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博士論文
Doctoral Dissertation

股票市場與 ESG 報酬之動態分析：馬可夫狀態轉換回歸法之應用

Dynamic Approach to Equity Markets' Index and ESG Return: An Application of Markov Regime Switch Regression Method

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中華民國 110 年 7 月
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Acknowledgments

Being a diabetic, working full-time as an investment professional, and writing a doctoral dissertation is no small challenge. Finally, after 12 years of struggles, my exciting student life can come to a closure and begin a new chapter in life that contests pro-profit business innovation and academic integrity. There is much unknown in our world than what is known to man; humanity's greed can become dangerous, as it will blindfold sight and distort one's mindset; the scientific method is the best-known way to help humankind distinguish between subjectivity and objectivity. Civilization should progress in consideration of good in common; as such, every business (especially the financial industry) shall always strive to balance near-term profit and humanity's environmental and social concerns. Balancing environmental, social, and governance (ESG) corners will yield long-term profits for shareholders and, more importantly, help society move forward in a sustainable future.

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Last but not least, I must thank my wife, Flora Tang, and my mom, Helen Yang, for encouraging me to complete the doctoral study; I am dedicating this dissertation to my son, Samuel C N Tan, and his future descendants that you shall never give up studying in your life, and always have faith in our Lord, Jesus Christ.

Gloria in excelsis Deo!

Timothy Hwa En Tan
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Abstract

This dissertation demonstrates the heteroscedasticity of mean excess returns (alpha) and risk factors (betas) in the stock market by extending dynamic Markov regime-switching regression (MRSR) to the capital asset pricing model and risk factor model to replace the ordinary least squares (OLS) regression approach. The nonlinearity of abnormal returns indicates that even stock markets in developed countries are in a semistrong efficient form in which a certain period of excess returns is possible. However, when market conditions change, marked by a regime switch, excess returns and risk factors change.

The regime-dependent nature of alpha and betas allows for an alternative approach to examining the change in risk factor premiums over time. Instead of using additional variables, such as short-term and long-term reversal, to examine the impact of momentum on portfolios and the changes in risk factor premiums over time, this paper adds a market regime-switching mechanism to risk factor models. Dynamic MRSR is fundamentally different from other time-series techniques, such as autoregressive conditional heteroscedasticity and threshold regression, which allow for a continuous (but irreversible) regime change. Dynamic MRSR advances the regime-switching mechanism, and endogenous probabilistic conditions determine the switch between regimes (the model determines which regime another regime should be switched according to the Markov chain property).

This dissertation documents momentum reversal under various market conditions (regimes), whereby momentum betas and other risk factors change from positive to negative or vice versa in a statistically significant manner. The results support those of studies on momentum crashes by Daniel and Moskowitz (2016) and others. This study also provides evidence that the worldwide issue of diminishing value premiums is regime-dependent, which supports Fama and French (2020) in that the variation in value premium is too large to confirm its disappearance.

When examining excess returns from ESG investment, traditional CAPM, and other risk factor models when applied with OLS, most of the time would yield a negative result in the US, Japan, and the Asia Pacific; however, when applying MRSR, it is evident that negative excess return is only statistically significant in the specific regime, but not in others regime. KLD (the U.S.

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Market) is the most extended available dataset globally, and the time probability results suggest only a month or so, during an economic recession, that KLD is underperformed the market index in a statistically significant manner.

In conclusion, this paper provides evidence that the benefits of responsible investment are not limited to small excess returns during financial crises (the benefit of social capital trust reduces a firm's sensitivity to stock market downturns), as suggested by Lins et al. (2017) and others. Although the benefits of environmental, social, and governance (ESG) factors are small, and those excess returns are sensitive to market risk are regime-dependent and persist through economic crises. The results suggest that investing in firms with high ESG scores (consistent with corporate social responsibility theory) is beneficial from the perspective of investment portfolio construction because responsible investments are not related to the performance of the broad market and occasionally outperform the market.

The heteroscedasticity of alpha and betas warrants further research to develop investment portfolio construction techniques because the assumed homoscedasticity of assets' expected means and variance does not yield optimized returns.

Keywords: ESG, CSR, Responsible Investment, Asset Pricing, Information and Market Efficiency

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摘要

本研究就股票市場平均超額報酬(α)與風險因子(β)於景氣與市場循環下所產生的結構性變異(heteroscedasticity)進行深究，並以動態馬可夫狀態轉換回歸法(Markov Regimes Switch Regression Method)取代過往線性回歸法(Ordinary Least Squares Regression method)用於資本資產定價模型(Capital Asset Pricing Model)及因子模型(Risk Factor Model)上，藉由非線性模型客觀的狀態轉換來觀察不同期間超額報酬與相關風險因子的改變。 從市場效率假說(Efficient Market Hypothesis)的角度，高效率的市場應伴隨著趨近於零的超額報酬率，惟本研究的結果卻是指出，當市場結構有所改變時，超額報酬與風險因子亦隨其變動，故，即便長期是依循市場效率假說，但是，伴隨景氣循環，不同風險因子的改變也會讓超額報酬有所改變。

不同於以往的文獻方法，本研究並不額外使用更多的變數，僅藉由馬可夫狀態轉換回歸法乃係「狀態依循(regime-dependent nature」)的特性來檢視傳統變數於不同市場循環(狀態)下的可能改變。 不同於其他時間序列分析(Time-Series Analysis)方法，如：自我回歸模型(autoregressive conditional heteroscedasticity)、門檻回歸模型(Threshold Regression Model)等，動態馬可夫狀態轉換回歸法有著讓允讓「狀態」可連續改變，並依照內生變數而決定所屬「狀態」的特性。

本研究透過動態馬可夫狀態轉換回歸法從時間序列資料中捕捉到動能因子(momentum factor)在不同市場循環階段中的反轉，即是由正轉為負或是由副轉回正，此外其他因子不同市場都有著類似的情況，並此結果具備統計上的顯著性。 此發現，在動能因子的部分與學者 Daniel and Moskowitz (2016)等有類似結論，惟本研究乃是以不同方法探知同樣結果。 另外在其他因子依循市場循環而改變的部分，為 Fama and French (2020)主張「價值因子」並未於美國市場消失提出另一個方向的論證，茲因為市場狀態的轉換也伴隨價值因子由正轉負而故讓長期平均失去統計上的顯著性。

本研究另外就 ESG 投資，也以動態馬可夫狀態轉換回歸法改良的資本資產定價模型及因子模型進行分析，確認 ESG 投資也因著市場狀態的改變而有著不明確的超額報酬。如，以傳統線性回歸法使用 CAPM 及其他因子模型，於美國、日本及亞太市場都有著

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「負報酬」的統計顯著績效，惟當以動態馬可夫狀態轉換回歸法進行分析時，顯著性的「負報酬」往往僅發生在一特定的市場狀態循環下，而另一市場狀態下則是沒有達到統計顯著的報酬。 若以美國 KLD 指數為例，(最長期數據)，其僅在一特定時期(狀態)內才會有著統計顯著的負報酬狀況產生，而此時期僅維持約一個月，相較於其他期間(狀態)，ESG 投資有著不亞於大盤的績效。

總結，不同於 Lins et al. (2017)等學者指出 ESG 投資僅於金融風暴下，基於市場對於公司的信任(social trust)而產生的超額報酬，本研究結果顯示 ESG 投資也受到市場狀態循環的影響，風險因子與超額報酬都會依隨市場狀態而有些許改變，故投資於高 ESG 評價公司的策略應被視為另一種投資風格，或是另一種 Smart Beta 策略，宜從投資組合角度作為可降低投資風險同時提升投資報酬率的策略性工具使用。

關鍵詞：企業社會責任、永續發展、責任投資、資產定價、市場效率

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LIST OF ABBREVIATION

The following are key abbreviations use in this dissertation, other specific variable or index name are detail in related sections

Abbreviation	Explanation
Alpha, α	Denote for the excess return, reference in section 3
AUM	Assets under Management
Beta, β	Denote for Risk Factor coefficient, reference in section 3
CAPM	Denote for the Capital Asset Pricing Model, reference in section 3.1
CFP	Corporate Financial Performance
CSP	Corporate Social Performance
CSR	Corporate Social Responsibility
EMH	Efficient-Market Hypothesis
ESG	Denote for Environmental, Social, and Governance
KLD	MSCI KLD 400 Social Index, reference in section 4
MSCI	In this dissertation it is reference stock indexes by Morgan Stanley
MRSR	Denote for Markov regime-switching Regression
OLS	Denote for Ordinary least squares, method of regression
RI	Responsible Investment, reference in section 1.2
SIF	Forum for Sustainable and Responsible Investment

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1.0 Introduction

In a post-2008 financial crisis global survey, McKinsey discovered that approximately half of top-ranked executives believed that their companies' efforts in environmental, social, and governance (ESG) programs would increase shareholder value. Although a breakdown of the survey revealed that 56% of investment professionals believed that more robust corporate social performance (CSP) improves corporate financial performance (CFP), meaning that it increases shareholder value, the survey also indicated that 62% of professionals in corporate social responsibility (CSR) believed otherwise[1] (McKinsey, 2009). This changed substantially in the 2019 McKinsey Global Survey, which indicated that more than 83% of executives and investment professionals strongly believed that CFP (or ESG programs) had resulted in positive shareholder value in the prior five years. One astonishing finding of this survey was that respondents across the spectrum said they would be willing to pay approximately a 10% premium for a company with an overall positive record on ESG issues over a company with an overall negative record (in a hypothetical merger or acquisition situation), with the spectrum including the 17% of respondents who believed that ESG programs do not create shareholder value (McKinsey, 2020). According to McKinsey, the business world strongly believes in ESG premiums at the end of the second decade of the 21st century.

As everyday business decisions become increasingly intertwined with ESG activities, the long-term shareholder value created by such activities remains "hard to quantify." [2] A tremendous amount of academic research has explored the causal link between a firm's ESG activities (or CSP) and shareholder value (or CFP). The literature reviews of Friede et al. (2015), Khan et al. (2016), and Nagy et al. (2015) indicated that approximately two-thirds of studies have suggested that ESG programs yield positive stock returns. A lesser-known benefit of ESG is risk-benefit, which scholars of management have suggested constitutes an insurance-like protection for firms with high CSP (Godfrey et al., 2009; Hong & Liskovich, 2016; Minor 2015). The empirical study of Gross and Roberts (2011) indicated that firms with high CSP receive higher credit ratings and hence have lower bank loan costs. Bae et al. (2016), Lundqvist and Vilhelmsson (2018), Bae et al. (2018), and Henisz and McGlinch (2019) approached the link between CSP and credit risk from various perspectives and indicated that ESG contributes

[1] A total of 62% of the CSR specialists responded, "do not know" or "do not think there is value creation."
[2] A term used by McKinsey and Company on page 80 of Chapter 6 of the seventh edition of *Valuation: Measuring and Managing the Value of Companies* (2020), which describes the valuation of initiatives and introduces the link between ESG and firms' financial performance to future executives.

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to a company's financials by lowering borrowing costs.

An analysis of US mutual funds with socially responsible investment (SRI) by Matallin-Saez et al. (2018) revealed that the excess returns on SRI funds are either negative or do not significantly differ from broad market indices. The findings of Matallin-Saez et al. (2018) corroborated those of Hamilton et al. (1993) and Statman (2000), which indicated that socially responsible mutual funds perform worse than the market does but similarly to conventional mutual funds, suggesting that high CFP does not benefit shareholders of firms with high CSP. However, when Statman and Glushkov (2009) analyzed US firms in the Kinder, Lydenberg, and Domini (KLD) database, their results revealed that if management fees and transaction costs are excluded, investment in firms with high CSP generates market excess return (alpha) for investors; however, this comes with the caveat that CSR screening (investment only in firms high ESG scores) would reduce opportunity cost, meaning a loss of the potential gains from firms with low ESG scores. They suggested that this is the main reason for the similar performance between ESG investment and conventional investment. Hartzmark and Sussman (2018) analyzed the flow of funds into conventional mutual funds and ESG mutual funds and concluded that despite a lack of evidence suggesting one type of fund outperformed the other in a certain period, investors preferred ESG. This result indicated that although ESG does not create shareholder value, investors like the concept of ESG.

Lins et al. (2017) identified the benefits of CSR firms for shareholders from another perspective. Their research demonstrated that firms with high CSP outperformed firms with low CSP during the financial crisis and provided new insight into investors' preference for ESG and its insurance-like protection during high-volatility periods. The second part of Matallin-Saez et al. (2018) also demonstrated that ESG mutual funds underperform conventional funds (or broad markets) during subperiods of market expansion but that investment in ESG outperforms conventional investment with partial significance during subperiods or recession.

Lins et al. (2017) and Henisz and McGlinch (2019) conducted event studies of a specific time frame. By contrast, Statman and Glushkov (2009) and Matallin-Saez et al. (2018) performed cross-sectional regression (risk factor) analyses by selecting a certain subperiod to ensure the robustness of the research and explore the potential link between CSP and CFP during a specific period. Both event studies and risk-factor analyses usually rely on the capital assets pricing model (CAPM), other expanded risk factor models, and the ordinary least squares (OLS) method (e.g., Ahern, 2009; Armitage, 1995; Binder, 1998; Brown & Warner, 1985). The fundamental limitations of the OLS method for linear regression are the assumptions of homoscedasticity, specifically that variance is constant and that the error term generated by the

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model does not depend on the independent variable; that the mean of the error term is 0; and that the variance remains equal throughout an entire period. These assumptions cause the error term of financial models to remain the same over the course of an observation period, which implies that variance is mathematically constant during market crises (or economic recessions) or in bullish markets (or periods of economic expansion). Therefore, a logical progression would be to investigate methodological innovations by relaxing the limitations of linear regression to investigate the link between CSP and CFP in a nonlinear fashion and performing cross-sectional analyses that allow for endogenous variables to have different characteristics under different environmental conditions, such as a financial crisis; this represents the motivation for this dissertation.

1.1 Objective of this Research

With the advancements in single-equation time-series analysis from the econometric method, scholars have developed mathematical algorithms that enable researchers to relax the assumption of homoscedasticity, the most crucial of which are the autoregressive conditional heteroscedasticity (ARCH) model developed by Engle (1982) and the generalized ARCH (GARCH) model developed by Bollerslev (1986) and Taylor (1986). The ARCH and GARCH methods were designed to relax the assumption of homoscedasticity in linear regression. Hamilton (1989) proposed the Markov switching autoregression technique, an innovative method of addressing stationarity, such as homoscedasticity in macroeconomic variables, by relaxing the constraint for error terms to be 0 and thus allowing variance in equations to change over time.

Markov regime-switching regression (MRSR) allows predictors (independent variables) to exhibit different behavior under different regimes (or market conditions). The innovative aspect of MRSR is that the regime-switching mechanism is regulated by an unobservable state variable that follows a first-order Markov chain; the current regime (state variable at time t) depends on the previous regime [state variable at (t – 1)]. A critical difference between MRSR and other time-series methods is that the switching between different regimes enables MRSR to capture more complex, dynamic, and nonlinear relationships between dependent and independent variables. Thus, MRSR is suitable for exploring relationships involving means and variance changes (Kuan, 2002).

MRSR and its variant methods have been widely applied in analyses of economic time series, such as those by Hamilton (1989), Engel and Hamilton (1990), Filardo (1994), Garcia

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and Perron (1996), and Gray (1996). Schgwert (1989) applied the technique to study the stock market and observed that stock returns could be subdivided into two regimes, those with high stock returns and those with low stock returns, between which the model can switch. Turner et al. (1989) analyzed S&P 500 index data for 1946–1989 and discovered that the variance in the index returns could be subdivided into two regimes. Hamilton and Susmel (1994) proposed an enhancement to the model by including sudden changes in variance and concluded that the Markov switching model could provide a superior statistical fit to the ARCH model proposed by Engle (1982). Schaller and Van Norden (1997), Dueker (1997), and Kim and Nelson (1999) then refined the MRSR technique.

Schgwert (1989), Turner et al. (1989), Hamilton and Susmel (1994), Dueker (1997), and Kim and Nelson (1999) focused on the autoregressive component of time-series analysis, which differs from most financial research in that the explanatory variable is not derived from the CAPM or any other risk factors but lagging terms.

The assumption of homoscedasticity can be relaxed by incorporating MRSR into the CAPM and other risk factor models (i.e., Fam and French and others extended variant risk factor models) instead of using the linear regression method. This method adds an extra endogenous variable, regime (or value of state), to the CAPM and risk factor models and enables researchers to analyze mean return and variance under different market conditions, such as regimes with high or low mean stock returns, and the associations between mean return and risk factors.

The objectives of this dissertation were (a) to document the heteroscedasticity in the stock market's mean return and the dynamic association between mean return and risk factors (e.g., momentum) by investigating the phenomenon of risk factor reversal and the studies on decreasing momentum premium by Daniel and Moskowitz (2016) and Fama and French (2020) and (b) to supplement the findings of Lins et al. (2017) and Henisz and McGlinch (2019) regarding the benefits of credit risk (or social trust) by exploring the differences in the stock market's mean return and risk factors in SRI under different regimes.

This paper presents the research in two parts. The first part explores regime heteroscedasticity in mean return and risk factors in stock markets in the United States, Europe, and Asia Pacific (e.g., Japan) by using MRSR for the CAPM and other risk factor models rather than OLS. The second part analyzes SRI (or ESG investment) in these markets through the same method to provide additional insight into the concept of insurance-like protection during market downturns proposed by Lins et al. (2017).

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1.2 Overview of Responsible Investment

According to the Principles for Responsible Investment of the United Nations, responsible investment (RI) incorporates ESG into investment decisions and active ownership. In the United States, the first publicly available mutual fund to incorporate social and financial criteria into its portfolio evaluation process was the Pax Fund (now known as "Pax Sustainable Allocation Fund"), launched in 1971. Because of the social nature of the creation of the Pax Fund, RI is often referred to as "SRI" in the United States and in much of the academic literature. The consideration of ESG in the business decision-making process is also commonly referred to as "CSR" in the academic community.

The widespread social justice movement of the early 1980s and the disinvestment in South Africa in protest of the apartheid policy forced many investment firms to incorporate social considerations into their investment policies. In addition, after the Exxon Valdez oil spill disaster, the public began to call for the Valdez Principles (now "Ceres Principles") and to pressure the authorities to audit firms and firms to include environmental impact assessments in the business decision-making process. As a result, United States-based firm KLD and Co., Inc. launched the first socially responsible index, the Domini 400 Social Index (now the "MSCI 400 Social Index"), by developing a framework to assess the social and environmental performance (including sustainability) of companies listed in the United States. Furthermore, since the UK government publicized the first Corporate Governance Code in 1998, consideration of ESG characteristics has become an essential component of any institutional investment process.

According to the US Forum for Sustainable and Responsible Investment (SIF; 2020), the total assets under management (AUM) of United States-based ESG investment (i.e., investment strategies that include a focus on environmental, social, and governmental aspects) increased substantially from US$12,000,000,000,000 in 2018 to US$17,100,000,000,000 in 2020,[3] a 42% increase (SIF, 2020). In addition, according to the SIF 2020 Trends Report, 149 institutional investors (e.g., pension funds and endorsement funds) and 56 investment management firms (e.g., mutual funds and exchange-traded funds) filed or Cofield shareholder resolutions regarding ESG-related matters on behalf of their clients from 2018 to mid-2020; these companies account for approximately US$2,000,000,000,000 in AUM. Thus, the boards

[3] The US SIF Trends Report was published on November 16, 2020, and includes data as of the end of 2019. Therefore "2020" refers to the beginning of 2020 and the end of 2019, and "2018" refers to the beginning of 2018 and the end of 2017.

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of directors of all listed companies in the United States received a strong message from shareholders that ESG is a vital issue that cannot be overlooked in favor of a firm's financial performance.

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2.0 Literatures Review

The concept of the random walk can be traced back to French stockbroker Jules Regnault,[4] and the related academic work can be traced to Louis Jean-Baptiste Alphonse Bachelier, a French mathematician first credited with expanding the stochastic process to the field of finance. [5]

Fama (1970) developed the efficient market hypothesis (EMH) and applied random walk to the field of finance by proposing an explanation of how stock information moves from the market to the participants—namely, investors. According to Fama (1970), the stock market can be classified into three different forms based on efficiency: strong, semistrong, and weak. In weak-form market efficiency, participants in the market only possess old price data, and the past trend can be used to predict the future; therefore, no investor can profit in such a stock market. In the semistrong form of efficiency, all public information (such as companies' earnings announcements) is available to investors (and is accurate); therefore, an investor with sound fundamental knowledge can potentially profit in such a market in the short term. Finally, in strong-form market efficiency, the EMH dictates that all information (including insider information) is perfectly revivals to the stock price already and that no monopolistic information is available based on which any investor can obtain a profit; therefore, every investor in the broad market would expect the same returns.

The EMH dictates that individuals cannot predict the future and that stock prices behave like a random walk; therefore, investors cannot outperform the market average (Malkiel 2015). [6]. In a business world application, John Bogle, founder of the Vanguard Group, made passive (or index-like) investment a remarkably successful specialization in the investment world (Bogle 1999).[7]

Harry Markowitz used mean-variance analysis to propose modern portfolio theory (MPT),

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[4] In *Calcul des chances et philosophie de la bourse* (1866), Jules Augustin Frédéric Regnault QE45RGT5 (1834–1894) used the concept of random walk to model stock price deviation. Contributed by Fisher, University of Toronto (2010); accessible at https://archive.org/details/calculdeschances00regn.

[5] Louis Jean-Baptiste Alphonse Bachelier (1870–1946) wrote his PhD dissertation, *Théorie de la speculation* (1990), using the mathematical model of Brownian motion to evaluate stock options. This is the reference by *Dictionary of Scientific Biography* (1970), edited by Felix L., published by Charles Scribner's Sons. ISBN 978-0-684-10114-9. 5W6RT4HY567HJUY.

[6] Malkiel famously described that random walk in the stock market means that "a blindfolded monkey throwing darts at a newspaper's financial pages could select a portfolio that would do just as well as one carefully selected by experts" in the first edition of his book.

[7] John Bogle is the founder of Vanguard Group, which is the second-largest investment firm with more than US$7,100,000,000,000 in AUM as of January 31, 2021, second only to the largest exchange-traded fund (also passive investment) provider, Blackrock.

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a mathematical framework that links investment risk and returns with portfolios. MPT dictates that a stock's expected risk and expected gain should not be analyzed alone but in terms of the asset's contribution to a portfolio. In Markowitz's work, variance is treated as a proxy for investment risk (Markowitz, 1952). The investigation of the correlation between mean return and risk has entered the field of finance; scholarship by Jack Treynor, William Sharpe, John Linter, and Jan Mossin in the 1960s resulted in the formulation of the CAPM (Craig, 2003). The CAPM can be used to determine the expected returns of stock marketing (the market's required risk premium) by using a risk-free interest rate, such as 1-month US treasury bill rates, and the risk (variance in stock price) of the market, which are analyzed through linear regression.

