage-point increase in economic growth is linked, on average, with a decrease of 0.633 percentage points in the risk premium of these funds, holding all other variables constant. This finding contradicts the expectations outlined in the methodology and supported by Eichengreen and Luengnaruemitchai (2004). Nonetheless, this indicates that as the economy grows, investors perceive less risk in corporate bond investments, which is consistent with conventional economic theory. According to this theory, during periods of economic expansion, investors anticipate higher corporate earnings and reduced default risk, leading them to favor corporate bonds (Bodie et al., 2009). Therefore, the observed negative coefficient for GDP indicates that higher GDP growth rates are associated with lower risk premiums. This suggests that as the economy expands, the perceived risk decreases, resulting in lower risk premiums and, consequently, lower returns on corporate bond investments. This inverse relationship underscores the reduced compensation investors require for holding corporate bonds during favorable economic conditions.

Similarly, the positive and highly statistically significant estimated coefficients for both the unemployment rate (0.011) and the government debt-to-GDP ratio (0.328) convey important

insights into the economic dynamics affecting risk premiums. A one percentage point increase in the unemployment rate is associated with a 0.011 rise in the risk premiums of European corporate bond funds, holding other variables constant, which is not a strong impact compared to other macroeconomic variables. Nonetheless, this suggests that higher levels of unemployment slightly intensify investor concerns about economic instability, thereby prompting them to demand higher returns from bond investments to compensate for the perceived elevated risk of default. Besides this result is not traditional in literature, labor productivity can have a negative effect on bond yields. An increase in labor productivity or decrease in unemployment feeds expectations regarding a path of economic robustness, which also motivates a fall in the government bond yields (Pinho & Barradas, 2020).

Likewise, and statistically significant, a one percentage point increase in the government debt-to-GDP ratio corresponds to a 0.328 increase of units in risk premiums, *caeteris paribus*. This suggests that investors interpret higher levels of government debt relative to GDP as indicative of heightened sovereign credit risk, leading to an increase in risk premiums as they seek compensation for the perceived greater likelihood of default on government debt obligations. As stated, before in methodologies, this result was expected since higher debt levels typically correlate with higher interest rates. Consequently, investors may find investing in bonds more attractive compared to other investments. Poghosyan (2012) observed an increase in government bond rates for an increase in the government debt-to-GDP ratio as well as Hsing (2015) identified a positive impact from government debt on Spanish government bond yields.

Moreover, the positive and statistically significant coefficient for the exchange rate variation (0.131) suggests that for every percentage point increase in currency volatility, there is an associated increase in risk premiums by 0.131 units, on average. This interpretation suggests that as the euro appreciates against U.S. dollar, investors demand higher risk premiums when investing in these bond funds. This can be interpreted as a reflection of investors' perception of increased risk associated with euro-denominated assets, due to changes in economic, political, or market expectations. In summary, a positive coefficient implies that a favorable variation in the euro against the dollar is linked to an increase in the risk premium of bond funds. This comes with the conclusion that a change in the exchange rate positively affects bond funds (Qureshi et al., 2019).

Regarding the economic sentiment indicator, it presents a positive and highly statistically significant coefficient (0.287), indicating that for every percentage point increase in economic sentiment, there is an associated increase in risk premiums by 0.287. Indeed, an uptick in this Economic Sentiment Indicator typically elicits an optimistic reaction from investors regarding the economic outlook. Nonetheless, this increase in optimism might also correlate with heightened perceived risks in the financial markets. This could arise from investor expectations of increased future volatility or uncertainty, concerns about overheating economies, or mounting inflationary pressures, prompting them to seek higher returns for holding assets perceived as riskier, such as corporate bonds.

However, it is noteworthy that the coefficient for CPI, albeit negative, lacks statistical significance at conventional thresholds, suggesting a weaker association between consumer price inflation and risk premiums. This insignificance was observed by Gyimah et al. (2021) and Coffie (2019) in their investigation of the macroeconomic factors affecting mutual fund performance in Ghana. Specifically, they found that in the short term, inflation had an insignificant effect on enhancing mutual fund performance, which was in contrast with Marfo (2016).