Fama and French (2019) attempted to examine momentum (see Section 2.1) using the linear regression method and compared models using the cross-section method with the time-series factor method. The momentum factor was allowed to be a time-varying loading factor, and Fama and French (2019) concluded that "time-series models that use only cross-section factors provide better descriptions of average returns than time-series models that use time-series factors." Thus, incorporating MRSR into the CAPM or other risk factor models represents a reasonable methodological innovation to expand on other studies.

2.1 Momentum Factor and Diminishing Value Premium

The expansion of the CAPM in the practitioners' world with additional risk factors by Fama and French (1993) quickly became widely accepted in the academic community.[8] Blanco (2012) validated that the CAPM can explain approximately 70% of a portfolio's returns but the Fama–French three-factor model can explain approximately 90% and confirmed that the Fama–French three-factor model is empirically superior to the CAPM. However, Carhart (1997) proposed expanding the three-factor model by adding momentum to the three-factor equation. The introduction of momentum as a risk factor entailed several complications; the growth (value) risk factor is similar to a winner (loser) in many aspects, but its predictions have opposite betas (Li, 2014). Carhart (1997) assumed the existence of a market anomaly, which is fundamentally inconsistent with the concept of random walk and the EMH. As opposed to behavioral economics, investment based on momentum (i.e., chasing past winners) is irrational in mainstream finance. According to the EMH, the only changes should be due to new

[8] See note 6 on page 68 of *Valuation: Measuring and Managing the Value of Companies (Seventh Edition)*, McKinsey (2020).

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information (Barberis et al., 1998; Daniel et al., 1998). However, according to Low and Tan (2016), momentum is critical for most investment professionals.

The contradictions between the three-factor and four-factor models in the field of the investment spurred several empirical studies. After winning the Nobel Memorial Prize in Economic Sciences, Fama introduced new five-factor models (Fama & French, 2015) to improve the market model without adding the momentum factor. However, Fama's student, Cliff Asness, Chief Researcher at Applied Quantitative Research Capital Management, insisted on the need for the momentum factor (Asness, 2014). Studies on momentum crashes (or reversals), especially that by Daniel and Moskowitz (2016), have suggested that factors (or betas) can suddenly change direction (i.e., from positive to negative or vice versa) during certain market events.

In addition, the use of the linear regression method in the CAPM and risk factor models is not perfect. For the CAPM, the weak betas identified by Pettengill et al. (1995) remain a substantial challenge for scholars examining robustness. The standard approach to address the robustness issue is to subdivide time-series data into two or more subperiods and perform analyses of each subperiod to determine whether each yields the same conclusions. [9]

Concerns regarding the weak beta relationship and the phenomenon of factor reversal motivated this research, which expands MRSR into risk factor models to replace the OLS method and eliminate the restriction of homoscedasticity in the CAPM and other risk factor 4models by developing a mathematical framework that objectively identifies subperiods of a regime. The benefit of this design is that it allows for the mean stock return and the betas of risk factors to differ among regimes.

In addition, as mentioned in the Introduction, the literature on CSR and ESG describes two comparison methods: event studies and time-series analyses. Therefore, this dissertation advances the scholarship on this topic by conducting an innovative investigation of CSR and CFP during different subperiods without manual selection.

[9] Fama and French (1992) explored robustness by dividing their data into subperiods.

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3.0 Methodology

This research explores the dynamic relationship between market mean returns and risk factors and the differences between the ESG index (and CSR index) and the broad market index. By considering the implications of the methodology of Fama and French (2019), this research expands MRSR to the CAPM and other risk factor models (i.e., Carhart, 1997; Fama & French, 1993, 2015) about Hamilton et al. (1993) and Hamilton (1994) to replace the underlying OLS methods. In the last part of the research, the ESG index (and CSR index) is compared with the other models. MRSR and OLS are executed using EViews (version 12, year 2021, IHS Global Inc., 4521 Campus Drive, #336 Irvine, CA 92612-2621 USA).[10]

3.1 CAPM

The CAPM was first introduced by Jack Treynor in 1961 and 1962. Sharpe (1964), Lintner (1965), and Mossin (1966) derived similar findings independently. The CAPM is based on Markowitz's work on diversification and MPT. Markowitz and Sharpe jointly received the 1990 Nobel Memorial Prize in Economic Sciences. The CAPM considers investment returns and the market's systematic risk as follows:

$$E(R_i) = R_f + \beta_i\left(E[R_m] - R_f\right) + \varepsilon_t,$$

where $E(R_i)$ is the expected return on an investment, namely the portfolio of stocks; R_f is the risk-free rate, generally a 1-month US treasury bill return rate; β_i is the risk factor of an investment and can be interpreted as the sensitivity to the broad market's ups and downs; $\left(E[R_m] - R_f\right)$ is the risk factor premium (or excess returns); and ε_t is the error term of the model.

[10] Note that some earlier results were generated using version 11 of EViews.

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3.2 Fama–French Three-Factor Model

The empirical studies of Fama and French (1992, 1993) challenged the CAPM by demonstrating that it could not fully explain the stock market's abnormal returns and that it had some fundamental flaws because of its narrow assumption:

$$E(R_i) = R_f + \alpha + \beta_i\left(E[R_m] - R_f\right) + \beta_s \cdot SMB + \beta_v \cdot HML + \varepsilon_t,$$

where α is the risk factor–adjusted excess return; $\beta_i, \beta_s,$ and β_v are the risk factors that measure the sensitivity of an investment to a change in the stock market's risk, size factor, and value factor, respectively; $\left(E[R_m] - R_f\right)$ is the risk premium under the assumption of a risk-free rate; SMB is the small cap return minus big cap return; and HML is the value (high book value) return minus growth (low book value) return.

3.3 Carhart's Challenge

Carhart (1997) challenged Fama and French (1993) by adding the industrial renown momentum factor to the Fama–French three-factor model and demonstrating the diminished explanatory power of SMB and HML:

$$E(R_i) = R_f + \alpha + \beta_i\left(E[R_m] - R_f\right) + \beta_s \cdot SMB + \beta_v \cdot HML + \beta_u UMD + \varepsilon_t,$$

where UMD is the winners' returns (from the previous period) minus the prior losers' returns and β_u is the sensitivity of a portfolio to momentum—specifically, the risk factor for momentum.

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3.4 Fama-French Five-Factor Model

In response, Fama and French proposed the five-factor model in 2015:

$$E(R_i) = R_f + \alpha + \beta_i\left(E[R_m] - R_f\right) + \beta_s \cdot SMB + \beta_v \cdot HML + \beta_r \cdot RMW + \beta_c \cdot CMA + \varepsilon_t,$$

where RMW is the robust earning winners' returns (from the previous period) minus the weak earning losers' returns (from the previous period); CMA is the conservative firms' (in capital investment from the previous period) returns minus the aggressive firms' (in capital investment from the previous period) returns; and β_r and β_c are the sensitivity of a portfolio to the RMW and CMA risk factors, respectively.

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3.5 Regime Switching Regression

Linear regression is the primary tool for econometric analysis and financial modeling. The fundamental presupposition of linear regression is that the parameters (or variables or factors) of the model do not change (or vary) throughout an observation period. However, a considerable amount of academic and practical evidence [e.g., Hansen (2001) and Perron (2006)] indicates that nonlinear modeling is occasionally more appropriate to explain empirical phenomena, especially in an analysis involving macroeconomic variables that are subject to structural breaks or a regime change in parameters within a sample period.

Switching regression models are linear regression models that can have nonlinearities when a discrete change of condition occurs. Switching regression models have been widely applied in the field of economics [e.g., Frühwirth-Schnatter (2006), Goldfeld and Quandt (1973, 1976), Hamilton (1994), and Maddala (1986)]. The Markov switching regression model assumes differences in the basic model (with different linear characteristics) associated with each regime (or phase).

3.5.1. The Basic Model of Regime Switching

(Excerpt from EViews manual with minor revisions)

By assuming a random variable of interest, y_t follows a process that depends on the value of discrete state variable s_t (unobserved). Because the model can be assumed to contain M possible regimes, under state or regime m in period t when $s_t = m$, $m = 1, \ldots, M$. The switching model assumes a different regression model (linear relationship) for each regime (or state). Given regressors X_t and Z_t, the conditional mean of y_t in regime m is as follows:

$$\mu_t(m) = X_t'\beta_m + Z_t'\gamma ,$$

where β_m and γ are coefficient vectors k_x and k_z. The β_m coefficients for X_t are indexed by the regime, and the γ coefficients associated with Z_t are regime invariant.

Regression error is assumed to be normally distributed with variance that may depend on the regime. Thus,

$$y_t = \mu_t(m) + \sigma(m)\epsilon_t ,$$

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when $s_t = m$, where ε_t follows *iid* standard normal distribution. Standard deviation σ may be regime dependent [$\sigma(m) = \sigma_m$].

The likelihood contribution for a given observation can be formulated by weighting the density function in each of the regimes by the one-step-ahead probability of being in that regime as follows:

$$L_t(\beta, \gamma, \sigma, \delta) = \sum_{m=1}^{M} \frac{1}{\sigma_m} \phi\left(\frac{y_t - \mu_t(m)}{\sigma(m)}\right) \cdot P(s_t = m | \Im_{t-1}, \delta)$$

.

The parameters that determine the regime probabilities are $\beta = (\beta_1,\ldots,\beta_M)$, $\sigma = (\sigma_1,\ldots,\sigma_M)$, and δ, ø (・) is the standard normal density function, and $\Im_{t-1}$ is the information set in period $t-1$. In the simplest case, δ represents the regime probabilities. The full log likelihood is a normal matrix given by

$$l(\beta, \gamma, \sigma, \delta) = \sum_{t=1}^{T} \log\left\{ \sum_{m=1}^{M} \frac{1}{\sigma_m} \phi\left(\frac{y_t - \mu_t(m)}{\sigma(m)}\right) \cdot P(s_t = m | \Im_{t-1}, \delta)\right\}$$

, which may be maximized with (β,γ,σ,δ).

3.5.2. Markov Switching

The Markov switching regression model expands the simple exogenous probability framework by specifying a first-order Markov process for the regime probabilities. We begin by describing the regime probability specification and then discuss the likelihood computation, filtering, and smoothing.

3.5.2.1. Regime Probabilities. The first-order Markov assumption requires that the probability of being in a regime depends on the previous state so that

$$P(s_t = j | s_{t-1} = i) = p_{ij}(t)$$

.

Typically, these probabilities are assumed to be time invariant so that $p_{ij}(t) = p_{ij}$ for all t,

but this restriction is not required. We may write these probabilities in a transition matrix as follows:

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$$p(t) = \begin{bmatrix} p_{11}(t) & \dots & p_{1M}(t) \\ \cdot & \dots & \cdot \\ p_{M1}(t) & \dots & p_{MM}(t) \end{bmatrix}$$

,

where the *ij*th element represents the probability of transitioning from the regime in *i* in period $t-1$ to the regime in that period [because some authors use the transpose of $p(t)$, their indices are reversed from those used here].

As in the simple switching model, we can parameterize the probabilities in terms of a multinomial logit. Because each row of the transition matrix specifies a complete set of conditional probabilities, we define a separate multinomial specification for each row *i* of the matrix as

$$p_{ij}(G_{t-1}, \delta_i) = \frac{\exp(G_{t-1}'\delta_{ij})}{\sum_{s=1}^{M} \exp(G_{t-1}'\delta_{is})}$$

for $j = 1, \dots, M$ and $i = 1, \dots, M$ with the normalizations $\delta_{iM} = 0$.

As mentioned previously, Markov switching models are generally specified with constant probabilities so that G_{t-1} contains only a constant. The model of gross domestic product (GDP) proposed by Hamilton (1989) is a notable example of a constant transition probability specification. By contrast, Diebold et al. (1994) and Filardo (1994) adopted two-state models that employ time-varying logistic parameterized probabilities.

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3.6 Hypothesis for Markov Switching Regression (2-Regimes)

The first variable of interest is excess returns (in the global stock market), and the assumption is that excess returns differ among regimes, such as bullish and bearish markets. Therefore, in the two-regime model, the two-state Markov switching model with exogenous variables can be formulated as follows:

$$\Delta ex\_return_t = \begin{cases} \alpha_{1t} + \boldsymbol{X}'_{\boldsymbol{t-1}}\boldsymbol{\beta_1} + \varepsilon_{1t};\ \varepsilon_{1t} \sim N(0, {\sigma_{1t}}^2)\ if\ s_t = 0 \\ \alpha_{2t} + \boldsymbol{X}'_{\boldsymbol{t-1}}\boldsymbol{\beta_2} + \varepsilon_{2t};\ \varepsilon_{2t} \sim N(0, {\sigma_{2t}}^2)\ if\ s_t = 1 \end{cases}, \qquad (1)$$

where Δex_return_t is the excess return from the stock market determined using monthly data; $\boldsymbol{X_{t-1}}$ is the risk factors, namely those from the CAPM, Fama and French (1993, 2015), and Carhart (1997); and s_t is the designated unobserved regime (latent variable), which can be either 0 or 1. According to Hamilton (1989), s_t is governed by the first-order Markov chain; hence, the constant transition probability matrix **P** is as follows:

$$\mathbf{P} = \begin{bmatrix} Pr(s_t = 0|s_{t-1} = 0) & Pr(s_t = 0|s_{t-1} = 1) \\ Pr(s_t = 1|s_{t-1} = 0) & Pr(s_t = 1|s_{t-1} = 1) \end{bmatrix} = \begin{bmatrix} p^{00} & p^{01} \\ p^{10} & p^{11} \end{bmatrix}, \qquad (2)$$

where p^{ij} is the probability of a transition from state *i* to state *j*. Note that $p^{01} = 1 - p^{00}$ and $p^{10} = 1 - p^{11}$; the transition probability matrix **P** is wholly defined by p^{00} and p^{11}.

This is a version of MRSR in which the transitional probability is time invariant; it is known as "fixed-probability MRSR." The conditional probability density function for Δex_return_t can be calculated by assuming the error term is normally distributed. Therefore, the regime-switching parameters can be estimated through the maximum likelihood method. The log-likelihood function of Δex_return_t is represented by the following equation:

$$lnL = \sum_{t=1}^{T} ln\left[\sum_{s_t=0}^{1} f(\Delta ex\_return_t|s_t, I_{t-1}) \times Pr\ (s_t|\ I_{t-1})\right], \qquad (3)$$

where $Pr\ (s_t|\ I_{t-1})$ is the prediction probability and can be interpreted as the weighting

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probability. By applying filtered probability $Pr\ (s_t|\ I_t)$ to the initial estimation, $Pr\ (s_t|\ I_{t-1})$ can be recursively calculated using Bayes' rule. Therefore, **P,** the expected duration within each regime, can be calculated using the following equation:

$$Expected\ duration\ in\ regime\ i = 1/(1-p^{ii}). \tag{4}$$

Equation (4) implies that with fixed transition probabilities, the regimes' expected durations are a constant value. Fama and French (2019) suggested that models with time-varying risk factor loading can be superior to those without. The next logical step is to relax the fixed transitional probability constraints; this can be accomplished by expanding the standard Markov switching model [denoted by (1) and (2)] to a time-varying transition probability Markov switching model (MRSR-TVTP). In contrast to the fixed transition probability matrix in (2), the time-variant transition probability matrix is as follows:

$$\boldsymbol{P_t} = \begin{bmatrix} p^{00}(y_t) & p^{01}(y_t) \\ p^{10}(y_t) & p^{11}(y_t) \end{bmatrix}, \tag{5}$$

where y_t is the information variable, generally with a time-lagged value. The expected duration in regime i can then be changed depending on the variation in y_t. With these MRSR-TVTP settings, the results of Fama and French (2019) can be examined and validated without limiting the momentum factor.

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3.7 Hypothesis for Markov Regime Switching Regression (3-Regimes)

Three-regime MRSR (MRSR-3R) uses a similar logic to that of standard MRSR. MRSR-3R can be used for typical bearish markets, typical bullish markets, and markets in previous financial crises. The mathematical model is as follows:

$$\Delta ex\_return_t = \begin{cases} \alpha_{1t} + \boldsymbol{X'_{t-1}\beta_1} + \varepsilon_{1t};\ \varepsilon_{1t} \sim N(0, {\sigma_{1t}}^2)\ if\ s_t\ = 0 \\ \alpha_{2t} + \boldsymbol{X'_{t-1}\beta_2} + \varepsilon_{2t};\ \varepsilon_{2t} \sim N(0, {\sigma_{2t}}^2)\ if\ s_t = 1, \\ \alpha_{2t} + \boldsymbol{X'_{t-1}\beta_3} + \varepsilon_{3t};\ \varepsilon_{3t} \sim N(0, {\sigma_{3t}}^2)\ if\ s_t = 2 \end{cases} \quad (6)$$

where all three regimes have the constant transition probability matrix **P**:

$$\mathbf{P} = \begin{bmatrix} Pr(s_t = 0|s_{t-1} = 0) & Pr(s_t = 0|s_{t-1} = 1) & Pr(s_t = 0|s_{t-1} = 2) \\ Pr(s_t = 1|s_{t-1} = 0) & Pr(s_t = 1|s_{t-1} = 1) & Pr(s_t = 1|s_{t-1} = 2) \\ Pr(s_t = 2|s_{t-1} = 0) & Pr(s_t = 2|s_{t-1} = 0) & Pr(s_t = 2|s_{t-1} = 2) \end{bmatrix}$$

$$= \begin{bmatrix} p^{00} & p^{01} & p^{02} \\ p^{10} & p^{11} & p^{12} \\ p^{20} & p^{21} & p^{22} \end{bmatrix}. \quad (7)$$

The MRSR-3R-TVTP model can be constructed by relaxing the assumption of constant transitional probability. However, the computation is challenging because it requires a substantial amount of time and energy to yield a solution.

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Expected excess returns:

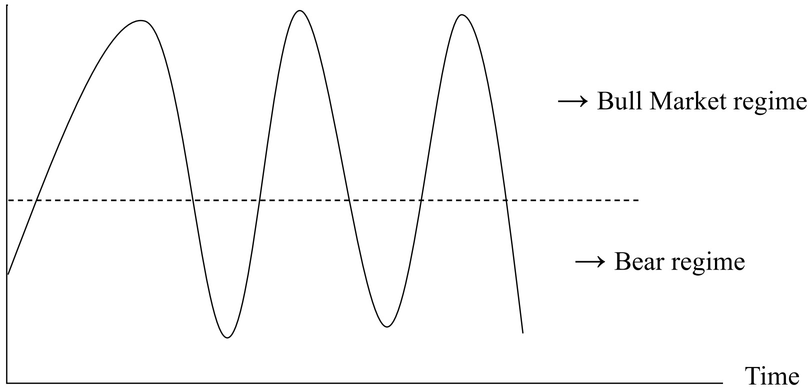

Figure 3.7-A 2-Regimes

Expected excess returns.

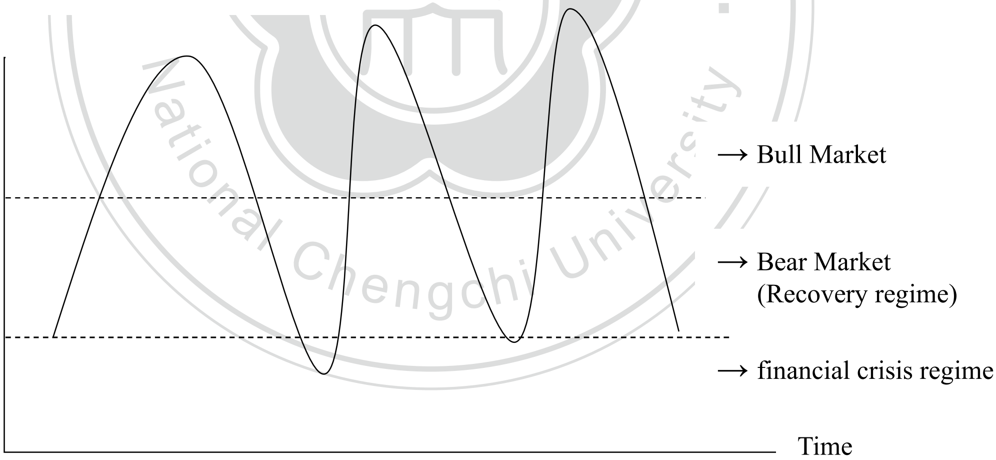

Figure 3.7-B 3-Regimes

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4.0 Empirical Results from the US. Market

The EMH dictates that no abnormal returns occur in the long-term but that they do occur in markets with semistrong efficiency. Because short-term excess returns may arise from fundamental research, certain types of risk factor premiums may be possible. The first goal of this section is to demonstrate the heteroscedasticity of excess returns and variance (risk factors) in the stock market under different regimes. The existence of heteroscedasticity in the US market suggests that it is a market with semistrong efficiency and that investors should be cautious in switching risk factor premiums over time because excess return drivers may be different in each regime. Second, this section determines the nature of ESG premiums; determines whether excess returns on RI occur despite regime switches in the stock market.

Unlike Kim and Nelson (1999), this study uses market capitalization-weighted portfolios rather than equal-weighted portfolios, as in the study on Markov regime-switching by Schaller and Van Norden (1997). The results generated through the OLS and MRSR approaches to the CAPM and risk factor models are also presented.

4.1 USA Data

The data on the risk factor model are from Wharton Research Data Services and were cross-checked and referenced with data in the Kenneth French Data Library. The Wilshire 5000 (W5000) (Full Cap) Total Market Index (total return level) was downloaded from the Wilshire Associates website (also available from Federal Reserve Economic Data) to serve as a different proxy for the US broad market.

Fama and French, beginning with their 1993 study, constructed their factor risk model US market data by referring to the Center for Research in Security Prices, which comprises all listed firms in the United States, namely those listed on the New York Stock Exchange (NYSE), the NASDAQ Exchange, and the American Stock Exchange (AMEX), and by using the 1-month US treasury bill rate from Ibbotson Associates as their benchmark for risk-free rate.

The W5000 was developed in 1974 and adopted by the business world as a benchmark for the US stock market. Unlike the Dow Jones Industrial Average, which consists of the 30 largest companies and uses the equal-weighting method to construct the index, the W5000 uses the market capital weight for index calculation and comprises almost all listed companies in the NYSE, the NASDAQ Exchange, and the AMEX. The W5000 comprises 10

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times as many companies as does the S&P 500, making it remarkably similar to the theoretical broad market proxy proposed by Fama and French. The W5000 Total Market Index also considers pink-sheet issues (i.e., suspensions from boards and movement to over-the-counter trading) and trading volume (i.e., halt trading), making it an excellent proxy for practitioners.

The monthly data of the W5000 Total Market Index have been available since December 1970 and return data have been calculatable since January 1971.