In line with this lack of statistical significance verified in the model, the regressions (5) and (6) emerge, as mentioned previously. It is worth noting that these regressions markedly bolstered the model's explanatory capacity, evident in the surge of adjusted R-squared from 0.303 in regressions (3) and (4) to 0.341 in (5) and (6). So that, the enhancement in explanatory capability indicates that incorporating the lagged CPI by one period boosts the model's explanatory power by 3.8%.

Regarding the outcomes of Lagged Regressions, starting by equations (5) and (6), the persistently negative and highly statistically significant coefficient for GDP (-0.584) reinforces the strong and negative impact it has on fund's risk premiums. In fact, this relationship mirrors the findings of the previous model, indicating a consistent inverse association between GDP growth and bond risk premiums.

Besides the reinforcement verified on GDP results, the CPI variable presents opposite results compared to the previous models. In fact, the inclusion of a lagged CPI makes CPI statistically significant, exhibiting a negative coefficient (- 0.382), as anticipated. This result implies that for each percentage point increase in consumer price inflation, there is a corresponding decrease of approximately 0.382 units, on average, in the risk premiums of bond funds, *caeteris paribus*. Moreover, the Lagged CPI by one period presents a negative and stronger impact on risk premiums, as it is expressed by a coefficient of -1.074. This means that for every percentage point increase in the CPI in the previous quarter, there is a corresponding decrease of, on average, 1.074 units in the risk premiums, which is a notable impact. These observations are consistent with findings that bond yields are negatively influenced by changes in inflation, thus indicating that lower inflation levels are viewed positively in the bond market (Burger & Warnock, 2007; Poghosyan, 2012). In fact, this pattern suggests that historical episodes of high inflation exacerbate investor concerns about future inflationary pressures, leading to a heightened perception of risk in the bond market. This finding underscores the importance of considering the temporal dynamics of inflationary effects on risk premiums, as it indicates that not only current but also past inflationary trends significantly influence investor behavior and market outcomes.

In the regression results (3) and (4), the initially positive coefficient for unemployment loses statistical significance upon the inclusion of lag effects. This change occurs because some of the explanatory power of the unemployment rate becomes insignificant when the lagged effects of CPI are considered. The negative coefficient for lagged CPI in explaining bond funds'

risk premiums, coupled with the non-statistically significant but positive coefficient for unemployment, can be understood through the Phillips Curve framework. The Phillips Curve posits an inverse relationship between inflation and unemployment, where higher inflation corresponds to lower unemployment and vice versa. First, the negative coefficient for lagged CPI indicates that higher past inflation rates are associated with lower current risk premiums for bond funds. This relationship suggests that inflationary pressures, captured by lagged CPI, tend to reduce the returns required by investors, due to an improved economic outlook and reduced perceived risk. Secondly, the positive but non-significant coefficient for unemployment implies that current unemployment rates do not have a strong immediate impact on bond fund risk premiums. This outcome aligns with the Phillips Curve, highlighting the overshadowing effect of inflationary trends over unemployment in shaping economic conditions and investment returns.

The exchange rate coefficient remains consistently positive and highly statistically significant (0.128) across both models, indicating its robust impact. This underscores the model's robustness and the positive effect of exchange rate variations on the fund's risk premiums. Additionally, the persistence of this relationship reaffirms the findings of the first models and further solidifies the conclusion that currency fluctuations play a significant role in shaping perceptions of risk among investors in the corporate bond market.

Again, the coefficient for the economic sentiment indicator retains a positive and highly statistically significant stance (0.295) as stated before, indicating that for every percentage point increase in economic sentiment, there is a corresponding increase of 0.295 units, on average, in the expected risk premium of European corporate bond funds, holding other variables constant. This reinforces the idea that a more optimistic economic sentiment is associated with higher risk premiums, reflecting a heightened appetite for risk among investors during periods of economic optimism.

At last, turning to the coefficient for government debt-to-GDP, which maintains a positive and highly significant stance (0.469), it suggests that for every percentage point increase in government debt relative to GDP, there is a corresponding increase of 0.469 units, on average, in the expected risk premium of European corporate bond funds, *caeteris paribus*, which is a bigger impact than the one verified in previous model. This reinforces the idea that higher levels of government debt are associated with higher risk premiums in the corporate bond market, reflecting investor concerns about sovereign credit risk and fiscal sustainability.