Table 4.1-A Label Summary for Data for USA Stocks' Market

Variables	Details	Sources
RF	Risk-Free Rate, 1-M U.S. Treasury Bill rate	Ken French Data Lib. & WRDS
FFMKT	FF Excess Return, i.e., MKT return minus RF	As above
FF3_SMB	SMB Factor from 3-Factor Model	As above
FF3_HML	HML Factor from 3-Factor Model	As above
FF5_SMB	SMB Factor from 5-Factor Model	As above
FF5_HML	HML Factor from 5-Factor Model	As above
FF5_RMW	RMW Factor from 5-Factor Model	As above
FF5_CMA	CMA Factor from 5-Factor Model	As above
FF_MOM	Momentum Factor calculated by Fama & French	As above
W5000	FT-Wilshire 5000 Total Market Index excess return, i.e., index returns minus RF	WILSHIRE ADVISORS
KLD	MSCI KLD 400 Social Index (US) (previously known as the Domini 400 Social Index)	MSCI
Catholic	MSCI USA Catholic Values Index	MSCI
Islamic	MSCI USA Islamic Index	MSCI
ESG	MSCI USA ESG Focus Index	MSCI

* Please noted that RI-related indexes have a shorter data horizon.

Launched in May 1990, the Domini 400 Social Index was named after Amy Domini,

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one of the founders of KLD Research and Analytics,[11] and has become the benchmark of the Domini Impact Equity Fund. In the 21st century, the MSCI KLD 400 Social Index is a capitalization-weighted index with the 400 top listed firms in the United States with outstanding ESG records. The index methodology consists of negative screening and the upbeat best-in-class approach. First, the index excludes firms related to adult entertainment, alcohol, firearms, weapons (both civilian and military), gambling, genetically modified organisms (foods), nuclear power, and tobacco. Second, companies with the highest ESG scores from each sector are identified on the basis of sector weight in the US market. A minimum of 200 companies are selected from the large and mid-cap categories, and the remaining companies are selected from those in the small-cap category with the highest ESG scores. The KLD index conducts quarterly reviews and rebalances in February, May, August, and November.

The MSCI USA Catholic Values Index is based on the United States Conference of Catholic Bishops' Socially Responsible Investment Guidelines, which follow the Catholic Church's moral teachings. Similar to the MSCI KLD, the USA Catholic Values Index excludes (negatively screens) firms related to abortion, abortifacients, contraceptives, and stem cells research. In addition, the Catholic Index adopts the best-in-class methodology to select firms from every economic sector. The Catholic Index conducts quarterly reviews and rebalances in March, June, September, and December.

The MSCI ESG Focus Index excludes only companies related to tobacco and controversial weapons companies; companies related to civilian firearms are eligible. Selection is based on the best-in-class methodology as well as ESG Intangible Value Assessment scores to consider certain environmental or social externalities that companies may be forced to internalize in the future, such as carbon taxes. Companies in a particular sector that are better prepared to meet future demand receive higher scores in the environmental and social components of ESG.

The MSCI USA Islamic Index is based on the principles of sharia law—a branch of Islamic social and moral teachings. The index negatively screens for companies related to adult entertainment, alcohol, firearms, weapons (both civilian and military), gambling, genetically modified organisms (foods), nuclear power, and tobacco and excludes

[11] Amy Domini is a pioneer in ethical and social investing. She coauthored early books on the subject, such as *Ethical Investing* (1984), *The Social Investment Almanac* (1992), and *Investing for Good* (1993), and independently authored *Challenges of Wealth* (1988) and the famous *Socially Responsible Investing: Making a Difference and Making Money* (2001).

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conventional financial services and pork-related products. The threshold for these activities is that they cannot constitute more than 5% of business activities (i.e., supermarket channels' profits from pork-related products should be less than 5%). In addition, companies cannot have excessive leverage according to sharia investment principles. In general, to satisfy sharia guidelines, a company's ratio of (a) total debt to total assets, (b) cash investment in interest-bearing securities to total assets, and (c) accounts receivables and cash equivalents to total assets should not exceed 1:3.

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Table 4.1-B Summary Statistics for USA's Data

	W5000	FF_MKT	FF3_SMB	FF3_HML	MOM	MOM_LT	MOM_ST	FF5_SMB	FF5_HML	FF5_RMW	FF5_CMA
Mean	0.0048	0.0059	0.0014	0.0029	0.0063	0.0016	0.0047	0.0018	0.0029	0.0029	0.0028
Median	0.0095	0.0102	0.0013	0.0021	0.0074	0.0008	0.0025	0.0009	0.0021	0.0026	0.0012
Maximum	0.1482	0.1610	0.2119	0.1258	0.1836	0.1450	0.1621	0.1808	0.1258	0.1338	0.0956
Minimum	-0.2645	-0.2324	-0.1682	-0.1112	-0.3439	-0.0780	-0.1460	-0.1489	-0.1112	-0.1848	-0.0686
Std. Dev.	0.0449	0.0447	0.0304	0.0289	0.0432	0.0253	0.0319	0.0298	0.0289	0.0225	0.0195
Skewness	-0.8547	-0.5638	0.4942	0.2016	-1.3362	0.7261	0.3560	0.3982	0.2016	-0.3812	0.4062
Kurtosis	6.1464	5.0546	8.7109	4.8379	13.3335	5.6319	8.4267	6.6693	4.8379	15.3382	4.7861
Jarque-Bera	314.1282	134.7979	824.3820	86.8839	2795.8292	221.7441	735.1607	345.9930	86.8839	3750.2794	94.4884
Probability	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Sum	2.8190	3.4767	0.8230	1.7250	3.7194	0.9383	2.7933	1.0491	1.7250	1.6858	1.6623
Sum Sq. Dev.	1.1823	1.1750	0.5435	0.4918	1.0994	0.3762	0.5991	0.5220	0.4918	0.2970	0.2227
Observations	588	589	589	589	589	589	589	589	589	589	589

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Table 4.1-C Correlation Table for USA's Data

Correlation	W5000	FF_MKT	FF3_SMB	FF3_HML	MOM	MOM_LT	MOM_ST	FF5_SMB	FF5_HML	FF5_RMW	FF5_CMA
W5000	1.0000										
FF_MKT	0.9981	1.0000									
FF3_SMB	0.2736	0.2720	1.0000								
FF3_HML	-0.2523	-0.2596	-0.1888	1.0000							
MOM	-0.1545	-0.1573	-0.0245	-0.1916	1.0000						
MOM_LT	0.0339	0.0391	0.3365	0.4319	-0.0996	1.0000					
MOM_ST	0.2934	0.2968	0.1694	0.0166	-0.3139	0.1113	1.0000				
FF5_SMB	0.2537	0.2502	0.9829	-0.0509	-0.0540	0.3879	0.1704	1.0000			
FF5_HML	-0.2523	-0.2596	-0.1888	1.0000	-0.1916	0.4319	0.0166	-0.0509	1.0000		
FF5_RMW	-0.2411	-0.2477	-0.4390	0.1269	0.0948	-0.2823	-0.1095	-0.3785	0.1269	1.0000	
FF5_CMA	-0.3796	-0.3841	-0.1271	0.6928	-0.0027	0.4478	-0.1163	-0.0451	0.6928	0.0467	1.0000

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Table 4.1-D Summary Statistics for USA RI-indexes

	KLD1	KLD2	CATHOLIC	ESG	ISLAMIC
Mean	0.00622	0.00024	0.0042	0.0041	0.0046
Median	0.01004	0.00019	0.0085	0.0094	0.0102
Maximum	0.11727	0.04217	0.1129	0.1081	0.1078
Minimum	-0.16871	-0.03525	-0.1762	-0.1982	-0.1655
Std. Dev.	0.04257	0.00892	0.0451	0.0440	0.0403
Skewness	-0.65156	0.33390	-0.7060	-0.8699	-0.8729
Kurtosis	4.27450	6.55629	4.2481	5.0582	5.0069
Jarque-Bera	49.00646	193.12397	38.4713	67.7902	40.9782
Probability	0.00000	0.00000	0.0000	0.0000	0.0000
Sum	2.20140	0.08323	1.0826	0.9172	0.6435
Sum Sq. Dev.	0.63956	0.02809	0.5257	0.4317	0.2242
Observations	354	354	260	224	139

Because of differences in the observational data, later sections provide a correlation table to compare the differences in alphas and betas. The data in Table 4.1–D are consistent with those of both studies, with KLD2 suggesting that RI outperforms the broad market, meaning that its alpha is the opposite of that suggested by the EMH.

This chapter determines whether statistically significant differences exist between (a) FFMKT and W5000 in the long-term (in theory (EMH), this difference should be 0 in the US market) and (b) FFMKT and W5000 under different regimes—this difference is assumed to be 0. If a difference exists in (a) and (b), then a regime may be a period in which information is been fully reflected in the market and confident investors can capitalize on this to profit under certain market conditions. Also statistically assessed are RI indexes and FFMKT in the long-term and in every regime, with the difference assumed to be 0 according to the EMH.

The EMH and random walk theory dictate that in the finance and business world, the stock market can be classified into three forms. According to Fama (1970), these forms are weak, in which only past information is priced into securities and fundamental analysis can

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provide an information advantage to achieve short-term outperformance; semistrong, in which all information from both the past and present are incorporated into the stock price, and any new information is instantly incorporated into the price; and decisive, in which insider information is also incorporated into the stock price. The EMS and random walk theory dictate that no patterns exist, meaning that a stock price behaves nonstationary.

The CAPM and other risk models have challenged the EMH. The theory suggests that a stock return (the first order of difference in stock price) is associated with risk factors, such as market, size, and value. Fama (1998) suggested that investors likely overreact to or underestimate market price information and that a serial correlation exists over time (for an investor to realize the mispricing).

Carhart (1997) and Lo and MacKinly (1999) also suggested that a stock price in the short-term is usually correlated and that the expected mean is nonzero. In addition, when the stock market is hot and stock prices are gaining momentum as investors start to jump on the bandwagon (i.e., chasing trending stocks), several consistent patterns become visible in specific periods, especially in trending stocks. Schiller (2000) noted that this is the leading cause of irrational exuberance in the late 90s and early 2000s. Therefore, correlations between stock returns (first order of difference in stock price) and risk factors may exist, and the mean reversion phenomenon may occur. Consequently, in the time-series analysis method, the unit root test must be performed for all data to confirm that each time series is statistically stationary; hence, the relationships identified in this research could mitigate the spurious correlation problem (Granger & Newbold, 1974; Nelson & Plosser, 1982; Yule 1926), and the conclusions may have practical implications.

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Table 4.1-E Unit Root Test for Intercept on USA data

Variables	Dickey-Fuller GLS	KPSS	Phillips-Perron
W5000	-2.5525 **	0.1087 +++	-22.5771 ***
FF_MKT	-2.1471 **	0.1010 +++	-22.8883 ***
FF-3 SMB	-2.8221 ***	0.1142 +++	-24.0405 ***
FF-3 HML	-20.1312 ***	0.3075 +++	-20.8182 ***
MOM	-5.0661 ***	0.3437 +++	-22.8601 ***
MOM-Short-Term	-2.9701 ***	0.5152 +	-24.8836 ***
MOM-Long-Term	-13.0458 ***	0.3663 ++	-20.9329 ***
FF-5 SMB	-1.7378 *	0.1469 +++	-23.6521 ***
FF-5 HML	-20.1312 ***	0.3075 +++	-20.8182 ***
FF5-RMW	-20.7973 ***	0.1101 +++	-20.8074 ***
FF5-CMA	-21.6401 ***	0.2440 +++	-21.6916 ***
KLD1	-1.2136	0.1236 +++	-18.1057 ***
KLD2	-0.96381	0.2348 +++	-19.3691 ***
Catholic	-5.0996 ***	0.3211 +++	-13.1167 ***
ESG	-4.1663 ***	0.3542 +	-13.0237 ***
Islamic	-9.4496 ***	0.1143 +++	-10.5498 ***

Notes:

1. *, **, and *** denotes the rejection of the null hypothesis with the probability of ρ is less than 1%, 5%, and 10% criterial levels. Both Dickey-Fuller with GLS detrending and Phillips-Perron Test have null hypotheses assuming “the time series has a unit root.”
2. +, ++, +++ denotes for the “No Rejection” of the null hypothesis with the probability of ρ is less than 10%, 5%, and 1% critical value. The null hypothesis for Kwiatkowski–Phillips–Schmidt–Shin Test is assuming that time series is stationary, i.e., without a unit root.

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Table 4.1-F Unit Root Test for Intercept & Trend on USA data

Variables	DF-GLS	KPSS	Phillips-Perron
W5000	-6.9458 ***	0.0437 +++	-22.5995 ***
FF_MKT	-6.0513 ***	0.0436 +++	-22.9030 ***
FF-3 SMB	-13.1189 ***	0.0760 +++	-24.0338 ***
FF-3 HML	-20.7262 ***	0.0425 +++	-20.8657 ***
MOM	-20.4980 ***	0.0468 +++	-22.9468 ***
MOM-Short-Term	-23.7041 ***	0.0826 +++	-25.1163 ***
MOM-Long-Term	-20.6586 ***	0.1160 +++	-21.0155 ***
FF-5 SMB	-13.0675 ***	0.0927 +++	-23.6551 ***
FF-5 HML	-20.7262 ***	0.0425 +++	-20.8657 ***
FF5-RMW	-20.8660 ***	0.0835 +++	-20.7977 ***
FF5-CMA	-21.5859 ***	0.0689 +++	-21.6857 ***
KLD1	-18.0827 ***	0.1232 ++	-18..0827 ***
KLD2	-19.3890 ***	0.1049 +++	-19.3890 ***
Catholic	-14.8333 ***	0.0447 +++	-15.2149 ***
ESG	-11.3616 ***	0.0491 +++	-13.2215 ***
Islamic	-9.8450 ***	0.0993 +++	-10.5121 ***

Notes:

1. *, **, and *** denotes the rejection of the null hypothesis with the probability of ρ is less than 1%, 5%, and 10% criterial levels. Both Dickey-Fuller with GLS detrending and Phillips-Perron Test have null hypotheses assuming "the time series has a unit root."
2. +, ++, +++ denotes for the "No Rejection" of the null hypothesis with the probability of ρ is less than 10%, 5%, and 1% critical value. The null hypothesis for Kwiatkowski–Phillips–Schmidt–Shin Test is assuming that time series is stationary, i.e., without a unit root.

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The result of the Dickey–Fuller test with GLS detrending indicates that SMB in the Fama–French five-factor model are similar to the critical value and that the null hypothesis of nonstationary cannot be rejected with a 5% or 1% confidence interval. In addition, the results of the Kwiatkowski–Phillips–Schmidt–Shin test indicate that the short-term momentum reversal factor is not stationary under a 5% or 1% confidence interval. However, the results of the other two unit root tests indicate that the issue of stationarity can be ignored.

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4.2 Empirical Testing for the USA Market

This section tests for statistically significant differences between the two market proxies FFMK and MSCIMKT using the graphical approach, the simple statistical test approach, and the risk factor model (with OLS) approach. The risk factor model with the MRSR approach is then used to identify differences between the intercept and the risk factors.

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4.2.1 The Graphical Approach

Figure 4.2.1 presents the descriptive statistics for the excess returns in the W5000 Total Market Index (lower risk-free rate) and Fama and French with data from January 1971 to December 2019.

Fig 4.2.1-A Histogram for Excesses Returns vs. Normal

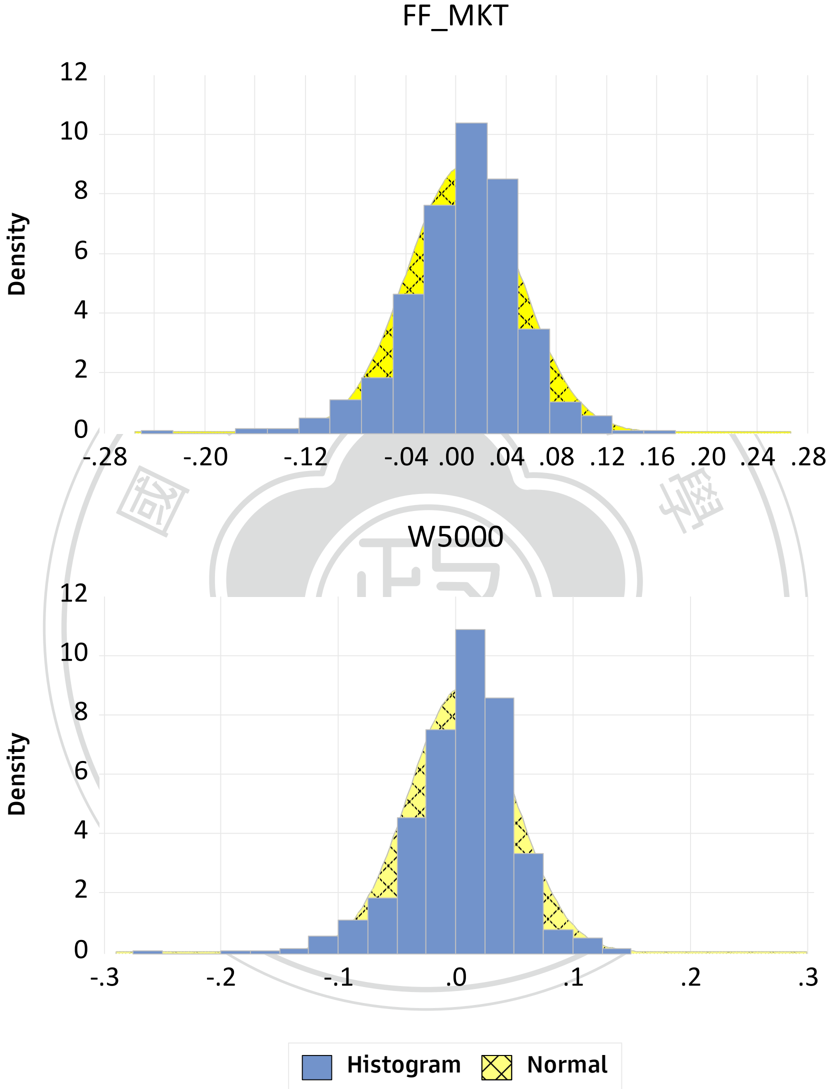

Figure 4.2.1-A USA Excess Returns distributions

The excess returns of Fama and French and the W5000 exhibit an extremely high correlation of 0.9981, with a mean of 0.0059% for FFMKT and a mean of 0.0048% for W5000 (Figure 4.2.1A). The results also indicate that the two data sets exhibit remarkably similar patterns and follow normal-like distributions with fat tails on the left, which is consistent with the literature.

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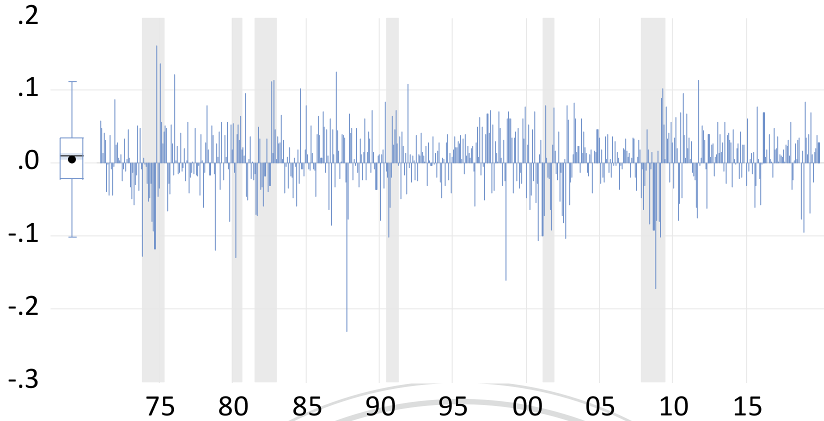
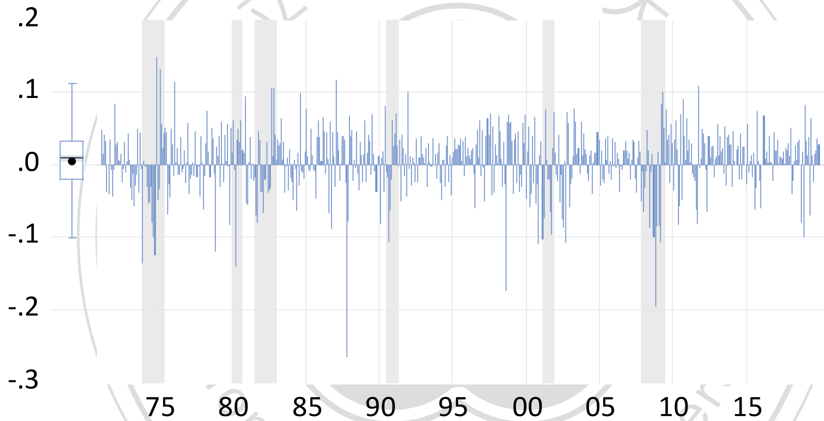
Fig 4.2.1-B Excesses Returns as Time Series

FF_MKT (US Market excess returns by Fama and French)



W5000 (US Market Excess returns using FT-Wilshire 5000 returns minus Risk-Free rate)



* Light Grey Shaded areas are recession period defined by National Bureau of Economic Research

Figure 4.2.1-B USA Excess Returns Time Series

The results exhibit unusually high volatility in excess returns during the market recession period, although this is not always the case, which is the motivation for this study to explore the heteroscedasticity of mean returns (and variance) among market regimes (Figure 4.2.1B).

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4.2.2 Simple Equality Test

The results of the simple equality test indicate that the US market is not entirely consistent with the EMH because the mean returns in the Fama and French and W5000 data are statistically different from zero and have monthly excess returns (alphas) compared with the 1-month US treasury bill (Table 4.2.2A). This is consistent with the conventional understanding of the investment community that the market rewards premiums.

Table 4.2.2-A Hypothesis Testing if means are different from zero.

Table 4.2.2-A Hypothesis Test, if means are different from zero?

	Fama & French	Wilshire
Mean	0.005903 **	0.004794 ***
ρ-value for t-statistic	0.0014	0.0098

Note: *, **, and *** denotes the rejection of the null hypothesis for 1%, 5%, and 10%, criterial levels, respectively.

The results are not entirely consistent with the EMH but satisfy the CAPM.

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Table 4.2.2-B Equality Test for means

Method		df	Value	Probability
t-test		1,175.0000	0.4245	0.6713
Satterthwaite-Welch t-test*		1,174.9625	0.4245	0.6713
Anova F-test		(1, 1175)	0.1802	0.6713
Welch F-test*		(1, 1174.96)	0.1802	0.6713
*Test allows for unequal cell variances				
Analysis of Variance				
Source of Variation		df	Sum of Sq.	Mean Sq.
Between		1	0.0004	0.0004
Within		1,175	2.3572	0.0020
Total		1,176	2.3576	0.0020
Category Statistics				
				Std. Err.
Variable	Count	Mean	Std. Dev.	Of Mean
FF_MKT	589	0.0059	0.0447	0.0018
W5000	588	0.0048	0.0449	0.0019
All	1,177	0.0053	0.0448	0.0013

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Table 4.2.2-C Equality Test for variance for data sets

Table 4.2.2-C Equality Test for Variance

Method		df	Value	Probability	
F-test		(587, 588)	1.0079	0.9238	
Siegel-Tukey			0.4021	0.6876	
Bartlett		1	0.0091	0.9238	
Levene		(1, 1175)	0.0233	0.8788	
Brown-Forsythe		(1, 1175)	0.0430	0.8357	
Category Statistics					
			Mean Abs.	Mean Abs.	Mean Tukey-
Variable	Count	Std. Dev.	Mean Diff.	Median Diff.	Siegel Rank
FF_MKT	589	0.0447	0.0338	0.0336	585.0187
W5000	588	0.0449	0.0335	0.0333	592.9881
All	1,177	0.0448	0.0337	0.0335	589
Bartlett weighted standard deviation: 0.044790					

The high correlation and the results of mean and variance equality tests (Table 4.2.2B, C) demonstrate that the two data sets are not statistically different; both are an excellent proxy for the US stock market.