Due to the lack of significance of the unemployment rate coefficient when including lagged CPI effects, this study proceeds with the forecast with a third model that includes the lagged CPI and excludes unemployment, as represented by equations (7) and (8). These models demonstrate notable explanatory power, comparable to models (5) and (6). Additionally, the effects of all other variables remain consistent with those observed previously, highlighting the robustness and reliability of the findings across different specifications. The choice to include the lagged CPI is validated by an increase in the model's explanatory power, as

evidenced by the adjusted R-squared increase from 0.303 to 0.341 when compared to the contemporaneous models. This improvement indicates that incorporating the lagged CPI provides a better representation of the inflationary. Additionally, the exclusion of the unemployment variable is justified by its lack of explanatory power in the previous model. Therefore, choosing this model for forecasting ensures both statistical robustness and a more accurate and reliable analysis of the economic trends affecting bond fund risk premiums.

These findings reinforce the critical role of macroeconomic factors in shaping investor perceptions and market outcomes in the European corporate bond market. By understanding the economic drivers of risk premiums, investors and policymakers can make more informed decisions, contributing to greater market efficiency and stability.

6. POST ESTIMATION ANALYSIS

6.1. ROBUSTNESS TESTS

In this subsection, additional tests are performed to validate the robustness of the findings, thereby adding credence to the present study.

Since this study employs a Random Effects model with panel data, estimations were also conducted using Fixed Effects and Pooled Ordinary Least Squares methods. This approach offers several advantages. By comparing results from different estimation techniques, the consistency and reliability of the findings can be assessed. Fixed effects estimation addresses potential endogeneity issues by controlling for unobserved heterogeneity within panel units, thereby providing more credible estimates. POLS, despite its simplicity, may offer efficiency gains under specific conditions, enhancing the overall analysis. Moreover, utilizing alternative methods allows for the detection of model misspecification or robustness concerns, ensuring a more comprehensive understanding of the data dynamics.

In line with this approach, the results obtained using POLS and Fixed Effects models were quite like those derived from the random effects model. The coefficient values and statistical significance were notably consistent across all three methods.⁶ This similarity in results underscores the robustness of the findings and suggests that the relationships identified are stable across different estimation techniques. Furthermore, to ensure the accuracy and reliability of these estimations, additional measures were taken to account for heteroskedasticity and autocorrelation.

In sum, the consistent results across these methods reinforce the validity of the study's conclusions, providing stronger evidence for the examined relationships and increasing confidence in the study's outcomes. This methodological rigor enhances the credibility and depth of the research findings.

6.2. FORECASTING RISK PREMIUMS

To assess the predictive power of the models, this study uses the contemporaneous financial model, as it was the only model developed due to the inappropriateness of considering lagged effects of financial factors. Furthermore, the Economic Model utilized excludes the unemployment variable while incorporating both lagged and contemporaneous CPI. This choice was based on the lack of significance shown by the unemployment rate, whose effect was overshadowed by the lagged CPI, as mentioned earlier. So, the forecast proceeds with models (2) and (8). The Adjusted R-squared value remained the same across models (6) and (8), justifying the exclusion of the unemployment rate. This approach ensures the selection of models that offer the best balance between complexity and predictive performance. By

⁶ Results available by request

replacing the previously estimated coefficients in the econometric models, the mathematical equations are as follows:

$$E(R_{it} - R_{ft}) = 0.003 + 0.237Mkt_t + 0.313SMB_t + 0.139HML_t + 0.413RMW_t + 0.192CMA_t + 0.063WML_t \quad (6)$$

$$E(R_{it} - R_{ft}) = 0.008 - 0.574GDP_t - 0.399CPI_t - 1.130CPI_{t-1} + 0.128Exch_t + 0.490GovDeb_t + 0.490EconSent_{it} \quad (7)$$

To ensure robustness in the forecasts, a rolling window approach is employed. Initially, the model was estimated using data up to June 2022, and the coefficients were used to forecast the risk premium for the next quarter, September 2022. This process was repeated for each subsequent forecast period by extending the estimation window by one quarter and incorporating the following quarter's data for out-of-sample forecasting. Each time the estimation period was extended by one quarter, the first quarter of the previous estimation was removed, maintaining a constant number of observations. Consequently, six risk premium estimations for each model were conducted, with results in tables 6.1 and 6.2.