Table 4.2.2-D US Business Cycle Contraction according to NBER, since 1970

Contraction/Recession Period		Duration	Mean Return	STD
Peak month	Trough month	(months)		
1973 November	1975 March	16	-1.8875%	8.0486%
1980 January	1980 July	6	0.6133%	7.0540%
1981 July	1982 November	16	-0.3350%	5.7648%
1990 July	1991 March	8	0.0750%	6.1852%
2001 March	2001 November	8	-1.9900%	5.6850%
2007 December	2009 June	18	-2.1633%	7.2439%

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Table 4.2.2-E Business Cycle Expansion according to NBER, since 1970

Expansion Period		Duration (months)	Mean Return	STD
Trough month	Peak month			
1970 November	1973 November	36*	0.4323%*	3.5350%*
1975 March	1980 January	58	0.6331%	4.1491%
1980 July	1981 July	12	0.9450%	4.2789%
1982 November	1990 July	92	0.8097%	4.8857%
1991 March	2001 March	120	0.8714%	4.0804%
2001 November	2007 December	73	0.5385%	3.5503%

* Data only starts from December 1970, missing 1970 November's data.

The results in Table 4.2.2D and E justify the need to explore the heteroscedasticity of mean return (and variance) among market regimes. For example, the monthly mean return during an economic recession is between −2.16% and 0.61%, whereas the mean excess return of the stock market during economic expansion ranges from 0.43% to 0.945% (Table 4.2.2D). Moreover, the standard deviation is between 5.56% and 8.05% during economic contraction and between 3.53% and 4.89% during expansion. Thus, the evidence indicates the heteroscedasticity of the mean and variance in stocks returns; hence, the mean and variance during periods of recession are different from those during periods of expansion.

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4.2.3 Comparison with Risk Models: OLS vs. MRSR

Five risk factor models were selected: the CAPM and the three-factor, four-factor, five-factor, and six-factor models. The models are explained in Section 3, and the six-factor model consists of the Fama–French five-factor model with the addition of the momentum factor. The left side of the equation, namely expected returns E(R_i), is the proxy used by Fama and French for expected returns, FF_MKT. The right side of the equation, namely the market risk factor βMKT, is the proxy used by Wilshire for W5000 excess returns.

Table 4.2.3-A Empirical Results of Risk Factor Model using OLS method

Table 4.2.3-A Empirical Results of Risk Factor Model using OLS method

	CAPM	3-Factor	4-Factor	5-Factor	6-Factor
C	0.0011***	0.0011***	0.0011 ***	0.0012 ***	0.0012 ***
β_{MKT}	0.9938***	0.9923***	0.9894 ****	0.9907 ***	0.9879 ***
β_{SMB}		-0.033	-0.0137 ***	-0.0087 **	-0.0170 ***
β_{HML}		-0.013***	-0.0284 ***	-0.0114 **	-0.02 ***
β_{CMA}				-0.0038	-0.0121
β_{RMW}				-0.0187 ***	-0.0115 **
β_{MOM}			-0.0049 *		-0.0040
β_{MOM-ST}			0.0055		-0.0052
β_{MOM-LT}			0.0275 ****		0.0272 ***
Adj. R^2	0.9961	0.9962	0.9963	0.9962	0.9964
S.E.	0.0028	0.0028	0.0027	0.0027	0.0027
Log. Likelihood	2627.005	2632.343	2647.893	2637.75	2651.632

Notes:

1. *, **, and *** denotes the rejection of the null hypothesis with the probability of ρ is less than 10%, 5%, and 1% criterial levels.

The results in Table 4.2.3A are consistent with those of other studies, except for the size factor losing explanatory power and being nonsignificant in the three-factor and four-factor

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models but becoming statistically significant in the five-factor and six-factor models. The CMA factor results are statistically nonsignificant in the five-factor and six-factor models. The intercept value C (or alpha) being close to zero is consistent with the EMH, and C demonstrates that investment in the stock market involves a minimal premium against buying 1-month treasury bills.

The results generated by using OLS for different risk factor models are consistent with Fama and French (2015).

Table 4.2.3-B Empirical Results of Risk Factor Model using MRSR-2 Regimes

Table 4.2.3-B Empirical Results of Risk Factor Model using MRSR-2 Regimes

Variables	CAPM		3-Factor		4-Factor	
	Regime 1	Regime 2	Regime 1	Regime 2	Regime 1	Regime 2
C	0.0027***	0.0005***	0.0026***	0.0004***	0.0023***	0.0004***
β_{MKT}	0.9764***	1.0167***	0.9760***	1.0171***	0.9758***	1.0148***
β_{SMB}			-0.0036	-0.0034	-0.0303**	-0.0062**
β_{HML}			-0.021	-0.0058	-0.0493***	-0.0078*
β_{RMW}						
β_{CMA}						
β_{MOM}					-0.0046	-0.0058***
β_{MOM-ST}					0.0067	0.0079**
β_{MOM-LT}					0.0594***	-0.0018
Log (SIGMA)	-5.2913	-6.5571	-5.3422	-6.5977	-5.443	-6.6644
Exp. duration	3	14	3.3	13.2	3.8	12.4
S.E.	0.0028		0.0028		0.0028	
Log. Likelihood	2805.317		2808.736		2824.284	

Notes:

1. *, **, and *** denotes the rejection of the null hypothesis with the probability of ρ is less than 10%, 5%, and 1% criterial levels.

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Table 4.2.3-C Empirical Results of Risk Factor Model using MRSR-2 Regimes

Table 4.2.3-CEmpirical Results of Risk Factor Model using MRSR-2 Regimes

Variables	5-Factor		6-Factor		6-Factor TVTP	
	Regime 1	Regime 2	Regime 1	Regime 2	Regime 1	Regime 2
C	0.0026***	0.0004***	0.0024***	0.0004***	0.0024***	0.0005***
β_{MKT}	0.9719***	1.0183***	0.9722***	1.0147***	0.9701***	1.0143***
β_{SMB}	-0.0313**	-0.0023	-0.0455**	-0.0062**	-0.0482**	-0.0062**
β_{HML}	-0.0108	0.0031	-0.0249	-0.0010	-0.0286	-0.0008
β_{RMW}	-0.0148	-0.0135**	-0.0315	-0.0143**	-0.0334	-0.0132**
β_{CMA}	-0.0393***	-0.0037	-0.0235	-0.0018	-0.0224	-0.0028
β_{MOM}			0.0017	-0.0056***	0.0032	-0.0056***
β_{MOM-ST}			0.0052	0.0086***	0.0055	0.0090***
β_{MOM-LT}			0.0527**	0.0032	0.0555**	0.0024
Log (SIGMA)	-5.4149	-6.5984	-5.4667	-6.6597	-5.444	-6.6257
Exp. duration	3.7	14.2	3.6	12.2	3.1	19.1
S.E.	0.0028		0.0027		0.0027	
Log. Likelihood	2814.986		2829.558		2834.825	

Notes:

1. *, **, and *** denotes the rejection of the null hypothesis with the probability of ρ is less than 10%, 5%, and 1% criterial levels.

The MRSR results in Table 4.2.3A indicate heteroscedasticity in mean return and variance (log sigma) and alpha (excess returns, represented by C) between Regime 0 and Regime 1. These results also indicate that the US stock market rewards investors differently depending on market conditions. Regime 0 is a bullish market, and it will reward investors 0.0027% of excess return per month; Regime 1 (a bearish market) will only reward investors with 0.0005% excess return per month according to the CAPM. In addition, bullish markets have an expected duration of 3 months, whereas bearish markets are expected to last for approximately 14 months before becoming a bullish market.

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Furthermore, the results indicate that the CAPM and three-factor model yield similar results because the size factor and value factor lose their statistically significant association with mean returns and the two models differ only in expected duration. The results of the four-factor model with MRSR indicate that the size factor and value factor regain their statistical significance in explaining mean returns. In addition, they indicate that the long-term momentum factor is statistically significant only during bullish markets (Regime 0), whereas short-term momentum and the momentum factor are statistically significant only during bullish markets (Regime 1). The decrease in the explanatory power of the value factor in a bullish market (Regime 1) suggests that the value factor and momentum factor have specific interference.

The results of the five-factor model with MRSR indicate that the CMA factor is not statistically significant under Regime 0 but becomes statistically significant under Regime 1 (Table 3.1.6B). RMW displays the opposite trend, exhibiting no significance under Regime 1 but becoming statistically significant under Regime 0. The no significance of the value risk factor creates a substantial problem for diminishing value premiums; this finding challenges Fama and French (2020), who concluded that the value premium remains in such a case.

The empirical finding suggests that markets behave differently over time. The EMH dictates that the mean returns are 0 in the long-term, but a particular investment style could outperform the broad market at certain times, which indicates that the US stock market is of a semistrong efficient form. When the momentum factor is added to the five-factor model, the RMW risk factor loses its statistical significance under both regimes; this raises a concern that the RMW risk factor may not have been an appropriate selection.

MRSR-TVTP relaxes the assumption of the constant transition probability in MRSR. In this model, the risk-free rate of the previous month is used as a predictor of regime change probability, suggesting that interest rates change as a predictor or structural market change.

OLS and MRSR do not improve error. However, the log-likelihood increases between models when OLS and MRSR are used, suggesting that MRSR is a superior market model to OLS, with the MRSR-TVTP method involving the addition of the momentum factor to the five-factor model and exhibiting the optimal log-likelihood. Fig 4.2.3-A 6-Factor MS TVTP model with smoothed regime probabilities.

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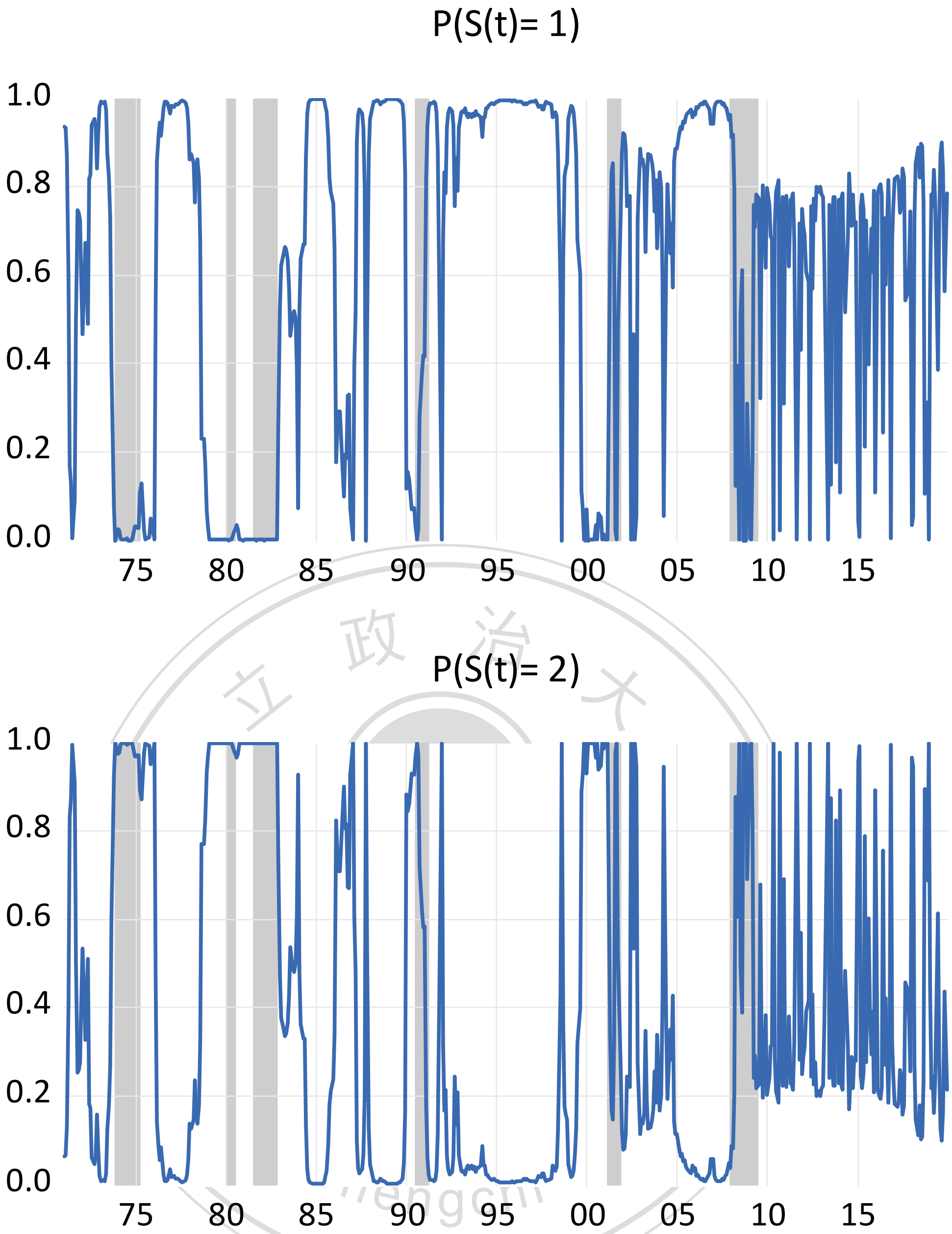

* Gray shaded area are period of economic recession according to NBER

Figure 4.2.3-A 6-Factor MS TVTP model regime probabilities

The dynamic MRSR expanded to a six-factor model with time-varying transitional probabilities indicates that the market generates a small excess return (Regime 1) for most of an economic recession (Figure 4.2.3A and Table 4.2.3C). However, in Regime 0, the excess return is nearly five times higher than in Regime 1; this occurs primarily during economic expansion.

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Table 4.2.3-D Hypothesis Test for mean difference using MRSR-3 Regimes, Part I

Table 4.2.3-D Hypothesis Test for mean difference using MRSR-3 Regimes, Part I

	CAPM			3-Factor			4-Factor		
	Regime = 1	Regime = 2	Regime=3	Regime = 1	Regime = 2	Regime=3	Regime = 1	Regime = 2	Regime=3
C	0.00047 ***	0.00201 ***	0.00007	0.0001	0.0005 ***	0.0022 ***	0.0003	0.0002 **	0.018 ***
β_{MKT}	0.98650 ***	0.95507 ***	1.05194 ***	1.0525 ***	0.9845 ***	0.9375 ***	0.9034 ***	1.0159 ***	1.0099 ***
β_{SMB}				-0.0032	-0.0010	-0.01436	-0.0089	-0.0059 *	-0.0116
β_{HML}				0.0040	-0.0105 ***	-0.07167 ***	-0.1087 ***	-0.0044	-0.0183 **
β_{MOM}							-0.0051	-0.0069 **	0.0021
β_{MOM-ST}							-0.0566 ***	-0.0093 **	-0.0089
β_{MOM-LT}							-0.0878 *	-0.0070	0.0420 ***
Log(SIGMA)	-6.78836	-5.2716	-6.6389	-6.6396	-6.7994	-5.3769	-5.563	-6.8509	-6.0789
Exp. Duration	1.9	6.5	1.8	1.7	1.7	5.9	3.1	6.1	2.8
S.E.	0.0029			0.0029			0.0028		
Log. Likelihood	2863.005			2874.412			2867.534		

Note: *, **, and *** denotes the rejection of the null hypothesis with the probability of ρ is less than 10%, 5%, and 1% criterial levels.

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Table 4.2.3-E Hypothesis Test for mean difference using MRSR-3 Regimes, Part II

Table 4.2.3-E Hypothesis Test for mean difference using MRSR-3 Regimes, Part II

	5-Factor			6-Factor			6-Factor-TVTP		
	Regime = 1	Regime = 2	Regime=3	Regime = 1	Regime = 2	Regime=3	Regime = 1	Regime = 2	Regime=3
C	0.00047 ***	0.0027 ***	0.0001	0.0013 **	-0.0005 **	0.0006 ***	0.0005 ***	-0.0002	0.0012 **
β_{MKT}	0.9859 ***	0.9289 ***	1.0513 ***	0.9315 ***	1.0699 ***	1.0045 ***	1.0017 ***	1.0565 ***	0.9361 ***
β_{SMB}	0.0001	-0.0517 **	-0.0033	-0.019	0.0020	-0.0075 **	-0.0076 **	-0.0050	-0.0126
β_{HML}	-0.0126 **	-0.0360	0.0103 *	0.0091	-0.0070	-0.0095 *	-0.0153 **	-0.0071	0.0036
β_{CMA}	0.0101 *	-0.061 ***	-0.0019	-0.0148	-0.016 **	-0.0020	0.0026	-0.020 ***	-0.0014
β_{RMW}	-0.0004	-0.0880 *	-0.0138 *	-0.0462 *	0.0103	-0.0082	-0.0034	0.0018	-0.0364 *
β_{MOM}				-0.0340 ***	0.0129 ***	-0.0053 **	-0.0078 **	0.0105 ***	-0.0306 ***
$\beta_{MOM\text{-}ST}$				-0.0017	0.0026	0.0097 ***	-0.0133 **	0.0043	-0.0016
$\beta_{MOM\text{-}LT}$				0.0224	0.0009	0	0.0004	0.0094	0.0202
Log(SIGMA)	-6.8228	-5.4710	-6.6383	-5.8523	-6.7994	-6.8313	-7.0925	-6.6279	-5.9338
Exp. Duration	1.6	4.6	1.7	2.1	1.9	4.2	2.6	1.9	1.6
S.E.	0.0029			0.0029			0.0029		
Log. Likelihood	2883.214			2886.056			2864.760		

Note: *, **, and *** denotes the rejection of the null hypothesis with the probability of ρ is less than 10%, 5%, and 1% criterial levels.

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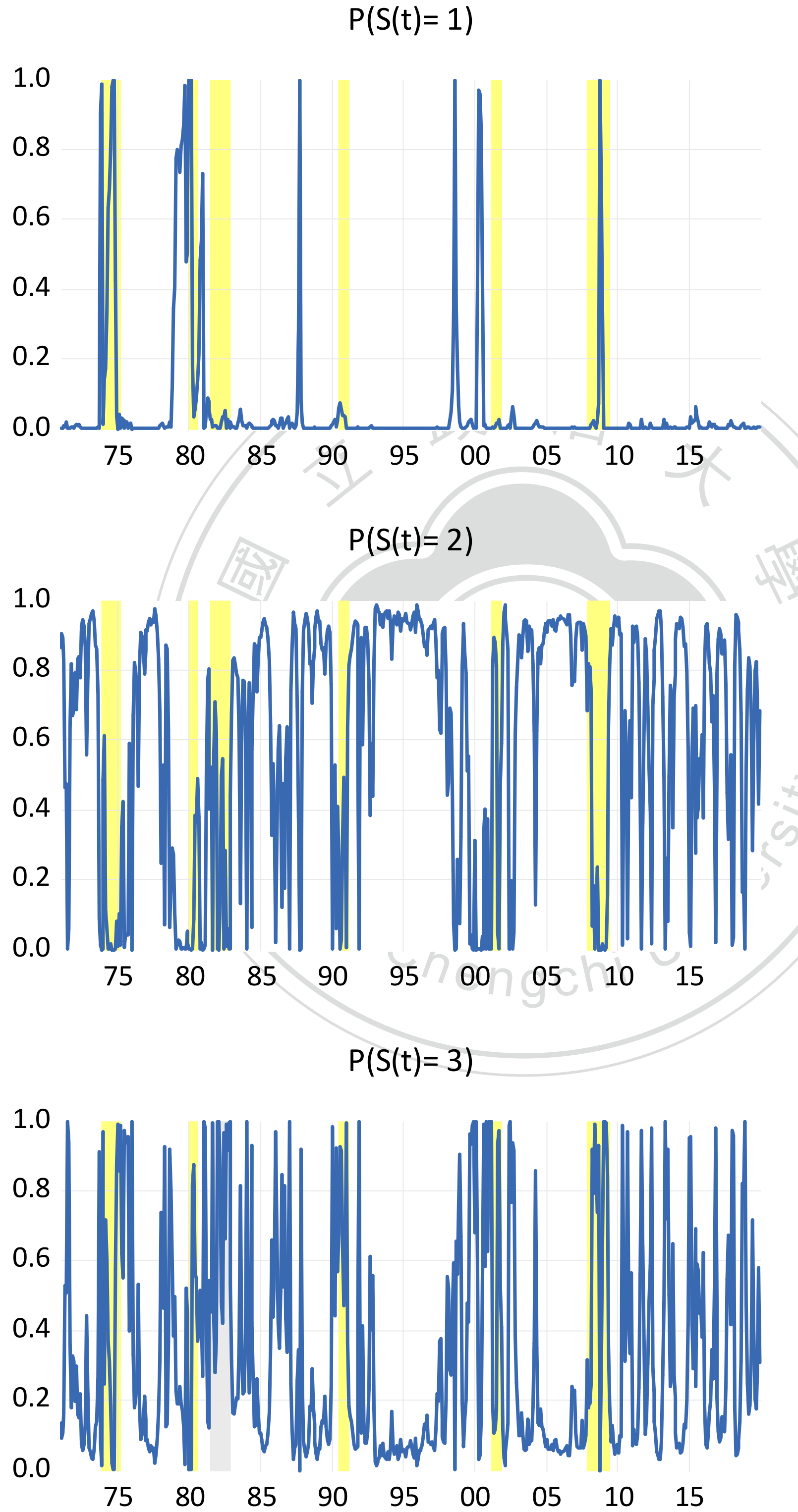
The log-likelihood of the three-regime MRSR expanded to the risk factor model suggests that the three-factor, five-factor, and six-factor models are superior to other models. However, the standard error terms suggest that the four-factor model is superior.