It is important to recognize that funds exhibit different longevities, resulting in varying numbers of observations for individuals in the panel data, thus creating unbalanced panel data. Therefore, when advancing one period for estimation, different periods must be removed for each ID in the panel data to maintain consistency.

Table 6.1 - Roller window estimations financial model

Estimate up to	Mkt	SMB	HML	RMW	CMA	WML	Intercept
06/2022	0.237	0.313	0.139	0.413	0.192	0.063	0.003
09/2022	0.163	0.127	0.332	0.461	0.319	0.203	0.001
12/2022	0.179	-0.086	0.048	0.432	0.483	0.030	0.002
03/2023	0.083	-0.064	0.063	0.024	0.303	-0.088	0.006
06/2023	0.050	0.079	-0.079	-0.022	0.499	-0.135	0.007
09/2023	0.052	0.080	-0.083	-0.027	0.507	-0.136	0.007

In the Financial Model, diverse estimations yield significantly varying coefficient values, reflecting dynamic risk exposures and evolving sensitivities to financial factors over time. These fluctuations are attributed to shifting market conditions, alterations in fund strategies, and other economic influences. Notably, the coefficient linked to the market factor shows a consistent decrease across the estimations, dropping from 0.237 in the initial estimation to

0.052 in the final one. This trend implies a diminishing sensitivity of the bond fund to market risk, suggesting reduced dependence on overall market movements for its returns. Similar trends of diminishing sensitivity are observed for factors like SMB, HML, RMW, and WML, with coefficient values deviating between 0.3 and 0.5 from the initial value. On the other hand, the steady rise in the CMA factor indicates an increasing alignment with conservative investment strategies, with values ranging from 0.192 to 0.507 in the most recent estimation. This indicates a heightened sensitivity of the fund's returns to investment factors over time.

Moreover, the signs of coefficient values exhibit inconsistency across estimations for factors like SMB, HML, RMW, and WML, indicating fluctuating sensitivities of the bond fund to these financial factors over time.

Table 6.2 - Roller window estimations economic model

Estimate up to	GDP	CPI	LAG(CPI,1)	EXCH	GOVDEB	ECONSENT	Intercept
06/2022	-0.584	-0.382	-1.074	0.128	0.469	0.295	0.008
09/2022	-0.591	-0.359	-1.084	0.134	0.474	0.299	0.008
12/2022	-0.578	-0.308	-1.030	0.131	0.494	0.296	0.007
03/2023	-0.577	-0.326	-1.052	0.132	0.497	0.297	0.007
06/2023	-0.590	-0.342	-0.952	0.133	0.465	0.295	0.007
09/2023	-0.577	-0.365	-1.036	0.137	0.489	0.295	0.008

In contrast to the previous model, the Economic Model demonstrates stable coefficients, reflecting consistent sensitivities of the bond fund's returns to economic factors. For instance, the GDP coefficient remains stable with minimal differences, indicating a consistent negative sensitivity to GDP growth. Similarly, the CPI coefficient shows moderate fluctuations, with variations around 0.074 at most, but still suggesting a stable negative impact of inflation on the fund's returns. Moreover, the lagged CPI coefficient shows modest variations across different estimations, with values ranging from -0.952 to -1.084. Despite these differences, it consistently reflects a stable negative influence of past inflation on the fund's returns. Furthermore, unlike the Financial Model, the Economic Model exhibits consistent signs of coefficients across estimations, supporting stable relationships between economic factors and the fund's returns. Highlighting the stability of coefficients in the economic model stands in stark contrast to the fluctuation observed in the financial model, which suggests a more reliable predictive capability by the economic model.

Notably, the random effects (specific intercepts) observed along the funds were all close to 0, so they were ignored, and the estimations proceeded considering only the common intercept and estimated coefficients. Subsequently, the expected risk premium value was derived by replacing the variables' real values with the data observed during the out-of-sample period, multiplying them by the previously estimated coefficients, and adding the estimated constant value. This process yielded the predicted values, which are detailed in Table 6.3.

Table 6.3- Predictions from both models

Expected Value for date	Financial Model Predictions	Economic Model Predictions
9/2022	-2.3879	-0.6605
12/2022	1.5251	-0.0083
03/2023	1.9333	-0.0082
06/2023	0.7424	-0.0262
09/2023	0.0160	-0.0149
12/2023	-0.0674	0.0079

The accuracy of the forecasts is evaluated by comparing the predicted values with the actual observed values. The evaluation focuses on whether the observed values fall within the 90%, 95%, or 99% confidence intervals of the forecasted values. To facilitate this evaluation, confidence intervals are generated for each predicted value and compared with the observed values for risk premiums. Therefore, critical observation arises when scrutinizing the alignment between predicted and observed values in the financial and economic models. The observed risk premiums frequently fall within the 90% confidence interval of the economic model predictions in most estimations, a pattern not mirrored in the financial model predictions. In the economic model, four out of six predicted values exhibit real risk premiums aligning with the 95% confidence interval across all funds. Furthermore, expanding the confidence interval to 99%, the observed values for 15 out of 16 funds fall within this interval in five out of the six estimations, indicating strong predictive relevance. At 90% confidence interval, predictions align in three, four, or five out of six instances, depending on the fund, further confirming the model's reliability.

In contrast, the financial model demonstrates limited statistical significance across all confidence levels. Only one prediction, for September 2023, has its actual value within the 90% confidence interval of the prediction. This emphasizes the superior predictive capability of the economic model over the financial model for risk premiums.

Furthermore, an analysis of the direction and magnitude of discrepancies between predicted and observed values reveals noteworthy trends. Both models tend to overestimate risk premiums, indicating a systematic bias in the forecasting process. However, the economic model performs more favorably in this regard, with its predictions closely aligning with actual values across multiple forecast periods. This suggests that while both models may overestimate risk premiums, the economic model's predictions are closer to observed values, indicating a higher level of forecasting accuracy. Tables 6.4 and Table 6.5 present the actual risk premium values for each fund and indicate whether they fall within the 90%, 95%, or 99% confidence intervals of the forecasted values for both the financial and economic models.

Table 6.4 - Actual risk premium values and confidence interval analysis for financial model

	Para 09/2022	Para 12/2022	Para 03/2023	Para 06/2023	Para 09/2023	Para 12/2023
NB	-0.0107	0.0163	0.0202	0.0066	0.0121***	0.0421
INV	-0.0297	0.0241	0.0105	0.0116	-0.0037***	0.062
FF	-0.0393	0.0298	0.012	-0.0025	-0.0008***	0.0837
ROB	-0.036	0.0247	0.0155	0.0063	0.0031***	0.055
ABR	-0.0251	0.0108	0.0116	0.0101	0.004***	0.0608
ABR-SU	-0.0269	0.012	0.0116	0.0108	0.0039***	0.0606
BGF	-0.0326	0.0202	0.0233	0.0056	0.0037***	0.0566
JAN	-0.0252	0.0021	0.0161	0.0067	0.0017***	0.0593
MOR	-0.027	0.023	0.0195	0.0091	0.0049***	0.0567
SCHR	-0.0216	0.0249	0.0183	0.0131	0.0068***	0.0629
VON	-0.0429	0.0233	0.0161	0.0052	-0.004***	0.0632
AMU	-0.0245	0.0181	0.0027	0.0068	0.0074***	0.0538
BNP	-0.0292	0.0152	0.0204	0.0061	0.0024***	0.057
DWS	-0.0255	0.0169	0.0194	0.0063	0.0046***	0.0554
FTIF	-0.0322	0.0176	0.0125	0.0053	0.0025***	0.0568
BNYM	-0.0254	0.0185	0.0196	0.0093	0.0028***	0.0626

Note: *fall within 99%; **fall within 95%; ***fall within 90%

Table 6.5 - Actual risk premium values and confidence interval analysis for economic model