Graph 4.2.3-B 4-Factor MS-3R model with smoothed regime probabilities



* light yellow (gray) shaded area are recession period, define by NBER

Figure 4.2.3-B 4-Factor MS-3Regimes Model Regime Probabilities

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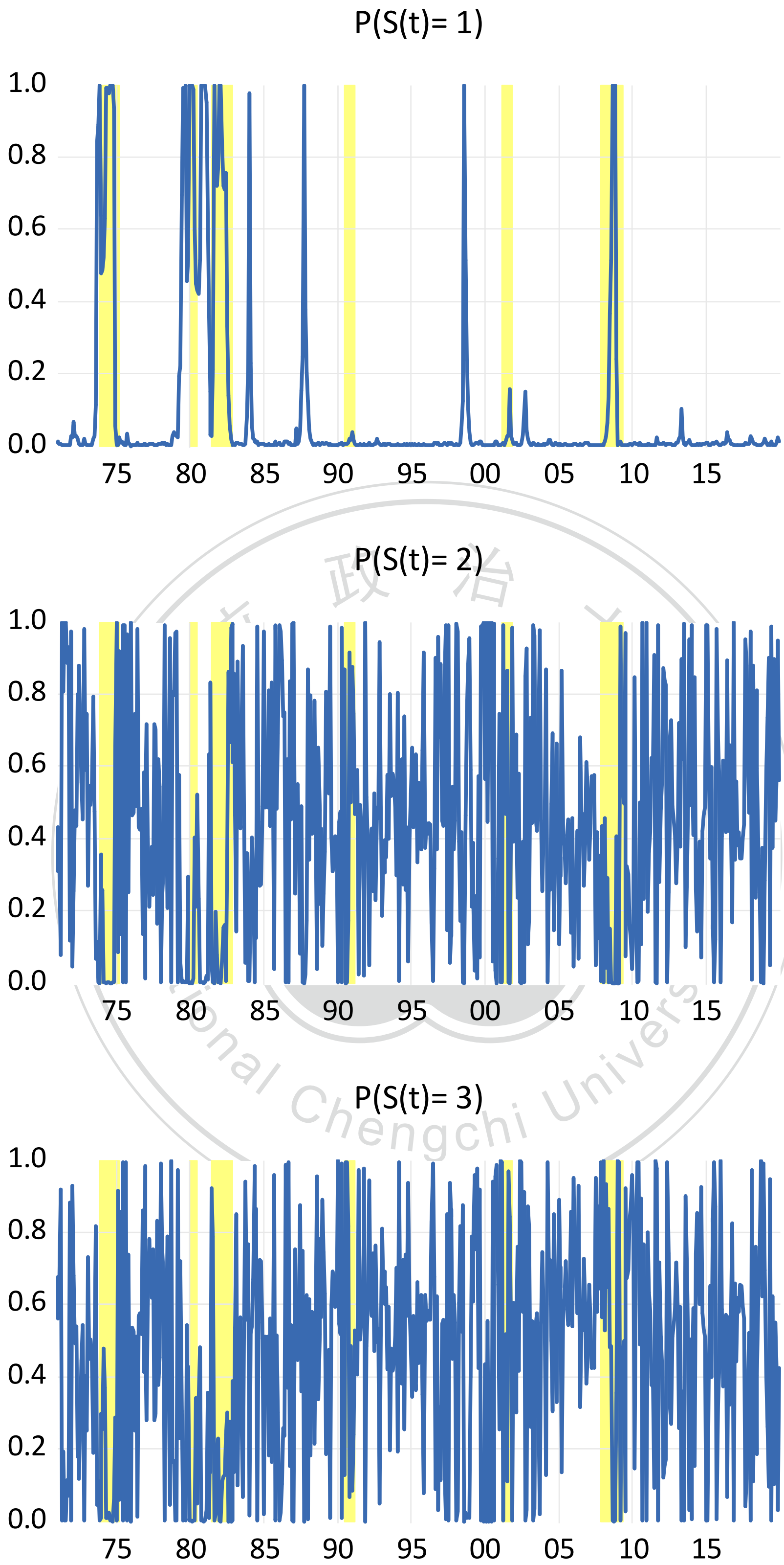
Graph 4.2.3-C 6-Factor MS-3R model with smoothed regime probabilities



* light yellow (gray) shaded area are recession period, define by NBER

Figure 4.2.3-C 6-Factor MS-3R Regime Probabilities

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To explore alpha and beta during an economic recession, a comparison of Figure 4.2.3B and C reveals that Regime 3 in the four-factor models covers most of the recession period. The six-factor model effectively captures the period of recession during the 1970s and 1980s but fails to capture the period of recession in the 1990s and early 2000s. However, Fama and French (2015) suggested that from a theoretical point of view, market risk factors βCMA and βRMW are sufficient to explain the momentum risk factor (i.e., βMOM, βMOM-ST, and βMOM-LT); the results of the six-factor models indicate the existence of a momentum factor in the short and medium terms. Fama and French (2015) are correct regarding momentum (βMOM-LT) in the long term; no statistically significant premium is observed when regime-switching is considered. In addition, the momentum factor βMOM is only positive during Regime 2 and is negative during Regimes 1 and 3; this demonstrates the momentum reversal phenomenon documented by other studies, such as Daniel and Moskowitz (2016). In Regime 1, the market return alpha is driven by the negative impact of momentum (reversal). Regime 3, with the most prolonged expected duration, exhibits the opposite pattern of short-term momentum (βMOM-ST) and the momentum risk factor (βMOM); this supports Fama and French (2015), who indicated that momentum risk factors are not based on financial theory. The momentum risk factor (i.e., βMOM, βMOM-ST, and βMOM-LT) is a mechanism resulting from mean reversion (or market correction). Therefore, investment professionals should always exercise caution when using momentum to solicit business from investors.

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4.3 Empirical Testing for RIs in USA Market

This section tests for statistically significant differences between the four US proxies for RI (namely the MSCI KLD Index, the MSCI ESG Index, the MSCI Catholic Index, and the MSCI Islamic Index) and FFMKT (the market proxy used by Fama and French) through the graphical approach, the simple statistical test approach, and the risk factor model (with OLS) approach. Subsequently, the approach using risk factor models and MRSR is used to identify differences between the intercept and the risk factors.

4.3.1 The Graphical Approach

Results from Table 6.1-D indicate that all RI indexes underperform against market returns, with the exception that SRI outperforms Fama and French Market' proxy.

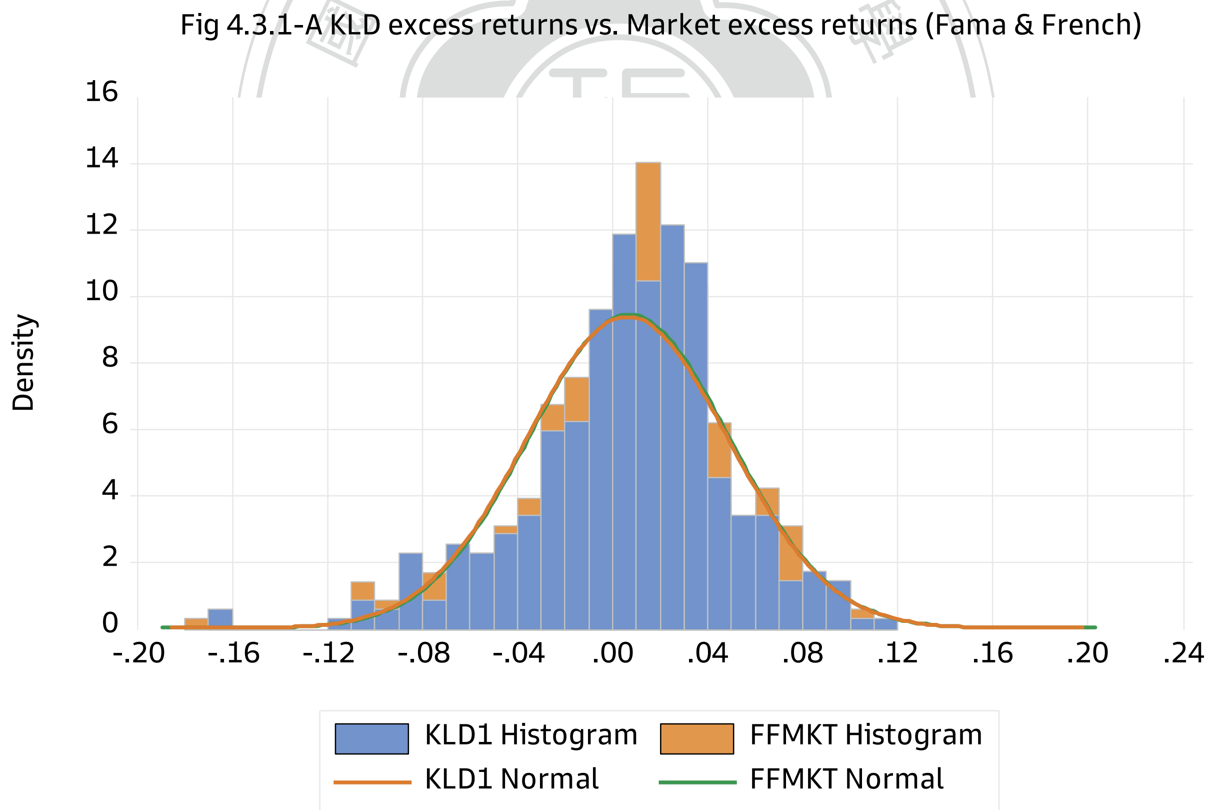

Figure 4.3.1-A excess returns vs. Market Proxy

Figure 4.3.1A presents data from December 1990 to the end of December 2019. FF_MKT exhibits a similar pattern as that described in Section 4.2.1. Again, KLD excess return outperforms broad market return with a high frequency, and broad market return outperforms the RI index outside the mean.

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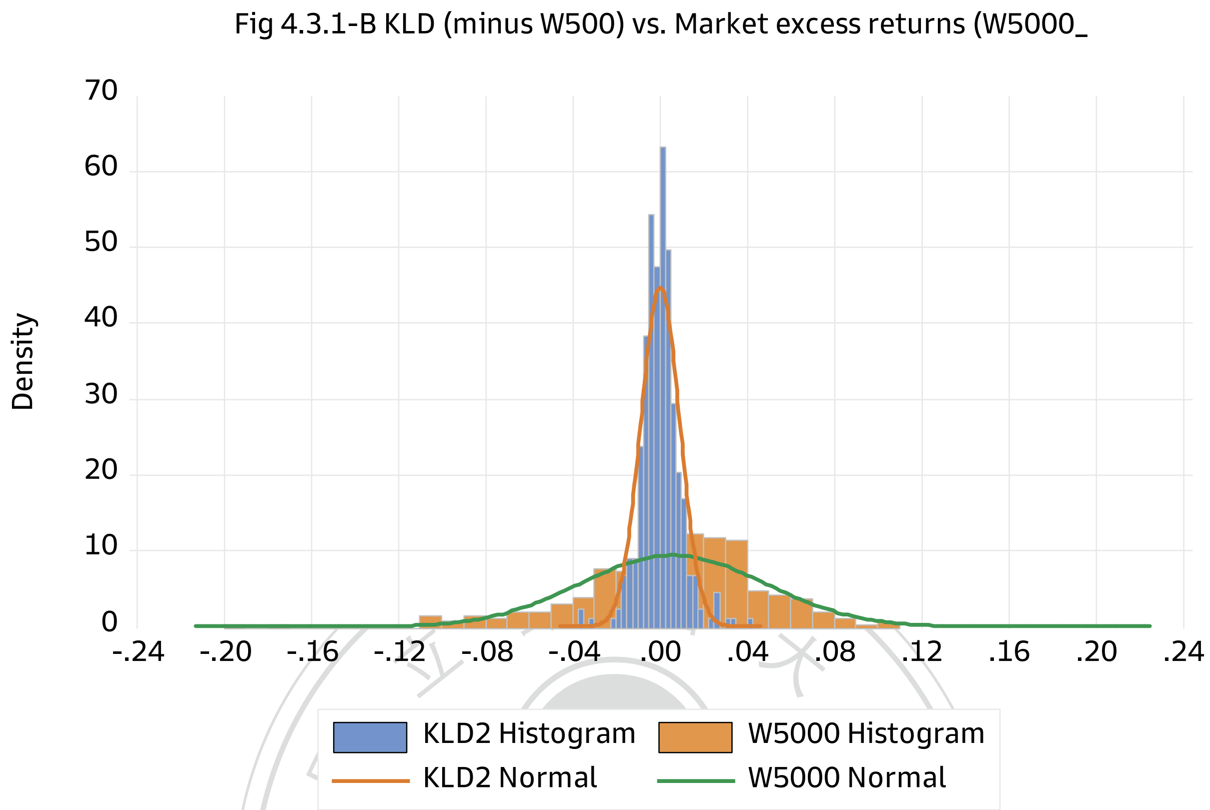

Figure 4.3.1-B Figure 4.3.1-A KLD (minus broad market returns) excess returns vs. Market Proxy

KLD2 is market excess return, represented by the KLD Index minus FF_MKT rather than the KLD Index minus the risk-free rate; this measures the degree to which KLD outperforms the broad market. KLD2 has a normal-like distribution but with fat tails on both the left and right sides (Figure 4.3.1B). The distribution is similar to that of market excess return, a normal-like distribution with a fat-tail on the left side (Figure 4.3.1-B and Figure 4.3.1-C).

Fig 4.3.1-B and Fig. 4.3.1-C showing distribution are like the market excess returns, i.e., "normal distribution like" with a fat-tail on the left side.

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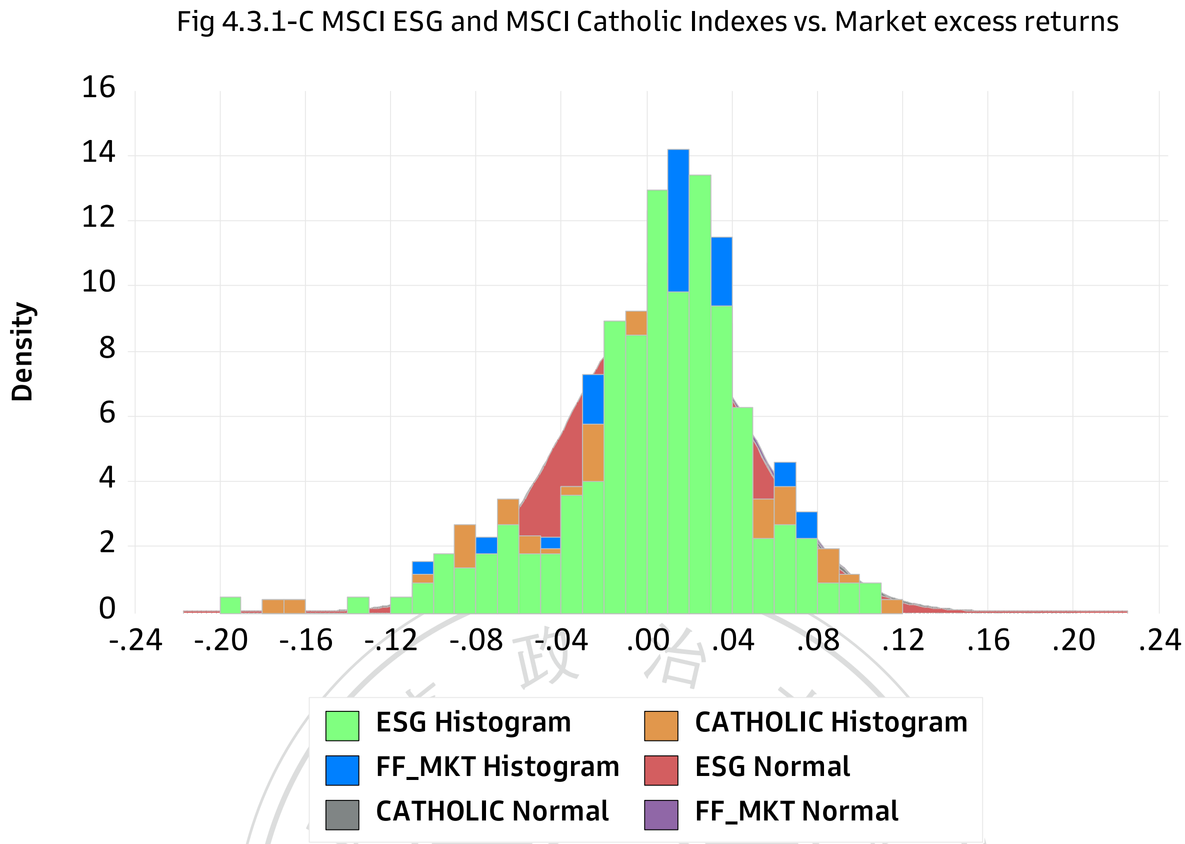

Figure 4.3.1-C MSCI ESG and Catholic excess returns vs. USA market proxy

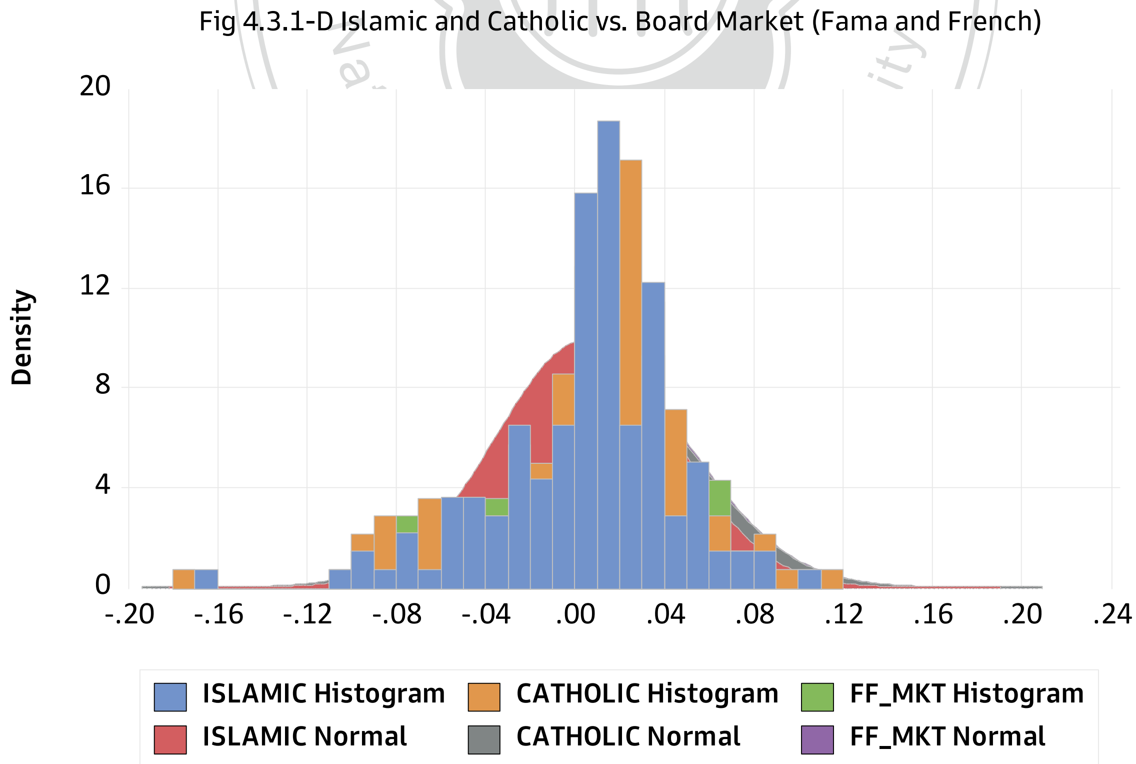

Figure 4.3.1-D Islamic and Catholic excess returns vs. USA market proxy

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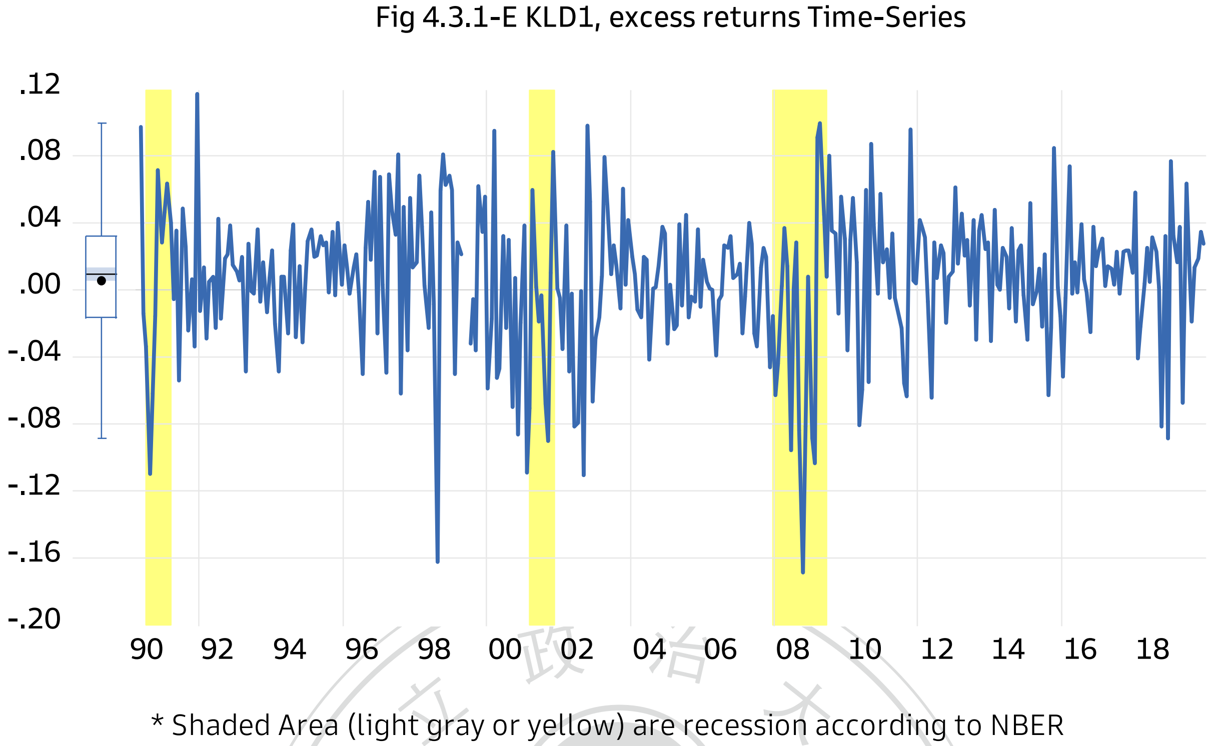

Figure 4.3.1-E KLD excess returns Time Series

Figure 4.3.1E indicates heteroscedasticity in both mean and variance. However, the Internet bubble era is a conspicuous outlier.

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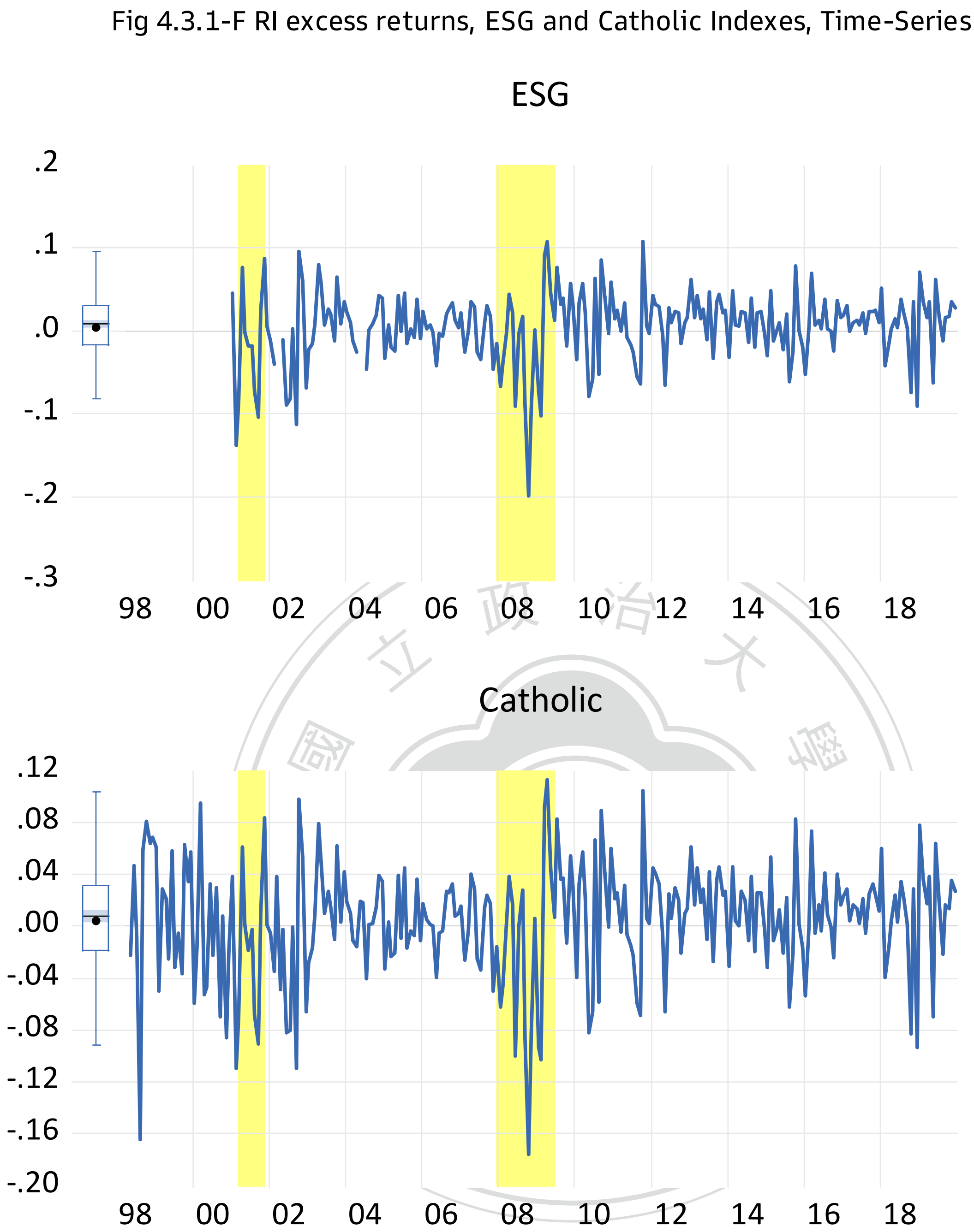

Figure 4.3.1-F ESG and Catholic Time series

Figure 4.3.1F indicates heteroscedasticity in both mean and variance for the ESG Index and the Catholic Index. In addition, the ESG Index exhibits some uplift after the 2008 financial crisis.

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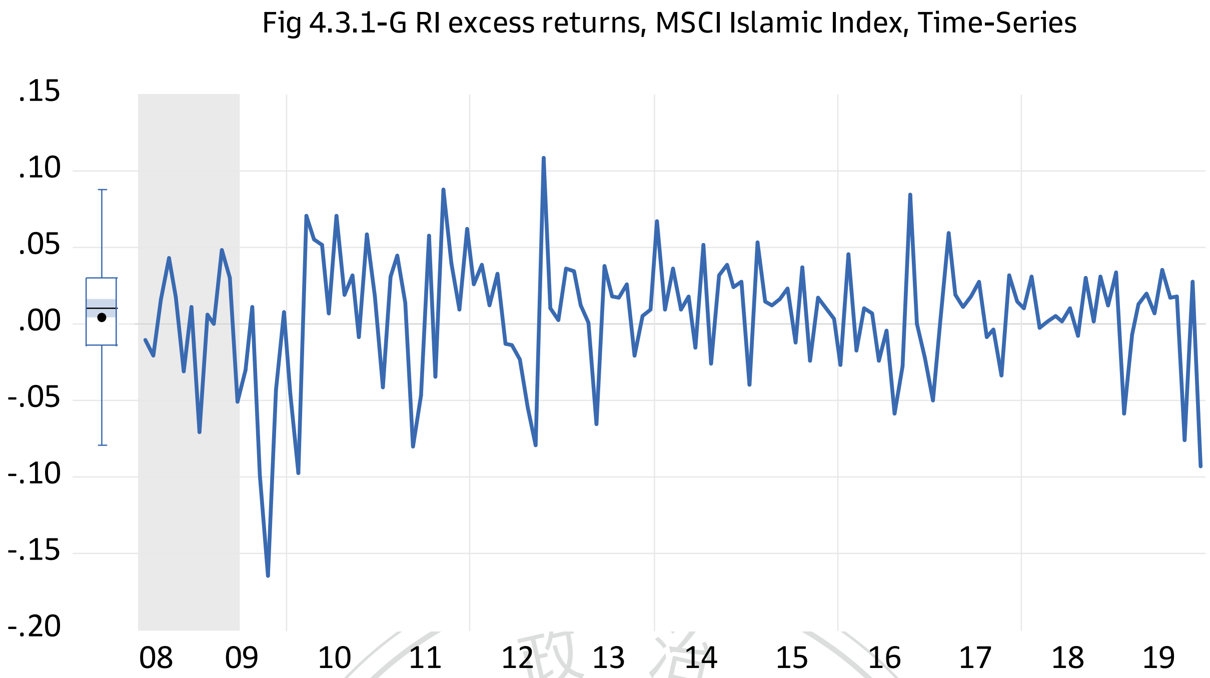

Figure 4.3.1-G Islamic excess return Time series

The Islamic Index has a short history in the United States compared with the Catholic, ESG, and KLD indices. Figure 4.3.1G indicates heteroscedasticity in both mean and variance for the Islamic Index. Thus, not investing in conventional financial servicing companies benefited Muslim investors because it allowed them to avoid many of the effects of the 2008 financial crisis.

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4.3.2 Simple Equality Test

The results of the simple equality test indicate that the US market is not completely consistent with the EMH because the mean returns in both the Fama and French and W5000 data are statistically different from zero and have a monthly excess return (alpha) compared with the 1-month US treasury bill (Table 4.3.2A). This is consistent with the conventional understanding in the investment community that the market rewards premiums.

Table 4.3.2-A Hypothesis Testing if means are different from zero.

	KLD1	KLD2	ESG	Islamic	Catholic
Data begins	1990.05	1990.05	2001.01	2008.06	1998.05
Mean	0.006219	0.000235	0.00409	0.00463	0.00416
ρ-value for t-statistic	0.0063	0.6203	0.1651	0.1779	0.1374

Note: *, **, and *** denotes the rejection of the null hypothesis for 1%, 5%, and 10%, criteria levels, respectively.

The results of the simple equality test indicate that KLD1 is the only data set with a mean that is statically different from zero. However, the results from KLD2 indicate that not even KLD can significantly outperform the broad market. The other RI-indexes, namely the ESG, Islamic, and Catholic indexes, exhibit similar performance to the broad market.

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Table 4.3.2-B Hypothesis Test for mean difference between data sets

Method		df	Value	Probability
Anova F-test		(5, 833)	0.131900	0.9851
Welch F-test*		(5, 388.671)	0.146008	0.9812
*Test allows for unequal cell variances				
Analysis of Variance				
Source of Variation		df	Sum of Sq.	Mean Sq.
Between		5	0.001257	0.000251
Within		833	1.587154	0.001905
Total		838	1.588410	0.001895
Category Statistics				
				Std. Err.
Variable	Count	Mean	Std. Dev.	of Mean
FF_MKT	140	0.008569	0.044437	0.003756
W5000	140	0.007345	0.045084	0.003810
KLD1	140	0.007670	0.043311	0.003660
CATHOLIC	140	0.007734	0.044664	0.003775
ESG	140	0.007319	0.043906	0.003711
ISLAMIC	139	0.004629	0.040304	0.003419
All	839	0.007214	0.043537	0.001503

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Table 4.3.2-C Hypothesis Test for variance difference between data sets

Method		df	Value	Probability
Bartlett		5	2.220821	0.8178
Levene		(5, 833)	0.233154	0.9480
Brown-Forsythe		(5, 833)	0.244398	0.9426
Category Statistics				
			Mean Abs.	Mean Abs.
Variable	Count	Std. Dev.	Mean Diff.	Median Diff.
FF_MKT	140	0.044437	0.032482	0.032119
W5000	140	0.045084	0.032512	0.031975
KLD1	140	0.043311	0.031685	0.031163
CATHOLIC	140	0.044664	0.032631	0.031981
ESG	140	0.043906	0.031473	0.030817
ISLAMIC	139	0.040304	0.029403	0.028675
All	839	0.043537	0.031700	0.031125
Bartlett weighted standard deviation: 0.043650				

The results of the equality test using data from May 2008 to the end of December 2019 (for the Islamic Index) indicate that the means of the RI indexes are the same as those of the broad market indexes, FF_MKT, an W5000 (Table 4.3.2B). Table 4.3.2C presents the hypothesis testing for variance in the data sets. The results indicate that the variance in each dataset, the RI indexes, and the broad market indexes is statistically the same.

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4.3.3 Comparison with Risk Models: OLS vs. MRSR

Table 4.3.3-A CAPM model, using Fama & French as broad market proxy.

	CAPM, KLD1	CAPM, KLD2	CAPM, ESG	CAPM, Catholic	CAPM, ISLAMIC
Data begins	1990.05	1990.05	2001.01	1998.05	2008.06
C	-0.0065	0.00032	-0.0017 ***	-0.0011 **	0.0045
β_{MKT}	0.9841 ***	-0.01395 ***	1.0148 ***	0.9891 ***	0.0109
Adj. R^2	0.9567	0.0015	0.9766	0.9595	-0.007152
S.E.	0.0089	0.0089	0.067	0.0091	0.0404
Log. Likelihood	1171.853	1169.647	803.62	854.962	249.649

Note: *, **, and *** denotes the rejection of the null hypothesis for 1%, 5%, and 10%, criteria levels, respectively.

Consistent with works of literature and others' findings, RIs perform similarly to market, i.e., no statistically significant difference. However, in the case of ESG and Catholic investment, the results from CAPM indicate a statistical significance underperformance. The exceptionally low (near to zero) of β_{MKT} for Islamic Investment might be due to the exclusion of the banking sector. In addition, negative β_{MKT} from KLD2 also suggests that RI's performance might be quite different from the broad market, where further research on the driver for RI is required.

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Table 4.3.3-B3-Factor model, using Fama & French as broad market proxy.

	3-Factor, KLD1	3-Factor, KLD2	3-Factor, ESG	3-Factor, Catholic	3-Factor, ISLAMIC
Data begins	1990.05	1990.05	2001.01	1998.05	2008.06
C	-0.0068	0.00344	-0.00165***	-0.00108 **	0.00523
β_{MKT}	1.0077***	0.0064	1.02718 ***	1.01497***	-0.03305
β_{SMB}	-0.1435***	-0.1369***	-0.05377 ***	-0.12365***	0.04076
β_{HML}	-0.01297	-0.0317**	-0.06210 ***	0.01226	0.1946
Adj. R^2	0.9670	0.2093	0.9787	0.96738	-0.00473
S.E.	0.007734	0.079	0.0642	0.00813	0.0404
Log. Likelihood	1220.908	1211.943	815.120	884.048	250.838

Note: *, **, and *** denotes the rejection of the null hypothesis for 1%, 5%, and 10%, criteria levels, respectively.

Table 4.3.3-C 4-Factor model, using Fama & French as broad market proxy.

	4-Factor, KLD1	4-Factor, KLD2	4-Factor, ESG	4-Factor, Catholic	4-Factor, ISLAMIC
Data begins	1990.05	1990.05	2001.01	1998.05	2008.06
C	-0.00054	0.0005	-0.00156 ***	-0.0009*	0.005155
β_{MKT}	0.9998***	-0.00145	1.0085***	1.0026 ***	0.0076
β_{SMB}	-0.1454***	-0.1506***	-0.04849 ***	-0.12445 ***	0.04059
β_{HML}	-0.0259	-0.0557***	-0.0447 **	-0.0055	0.1715
β_{MOM}	0.01811*	-0.01821*	-0.0756 ***	-0.0268**	-0.02136
β_{MOM-ST}	0.00478	0.0014	-0.0002	0.00034	-0.1726
β_{MOM-LT}	0.008211	0.0403*	-0.0381 *	0.01607	0.06074
Adj. R^2	0.9671	0.2170	0.9803	0.9678	-0.0133
S.E.	0.0077	0.0078	0.0617	0.00808	0.0405
Log. Likelihood	1223.018	1215.215	825.115	887.3809	251.807

Note: *, **, and *** denotes the rejection of the null hypothesis for 1%, 5%, and 10%, criteria levels, respectively.

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Table 4.3.3-D 5-Factor model, using Fama & French as broad market proxy.

	5-Factor, KLD1	5-Factor, KLD2	5-Factor, ESG	5-Factor, Catholic	5-Factor, ISLAMIC
Data begins	1990.05	1990.05	2001.01	1998.05	2008.06
C	-0.0011**	0.00005	-0.00118 ***	-0.00141 **	0.005499
β_{MKT}	1.0229 ***	0.0210*	1.0071 ***	1.03254 ***	-0.0375
β_{SMB}	-0.1144***	-0.1109***	-0.0754 ***	-0.0956 ***	0.01482
β_{HML}	-0.0035	-0.0241	-0.03151	0.01543	0.08845
β_{RMW}	0.0986 ***	0.09057***	-0.0826 ***	0.0930 ***	-0.2453
β_{CMA}	-0.0204	-0.0140	-0.0137	-0.0258	0.2737
Adj. R^2	0.9693	0.2543	0.9803	0.9695	-0.006712
S.E.	0.00745	0.0077	0.0617	0.007871	0.0404
Log. Likelihood	1235.050	1223.336	825.115	893.7047	251.739

Note: *, **, and *** denotes the rejection of the null hypothesis for 1%, 5%, and 10%, criteria levels, respectively.

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Table 4.3.3-E 6-Factor model, using Fama & French as broad market proxy.

	6-Factor, KLD1	6-Factor, KLD2	6-Factor, ESG	6-Factor, Catholic	6-Factor, ISLAMIC
Data begins	1990.05	1990.05	2001.01	1998.05	2008.06
C	-0.0009**	0.000122	-0.00132 ***	-0.00125 **	0.00541
β_{MKT}	1.0143***	0.0118	0.9945***	1.0204***	0.0047
β_{SMB}	-0.1235***	-0.1289***	-0.0626***	-0.1013***	0.0207
β_{HML}	-0.02727	-0.0548***	-0.0244	-0.02079	0.1075
β_{RMW}	0.1120***	-0.1115***	-0.0681***	0.1175***	-0.3575
β_{CMA}	-0.02968	-0.0394	0.0339	-0.0436	0.29621
β_{MOM}	-0.0233**	-0.0232**	-0.0305***	-0.0343 **	-0.03228
β_{MOM-ST}	0.0008	-0.0031	0.0026	-0.0048	-0.20015
β_{MOM-LT}	0.0426**	0.0766***	-0.0587 **	0.0595 **	-0.0502
Adj. R^2	0.9699	0.2819	0.9810	0.9708	-0.0101
S.E.	0.0074	0.007559	0.0605	0.0077	0.0405
Log. Likelihood	1239.890	1231.555	830.803	900.932	253.088

Note: *, ** and *** denotes for the rejection of the null hypothesis for 1%, 5% and 10%, criterial levels, respectively.

The results using other Factor models are similar to those yielded by the CAPM model, where KLD, ESG, and Catholic all underperform in a statistically significant fashion, and that Islamic investment is a mystery to be addressed. However, KLD2's results suggest that when comparing to broad market alone, not risk-free rate, there is no statistically significant difference between equity market return and the index return.

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Table 4.3.3-F CAPM model with MRSR-2 Regimes, using Fama & French as broad market proxy.

	CAPM, KLD1		CAPM, ESG		CAPM, Catholic		CAPM, ISLAMIC	
Data begins	1990.05		2001.01		1998.05		2008.06	
	Regime 1	Regime 2	Regime 1	Regime 2	Regime 1	Regime 2	Regime 1	Regime 2
C	0.0000	-0.00767*	-0.0007 *	-0.0024	-0.0013 ***	-0.0008	-0.0143	0.0146 ***
β_{MKT}	0.9913 ***	0.9811 ***	0.9594 ***	1.1168 ***	0.9979 ***	0.969558***	-0.0694	0.04313
Log(SIGMA)	-4.177	-5.0861	-5.2553	-4.717	-5.0769	-4.1092	-2.8983	-3.7675
Exp. duration	58.1	270.2	83	18.6	296.6	134.3	3.9	7.2
S.E.	0.008922		0.065		0.0091		0.04138	
Log. Likelihood	1225.705		832.080		900.737		262.814	

By applying MRSR to CAPM model, where market structural change was captured by the model, it is become clearly that statistically significant underperformance only happens under one market regime for KLD, ESG, and Catholic, and that in the other regime, the performance between the index and the market are having no statistically significant difference. This may well explain the inconsistent results from different literatures and research. Noting that Islamic index even outperforming the market in specific regime.

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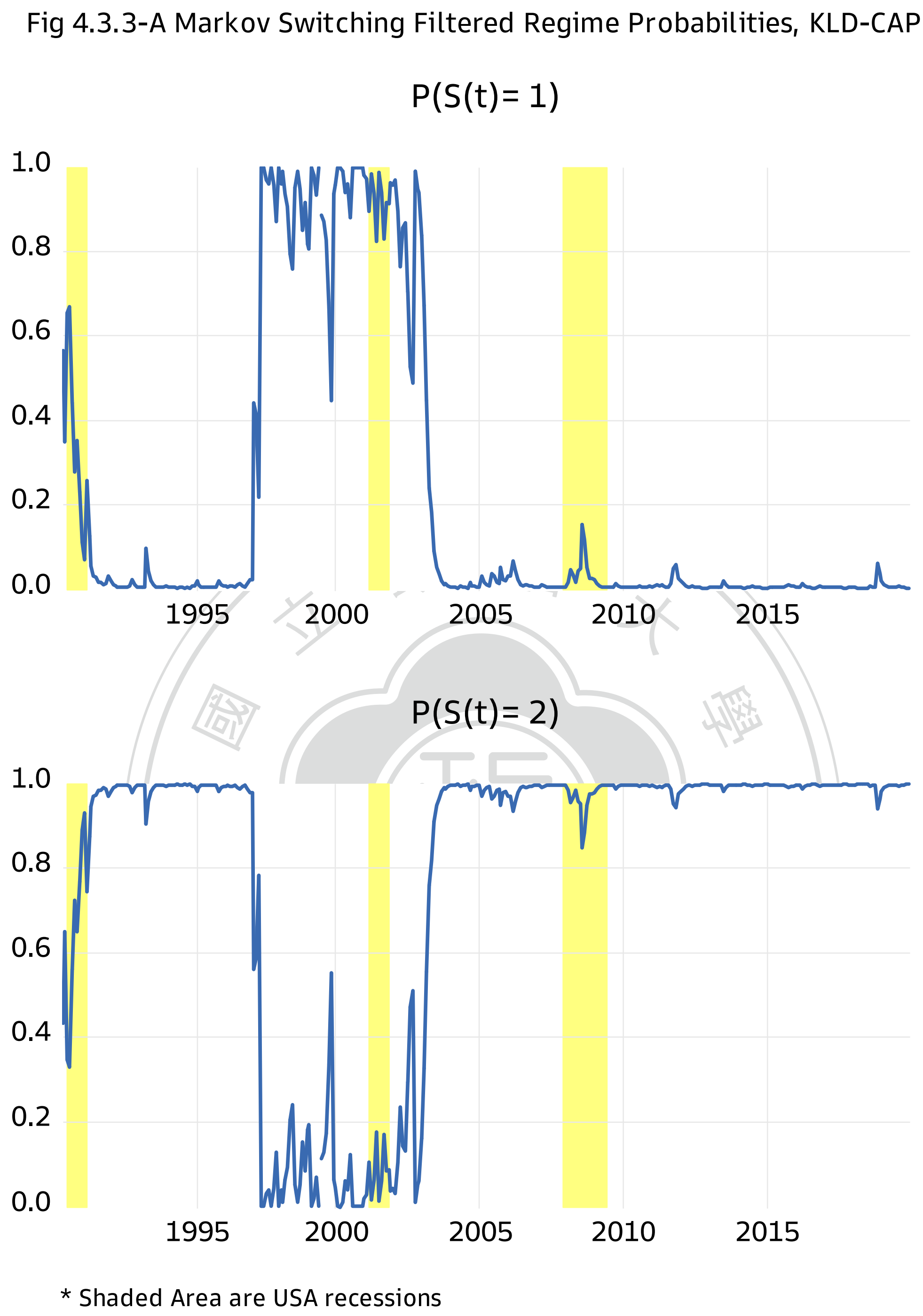

Figure 4.3.3-A KLD MS2-Probabilities

Fig 4.3.3-A shows the regime probabilities for the CAPM model using KLD1 as the dependent variable. A structural change during 1998 to 2003 subdivided data into regime one and regime 2, where heteroskedasticity in mean (excess return) and variance (β_{MKT}) is clear according to the results from Table 4.3.3-F.

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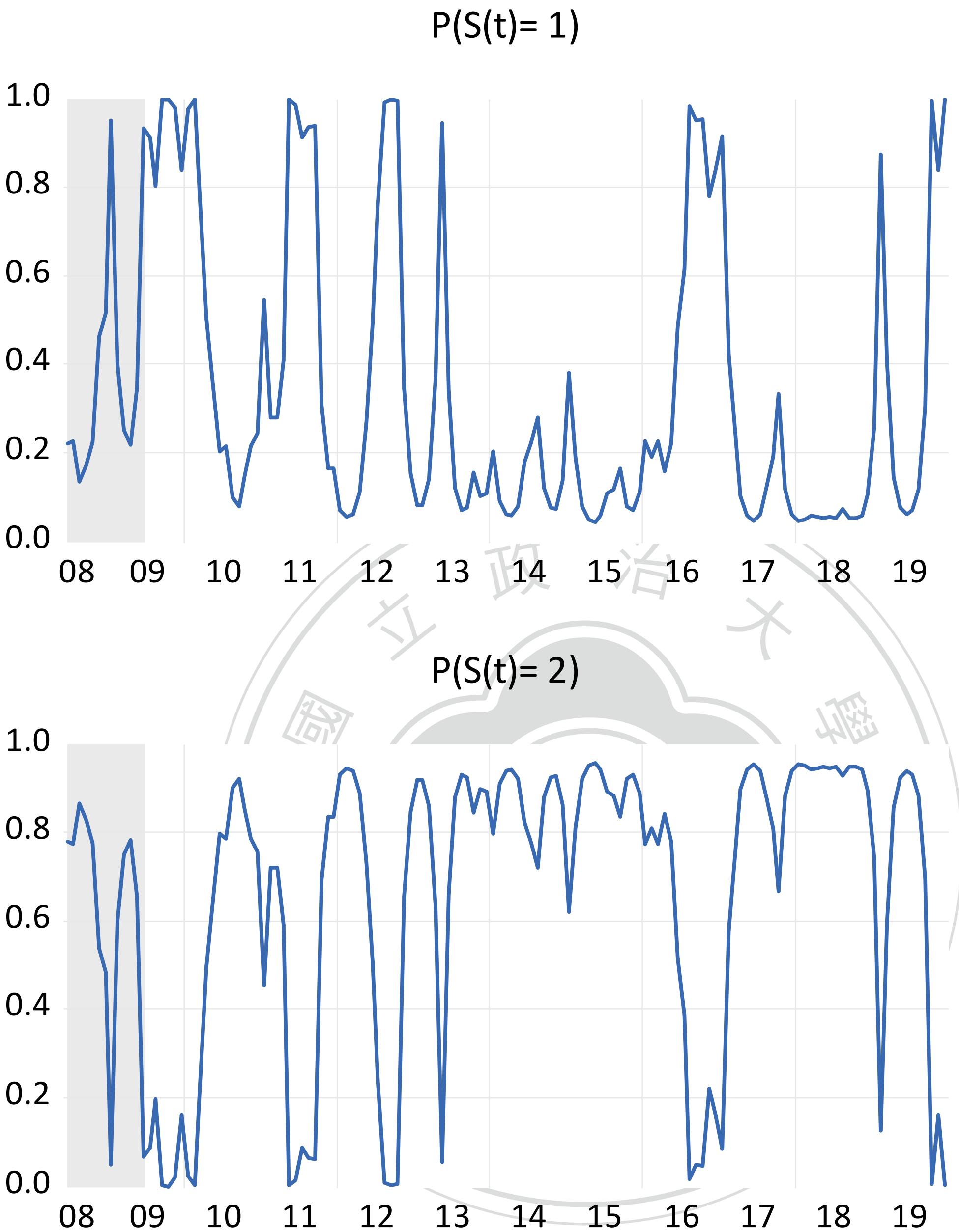
Fig 4.3.3-B Markov Switching Smoothed Regime Probabilities, Islamic-CAPM



* Gray shaded area is recession period according NBER

Figure 4.3.3-B Islamic CAPM MS2 Probabilities

Figure 4.3.3B indicates that the Islamic Index cannot be explained by the CAPM. In addition, the results in Table 4.3.3F indicate that it has an alpha (excess return) in Regime 2 regardless of market beta.