	Para 09/2022	Para 12/2022	Para 03/2023	Para 06/2023	Para 09/2023	Para 12/2023
NB	-0.0107	0.0163***	0.0202***	0.0066***	0.0121***	0.0421***
INV	-0.0297	0.0241***	0.0105***	0.0116***	-0.0037***	0.0620*
FF	-0.0393	0.0298***	0.0120***	-0.0025***	-0.0008***	0.0837
ROB	-0.0360	0.0247***	0.0155***	0.0063***	0.0031***	0.0550*
ABR	-0.0251	0.0108***	0.0116***	0.0101***	0.0040***	0.0608*
ABR-SU	-0.0269	0.0120***	0.0116***	0.0108***	0.0039***	0.0606*
BGF	-0.0326	0.0202***	0.0233***	0.0056***	0.0037***	0.0566*
JAN	-0.0252	0.0021***	0.0161***	0.0067***	0.0017***	0.0593*
MOR	-0.0270	0.0230***	0.0195***	0.0091***	0.0049***	0.0567*
SCHR	-0.0216	0.0249***	0.0183***	0.0131**	0.0068***	0.0629*
VON	-0.0429	0.0233***	0.0161***	0.0052***	-0.004***	0.0632*
AMU	-0.0245	0.0181***	0.0027***	0.0068***	0.0074***	0.0538*
BNP	-0.0292	0.0152***	0.0204***	0.0061***	0.0024***	0.0570*
DWS	-0.0255	0.0169***	0.0194***	0.0063***	0.0046***	0.0554*
FTIF	-0.0322	0.0176***	0.0125***	0.0053***	0.0025***	0.0568*
BNYM	-0.0254	0.0185***	0.0196***	0.0093***	0.0028***	0.0626*

Note: *fall within 99%; **fall within 95%; ***fall within 90%

In summary, the rolling window approach provides a robust framework for forecasting risk premiums, generating six estimations for each model, with the Economic Model consistently outperforming the Financial Model. The Economic Model demonstrates consistent coefficient stability across various estimations, indicating its reliability. Furthermore, the Economic Model effectively captures the variability in risk premiums, providing forecasts that closely aligned with observed values. This underscores its reliability as a predictive tool in the corporate bond market. Consequently, stakeholders seeking accurate insights into risk premiums may find the Economic Model to be a more dependable framework for decision-making.

7. CONCLUSIONS AND FUTURE WORKS

This study used a rolling window approach to forecast risk premiums in bond funds with two different models: the financial model and the economic model. The goal was to determine which model provides better explanatory power and forecasting accuracy. The hypothesis to be tested was that the economic model, which includes macroeconomic factors, would outperform the financial model, also known as the Fama and French Six Factor Model. The results confirmed the hypotheses. The economic model consistently showed superior explanatory power of risk premium variations, with higher Adjusted R Squared values, more stable coefficients, and better predictive capabilities, demonstrating closer alignment between predicted and observed values. These bond funds are more intricately linked to corporate fundamentals, and the economic model's focus on macroeconomic factors proved more suitable for explaining bond returns. In contrast, the financial model, which includes financial factors, is expected to be more ideal for explaining equity returns and therefore exhibited limited predictive accuracy for bond returns. As a result, investors in bond funds should prioritize macroeconomic fundamentals over market-specific (microeconomic) factors when assessing risk premiums.

Despite these findings, it is important to acknowledge the limitations of the study. A major limitation was the inability to work with monthly data due to the unavailability of information at that frequency. This limitation restricted the details of the analyses and potentially impacted on the precision of forecasts. Additionally, the Unemployment Rate and Economic Sentiment Indicator variables were only available for the Euro area and not for the entire European Union, limiting the scope and accuracy of economic model's applicability across different regions. Moreover, dealing with unbalanced panel data, due to varying fund longevities, posed challenges in maintaining estimation consistency.

Future research should investigate whether macroeconomic models exhibit similar predictive capabilities when applied to sovereign bond funds. This investigation could provide valuable insights into the applicability and effectiveness of economic models across different segments of the bond market. Furthermore, obtaining higher-frequency data, such as monthly values, could significantly enhance the precision and robustness of forecasts, offering a more detailed understanding of risk dynamics in bond markets.

These proposed future works aim not only to address the identified limitations but also to expand the scope of research, contributing to a more comprehensive understanding of the factors influencing risk premiums in various financial market segments.

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