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Table 4.3.3-G 3-Factor model with MRSR-2 Regimes, using Fama & French as broad market proxy.

Table 4.3.3-G 3-Factor model with MRSR-2 Regimes, using Fama & French as broad market proxy.

	3-Factor, KLD1		3-Factor, ESG		3-Factor, Catholic		3-Factor, ISLAMIC	
Data begins	1990.05		2001.01		1998.05		2008.06	
	Regime 1	Regime 2	Regime 1	Regime 2	Regime 1	Regime 2	Regime 1	Regime 2
C	-0.0001	-0.00084**	-0.0016 **	-0.0007	-0.00125 ***	-0.00018	-0.0186 *	0.0161 ***
β_{MKT}	1.0145 ***	1.0019***	1.0778 ***	0.9494 ***	1.0135 ***	0.9786 ***	-0.37827	0.0189
β_{SMB}	-0.1745 ***	-0.0941***	-0.0316	-0.0778 ***	-0.0804 ***	-0.1791 ***	-0.16268	0.18795
β_{HML}	-0.0037	-0.0456**	-0.0839 ***	-0.0101	0.0051	-0.0450	0.6100 *	0.0954
Log(SIGMA)	-4.439	-5.1807	-5.0467	-5.3420	-5.1019	-4.2675	-2.9695	-3.7808
Exp. duration	32.8	113.5	197.5	205.5	288.5	113.9	3.6	7.6
S.E.	0.07714		0.061		0.00812		0.0415	
Log. Likelihood	1259.222		843.261		918.063		266.206	

The three-factor model yielded results similar to those yielded by the CAPM model and moreover, it captures some performance drivers for Islamic Investment.

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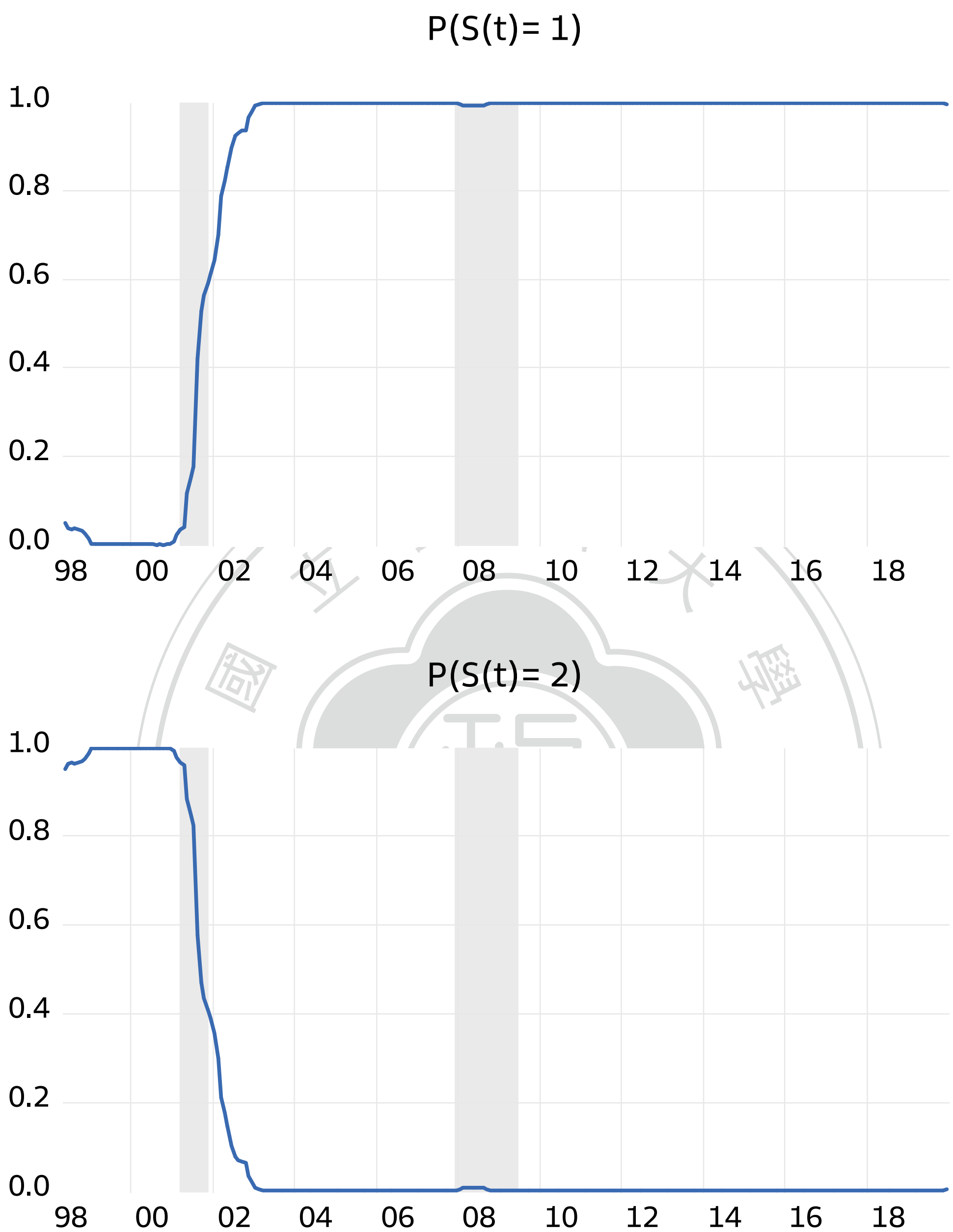
Fig 4.3.3-C Markov Switching Smoothed Regime Probabilities for Catholic 3-Factor



* Gray Shaded are economic recession according to NBER

Figure 4.3.3-C Catholic 3-Factor MS Probabilities

Before the recession in the early 2000s, Catholic investment was in Regime 1, and β_{MKT} is higher than 1, suggesting high market risk and consistent, significant underperformance of −0.00125% monthly (Figure 4.3.3C and Table 4.3.3G). However, after the recession, Catholic investment switches to Regime 2, with β_{MKT} less than 1, indicating less market risk, and performance is the same as that of the broad market.

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Table 4.3.3-H 4-Factor model with MRSR-2 Regimes, using Fama & French as broad market proxy.

Table 4.3.3-H Factor model with MRSR-2 Regimes, using Fama & French as broad market proxy.

	4-Factor, KLD1		4-Factor, ESG		4-Factor, Catholic		4-Factor, ISLAMIC	
Data begins	1990.05		2001.01		1998.05		2008.06	
	Regime 1	Regime 2	Regime 1	Regime 2	Regime 1	Regime 2	Regime 1	Regime 2
C	-0.0007*	0.0007	-0.00248 ***	0.00064	0.0008	-0.00108 **	-0.0139	0.01578 ***
β_{MKT}	0.9993***	0.9731***	1.0208***	0.9794 ***	0.9592 ***	1.0070 ***	-0.2081	-0.0511
β_{SMB}	-0.0982 ***	-0.1868***	-0.0899 **	-0.0361 **	-0.1442 **	-0.0898 ***	-0.1238	0.1485
β_{HML}	-0.0472**	-0.04733	-0.0099	-0.0719 ***	-0.0417	-0.0237	0.4371	-0.0489
β_{MOM}	-0.0106	-0.0160	-0.0494 ***	0.0093 ***	-0.0256	-0.0162	0.01526	-0.0953
$\beta_{MOM\text{-}ST}$	-0.0067	0.0032	0.0016	0.0146	0.0005	-0.0138	-0.6339	0.1007
$\beta_{MOM\text{-}LT}$	0.0355*	-0.0455	-0.1525 ***	0.0933 ***	-0.0691	0.0481 **	0.3361	0.0035
Log(SIGMA)	-5.1314	-4.4083	-5.0169	-5.9928	-4.2857	-5.1175	-2.9926	-3.8183
Exp. duration	289.6	51.5	14.9	25	120.2	295.6	3.7	7.4
S.E.	0.00775		0.0619		0.00810		0.0427	
Log. Likelihood	1261.980		850.7083		922.93		268.793	

The four-factor model yielded similar results to those yielded by the three-factor model and CAPM. In addition, the ESG data sets exhibit a momentum reversal in β_{MOM} and $\beta_{MOM\text{-}LT}$, whereby both are negative in Regime 1 but become positive in Regime 2.

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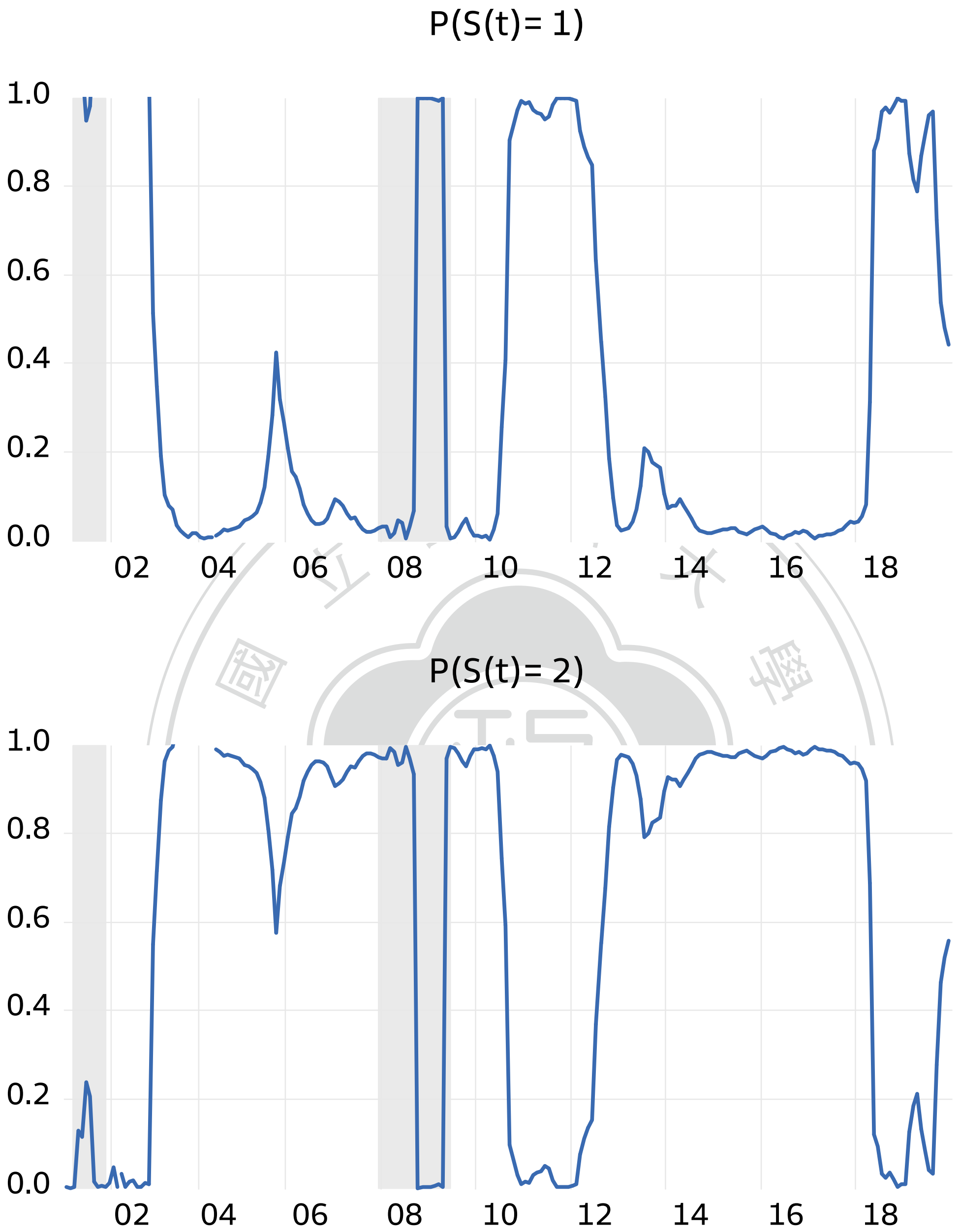
Fig 4.3.3-D Markov Switching Smoothed Regime Probabilities for ESG 4-Factor Model



Gray shaded are are economic recession according to NBER

Figure 4.3.3-D ESG 4-factor Model Switch Probabilities

Figure 4.3.3D presents a four-factor model for the ESG Index and demonstrates the switch between Regime 1 and Regime 2. In Regime 1, ESG exhibits a negative alpha and high sensitivity to the market, with a β_{MKT} higher than 1. However, in Regime 2, ESG exhibits a positive alpha and less sensitivity to the market ($\beta_{MKT} < 1$). The critical difference between Regime 1 and Regime 2 is the momentum reversal for β_{MOM} and $\beta_{MOM\text{-}LT}$.

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Table 4.3.3-I 6-Factor model with MRSR-2 Regimes, using Fama & French as broad market proxy.

	6-Factor, KLD1		6-Factor, ESG		6-Factor, Catholic		6-Factor, ISLAMIC	
Data begins	1990.05		2001.01		1998.05		2008.06	
	Regime 1	Regime 2	Regime 1	Regime 2	Regime 1	Regime 2	Regime 1	Regime 2
C	-0.00084 **	-0.0009	0.00047	-0.0025 ***	0.00113	-0.0012 ***	-0.0113	0.0137***
β_{MKT}	0.9853***	1.0105***	0.99175***	0.9957 ***	0.9094 ***	1.0152 ***	-0.2060	0.0140
β_{SMB}	-0.1203***	-0.1148***	-0.01127	-0.0925 ***	-0.0241 **	-0.0903 ***	-0.0075	0.1272
β_{HML}	-0.0763***	0.0216	-0.0888 ***	0.00378	-0.1954 **	-0.0137	0.5913	-0.3607 *
β_{RMW}	-0.0059	0.1740***	0.03124	-0.1244 ***	0.3578 ***	0.0255	-0.6146	-0.1571
β_{CMA}	0.0718**	-0.1666***	0.11199 ***	0.0619	-0.1924 *	0.0191	-0.1489	0.6007 **
β_{MOM}	-0.0157	-0.0116	0.0279 *	-0.0463 ***	-0.0084	-0.01835 *	0.0655	-0.1456 **
β_{MOM-ST}	-0.0024	0.0049	0.02135	0.0078	0.00045	-0.0147	-0.5028	0.1120
β_{MOM-LT}	-0.0098	0.0805**	0.05893 **	-0.1584 ***	-0.02915	0.0436 *	-0.0072	-0.1685
Log(SIGMA)	-5.2992	-4.7235	-5.8803	-5.1928	-4.6385	-5.1199	-3.0133	-3.8960
Exp. duration	68.5	49.1	1.9	2.3	117.8	299.9	4.2	6.9
S.E.	0.0072		0.064		0.0072		0.0428	
Log. Likelihood	1276.874		861.606		938.158		271.740	

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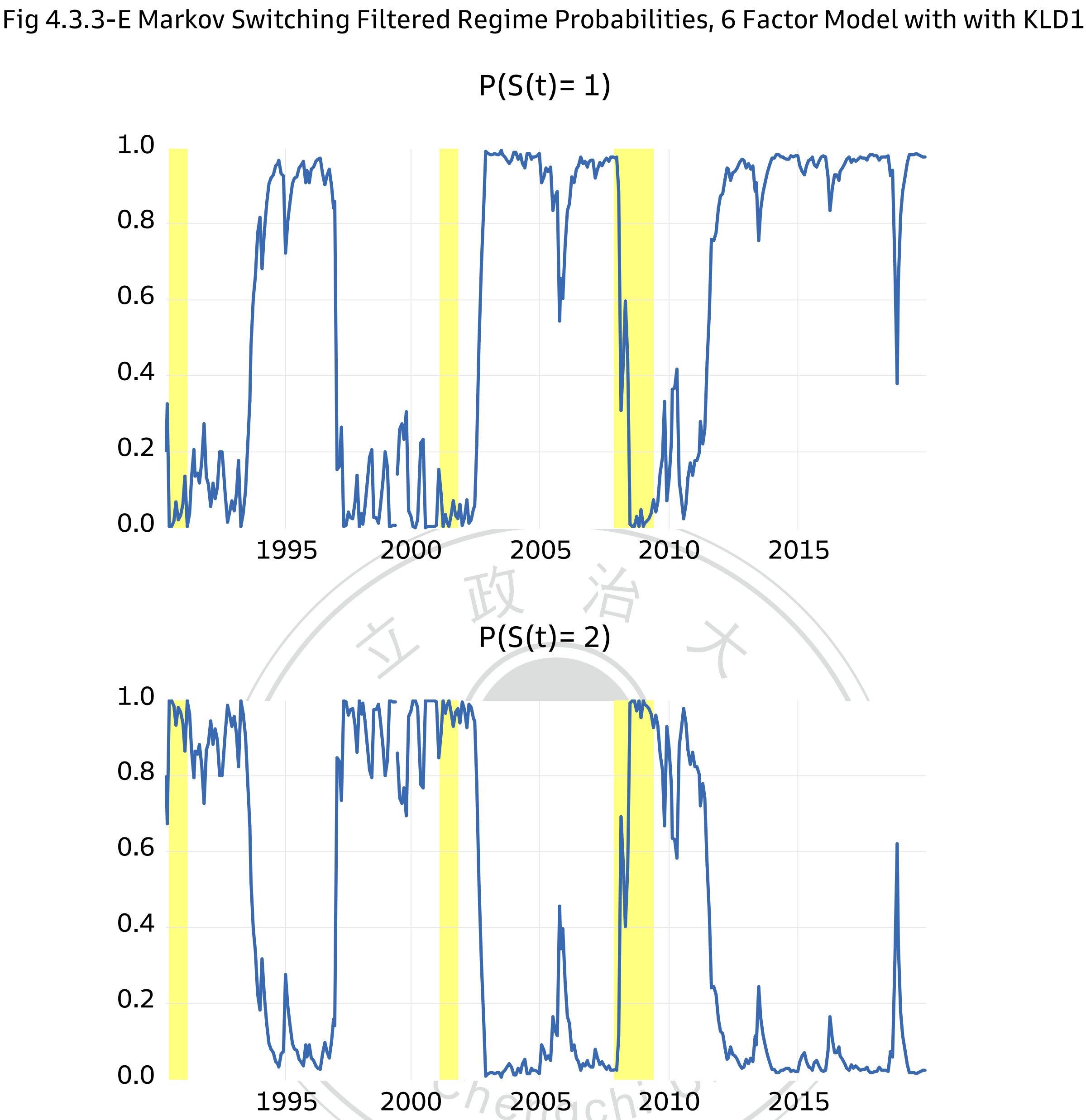

Figure 4.3.3-E KLD1 with 6-Factor Model, Regime Switch Probabilities

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With the momentum factors being added to the five-factor model, the results from KLD Index, Fig 4.3.3-E, indicate that recession does not drag down the performance for ESG companies. Nevertheless, this can only partially address the mystery in RI, especially for Islamic investment.

Table 4.3.3-J 6-Factor model with MRSR-3 Regimes, using Fama & French as broad market proxy.

	KLD2 From May 1990		
Regime	Regime 1	Regime 2	Regime 3
C	0	-0.00048	-0.0039***
β_{MKT}	0.03658 *	-0.0046	-0.02213***
β_{SMB}	-0.1433***	-0.0917***	0.0419***
β_{HML}	0.0091	-0.0890***	-0.0952***
β_{RMW}	0.2597***	-0.0057	0.1219***
β_{CMA}	-0.1764***	0.0747*	-0.2798***
β_{MOM}	0.0079	-0.215**	-0.2231***
β_{MOM-ST}	-0.0314	0.0356*	-0.0468***
β_{MOM-LT}	0.1042**	0.0056	0.1812***
Log(Sigma)	-4.9626	-5.286	-12.311
Expected durations	12.3	26.8	1.1
S.E.	0.0074		
Log. Likelihood	1335.381		

The regime probability results reveal that Regime 1 and Regime 3 are unique and that β_{MKT} coefficient changes from positive to negative, indicating that when the market goes up, the excess return of KLD2 decreases (and vice versa). Although statistically significant negative alpha is noted in Regime 3, the expected duration is the shortest of all regimes. MRSR demonstrates the heteroscedasticity of mean return with different market regimes; more importantly, Risk factors reversal is also captured, where the drivers of excess returns also change according to the market regime.

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Fig 4.3.3-F Markov Switching Filtered Regime Probabilities, 6-Factor with KLD2

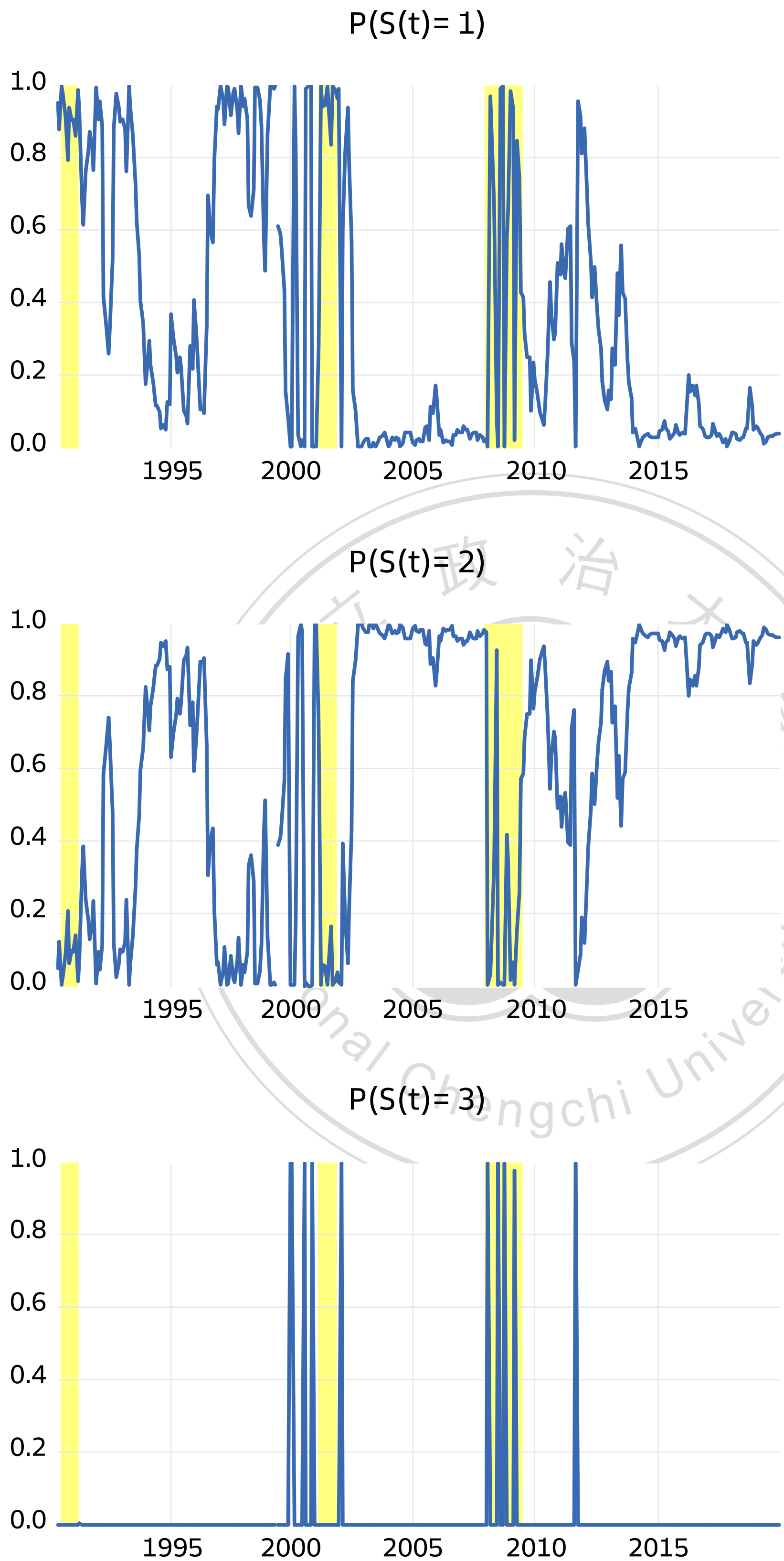

Fig 4.3.3-F Markov Switching Filtered Regime Probabilities, 6-Factor with KLD2

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5.0 Empirical Results from Japan

This section identifies heteroscedasticity in the returns and variance of the Japanese stock market. It investigates RI performance under different market conditions using the same assumptions as those used to study the US market, namely the EMH and a semistrong efficient form of the stock market. The methodology and workflow are also the same. To test for ESG premiums, RI performance in Japan is analyzed using a similar approach to identify heteroscedasticity in returns and variance under different market regimes.

5.1 Data for Japanese Market

The data for the risk factor model are from Wharton Research Data Services and are cross-checked and referenced against materials from the Kenneth French Data Library. The MSCI Japan Index and MSCI Japan Investable Market (IMI) data are downloaded from the MSCI website for historical end-of-day data to serve as alternative proxies for the broad Japanese market. Fama and French constructed their factor risk model using market data from the Bloomberg Database for the Japanese market, and they outlined their method in Fama and French (2012). Because Fama and French researched from a US perspective, the risk-free rate is the 1-month US Treasury bill rate from Ibbotson Associates. They also used the top 90% of market capitalization as the breakpoint for large companies outside the United States rather than the top and bottom 30%. The bottom 10% of small-size companies, big firms in Japan, may only be mid-size firms in the USA. The MSCI Japan Index has been available since January 1990 and is a few months older than the data of Fama and French.

With the data becoming available in May 2006, the MSCI Japan ex Controversial Weapons Index is the earliest RI-related index in the MSCI family for Japan. Like the MSCI USA ex Weapons Index, this index adopts a negative screening approach, whereby firms involved in the production of bombs, landmines, chemical and biological weapons, and depleted uranium weapons are excluded.

Like the MSCI KLD Index, the MSCI Japan SRI Index applies both negative screening and the best-in-class approach. Firms related to adult entertainment, alcohol, firearms, weapons (both civilian and military), gambling, genetically modified organisms (foods), nuclear power, thermal coal, and tobacco are excluded from investment. In addition, companies with high ESG scores from each sector are selected based on sector weight in the Japanese market.

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Table 5.1-A Label Summary for Data for Japanese Stocks' Market

Variables	Details	Sources
RF	Risk-Free Rate, 1-M U.S. Treasury Bill rate	Ken French Data Lib. & WRDS
FFMKT	FF Excess Return, i.e., MKT return minus RF	As above
FF3_SMB	SMB Factor from 3-Factor Model	As above
FF3_HML	HML Factor from 3-Factor Model	As above
FF5_SMB	SMB Factor from 5-Factor Model	As above
FF5_HML	HML Factor from 5-Factor Model	As above
FF5_RMW	RMW Factor from 5-Factor Model	As above
FF5_CMA	CMA Factor from 5-Factor Model	As above
FF_MOM	Momentum Factor calculated by Fama & French	As above
MSCI	MSCI Japan Index	MSCI
MSCI IMI	MSCI IMI Index (addition small cap)	MSCI
JPxWP	MSCI Japan excluding weapon Index	MSCI
ESG	MSCI Japan ESG Lead Index	MSCI
SRI	MSCI Japan SRI Index	MSCI
Islamic	MSCI Japan Islamic Index	MSCI

* Please note that RI-related indexes generally have a shorter data period.

The MSCI Japan ESG Leader Index adopts only the best-in-class approach; unlike its US counterpart, no sector is eliminated. It only includes the top ESG companies that account for 50% of each sector. Alcohol companies, such as Asahi Breweries, are considered socially acceptable companies in Japan for investment purpose, unlike the USA. The MSCI Japan Islamic Index involves the same criteria as the MSCI USA Islamic Index.

The MSCI Japan Islamic Index is developed based on the "Sharia principles," i.e., Islamic social and moral teaching. In addition to negatively screening on: Adult Entertainment, Alcohol, Firearms and Weapons (both Civilian and Military), Gambling, Genetically Modified Organisms (foods), Nuclear Power, and Tobacco; it extension exclusion conventional financial services and "pork-related products." The threshold for the above activities is that it cannot generate more than 5% from such business activities (i.e., supermarket channel should have profit from "pork" related product less than 5%). In addition, companies cannot have

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“excessive leverage” according to Sharia investment principles. In general, for a company to satisfy Sharia guidelines, its financial ratio on a. total debt to total assets; b. cash investment into interest-bearing securities over total assets; and c. accounts receivables and cash equivalents over total assets; should not exceed 33.33%.

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Table 5.1-Bsummary Statistics for Japan's Data

	FFMKT	MSCI	FF3SMB	FF3HML	FF5SMB	FF5HML	FF5RMW	FF5CMA	MOM
Mean	0.001432	2.49E-05	0.000246	0.002356	0.000866	0.002356	0.001530	0.000266	0.000504
Median	0.003400	0.003103	0.001900	0.002600	0.002200	0.002600	0.001100	0.001000	0.004600
Maximum	0.168700	0.161335	0.133500	0.100500	0.131000	0.100500	0.087900	0.075400	0.149500
Minimum	-0.162200	-0.183832	-0.114300	-0.142500	-0.115300	-0.142500	-0.080900	-0.129900	-0.198300
Std. Dev.	0.053848	0.053504	0.031574	0.029390	0.031488	0.029390	0.021131	0.023545	0.043340
Skewness	0.190114	-0.065307	0.174396	-0.194875	0.110946	-0.194875	-0.009082	-0.750547	-0.442081
Kurtosis	3.599249	3.522700	4.851537	4.854722	4.932635	4.854722	4.942694	7.137077	5.750105
Jarque-Bera	7.701987	4.438801	54.28303	54.92610	57.86847	54.92610	57.71670	296.1795	127.6062
Probability	0.021259	0.108674	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
Sum	0.525500	0.009120	0.090300	0.864800	0.317800	0.864800	0.561600	0.097600	0.185000
Sum Sq. Dev.	1.061251	1.047727	0.364864	0.316135	0.362876	0.316135	0.163429	0.202892	0.687493
Observations	367	367	367	367	367	367	367	367	367

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Table 5.1-C Correlation Table for Japan's Data

Correlation	FFMKT	MSCI	FF3SMB	FF3HML	FF5SMB	FF5HML	FF5RMW	FF5CMA	MOM
FFMKT	1.000000								
MSCI	0.983086	1.000000							
FF3SMB	0.133978	0.029803	1.000000						
FF3HML	-0.178291	-0.154157	-0.083887	1.000000					
FF5SMB	0.100385	-0.000635	0.987174	0.053085	1.000000				
FF5HML	-0.178291	-0.154157	-0.083887	1.000000	0.053085	1.000000			
FF5RMW	-0.246000	-0.261472	-0.118893	-0.427057	-0.161778	-0.427057	1.000000		
FF5CMA	-0.034810	-0.023694	0.128869	0.569684	0.193556	0.569684	-0.669223	1.000000	
MOM	-0.178991	-0.207197	-0.058859	-0.266750	-0.090886	-0.266750	0.327445	-0.252538	1.000000

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Table 5.1-D Summary Statistics for Japan RI-indexes' excess returns

	JPXWP	SRI	ESG	ISLAMIC
Mean	0.002405	0.003044	0.002672	0.003048
Median	0.005311	0.006050	0.006460	0.006651
Maximum	0.117661	0.131058	0.128637	0.133802
Minimum	-0.160676	-0.182548	-0.175261	-0.174726
Std. Dev.	0.044690	0.046547	0.045663	0.046004
Skewness	-0.593477	-0.633784	-0.628211	-0.716271
Kurtosis	4.201422	4.552532	4.463475	4.817878
Jarque-Bera	19.49054	27.45009	25.42243	36.60521
Probability	0.000059	0.000001	0.000003	0.000000
Sum	0.394417	0.499260	0.438152	0.499895
Sum Sq. Dev.	0.325539	0.353152	0.339876	0.344966
Observations	164	164	164	164

Because of differences in the observational data, a correlation table is provided in later sections to compare the differences in alphas and betas. The results in Table 5.1B–D are consistent with those of other studies and indicate a mean close to zero, which the EMH suggests.

This section determines whether statistically significant differences exist between (a) FFMKT and MSCIMKT in the long term. According to the EMH, this difference should be zero in the Japanese market; (b) FFMKT and MSCI under different regimes. This difference is assumed to be zero. If a difference exists in this part and "A," then that regime may be a period in which information is not fully reflected market and confident investors can capitalize on this to profit under certain market conditions; and (c) RI indexes and FFMKT in the long-term and every regime. The difference is assumed to be zero for both, according to the EMH.

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Table 5.1-E Unit Root Test for Intercept on Japan data

Table 5.1-E Unit Root Test for Intercept on Japan data

Excess Returns	Dickey-Fuller GLS	KPSS	Phillips-Perron
FFMKT	-0.7416	0.1803 +++	-16.9156 ***
FF3_SMB	-0.7971	0.2588 +++	-19.0643 ***
FF3_HML	-15.9461 ***	0.2807 +++	-16.4566 ***
FF5_SMB	-0.7971	0.2588 +++	-19.0642 ***
FF5_HML	-15.9461 ***	0.2807 +++	-16.4566 ***
FF5_RMW	-1.1098	0.1212 +++	-18.5224 ***
FF5_CMA	-4.2064***	0.0800 ++	-17.4430 ***
FF_MOM	-16.0102 ***	0.0576 +++	-17.1731 ***
MSCI	-0.7843	0.3075 +++	-17.2911 ***
MSCI IMI	-10.7446 ***	0.2608 +++	-10.8658 ***
JPxWP	-10.7657 ***	0.2615 +++	-10.8716 ***
ESG	-10.9756 ***	0.2435 +++	-10.8963 ***
SRI	-10.9249 ***	0.2324 +++	-11.0246 ***
Islamic	-9.5221 ***	0.2339 +++	-10.5389 ***

Notes:

1. *, **, and *** denotes the rejection of the null hypothesis with the probability of ρ is less than 1%, 5%, and 10% criterial levels. Both Dickey-Fuller with GLS detrending and Phillips-Perron Test have null hypotheses assuming "the time series has a unit root."
2. +, ++, +++ denotes for the "No Rejection" of the null hypothesis with the probability of ρ is less than 10%, 5%, and 1% critical value. The null hypothesis for Kwiatkowski–Phillips–Schmidt–Shin Test is assuming that time series is stationary, i.e., without a unit root.

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Table 5.1-F Unit Root Test for Intercept & Trend on Japan data

Table 5.1-F Unit Root Test for Intercept & Trend on Japan data

Excess Returns	DF-GLS	KPSS	Phillips-Perron
FFMKT	-2.1049	0.0593 +++	-19.1020 ***
FF3_SMB	-1.9181	0.0436 +++	-22.9030 ***
FF3_HML	-15.8786 ***	0.1180 +++	-16.4840 ***
FF5_SMB	-1.9181	0.0593 +++	-19.1020 ***
FF5_HML	-15.8786 ***	0.1180 +++	-16.4840 ***
FF5_RMW	-3.3797 **	0.1118 +++	-18.5145 ***
FF5_CMA	-8.9469 ***	0.0807 +++	-17.4253 ***
FF_MOM	-16.8227 ***	0.0534 +++	-17.1505 ***
MSCI	-2.2204	0.0299 +++	-17.3015 ***
MSCI IMI	-11.1098 ***	0.0707 +++	-10.9730 ***
JPxWP	-11.1158 ***	0.0706 +++	-10.9795 ***
ESG	-11.0771 ***	0.0662 +++	-10.9960 ***
SRI	-11.2078 ***	0.0574 +++	-11.1507 ***
Islamic	-10.5912 ***	0.0691 +++	-10.6415 ***

Notes:

1. *, **, and *** denotes the rejection of the null hypothesis with the probability of ρ is less than 1%, 5%, and 10% criterial levels. Both Dickey-Fuller with GLS detrending and Phillips-Perron Test have null hypotheses assuming "the time series has a unit root."
2. +, ++, +++ denotes for the "No Rejection" of the null hypothesis with the probability of ρ is less than 10%, 5%, and 1% critical value. The null hypothesis for Kwiatkowski–Phillips–Schmidt–Shin Test is assuming that time series is stationary, i.e., without a unit root.

The Dicker–Fuller (with GLS detrending) test of the variables identifies the following unit root issues: FFMKT, FF3SMB, FF5SMB, FF5RMW, and MSCI. These are likely caused by the first lost decade of the Japanese economy (the 1990s), in which Japan's GDP growth was less than 1%, and the stock market swung like a pendulum between unit root test points and unit root problems. Two additional tests and the fact that the test with MSCIIMI (supposedly primarily similar to MSCI and FFMKT but beginning in 2007) identifies no unit root issues that indicate the data are suitable for modeling risk factors.

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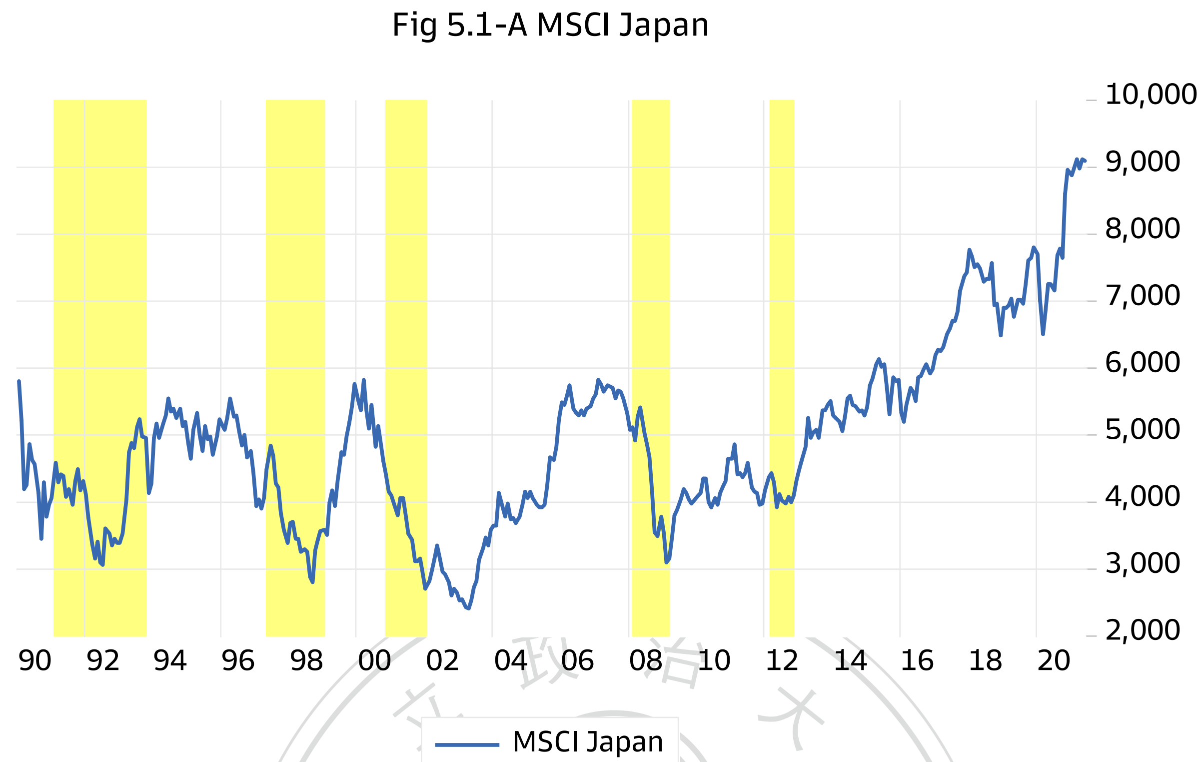

* Shaded area (light-yellow or gray) is recession period according to Japan Government

Figure 5.1-A MSCI (Gross Returns) Japan Time Series

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5.2 Empirical Testing for the Japan Market

This section tests for statistically significant differences between the two market proxies, FFMK and MSCI, through the graphical approach, the simple statistical test approach, and the risk factor model (with OLS) approach. Then, the approach involving the risk factor model and MRSR (dynamic Markov regression) is used to identify differences between the intercept and the risk factors.

5.2.1 The Graphical Approach

Figure 5.2.1-A presents the proxies for the Japanese stock market's excess returns with data from November 1990 to May 2021.

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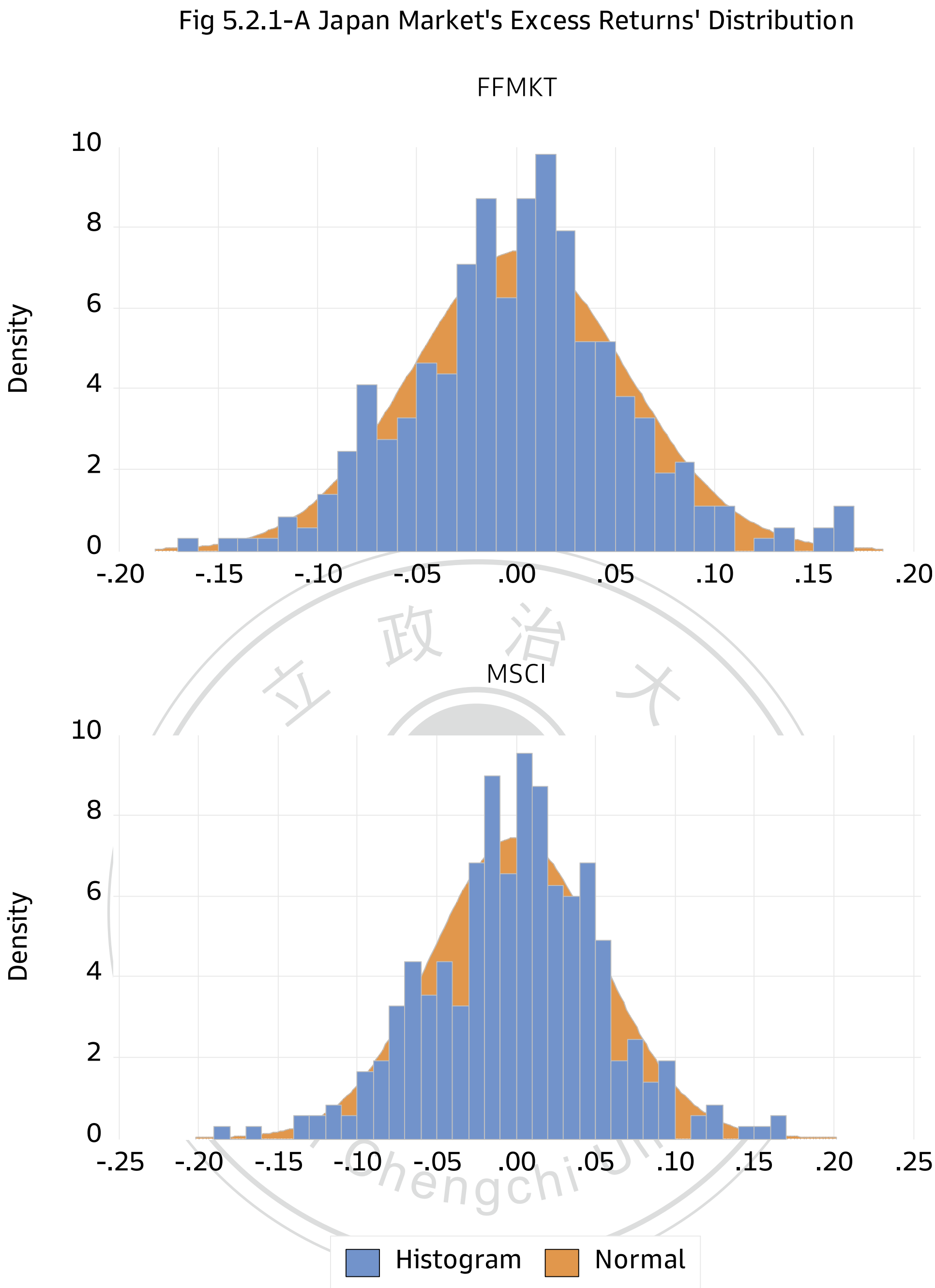

Figure 5.2.1-A Japan Market Excess Returns (proxies) Distribution

The excess returns in the Fama and French and MSCI data have a remarkably high correlation of 0.9830. FFMKT has a mean of 0.001432%, and MSCI Japan has almost zero, which is consistent with the EMH (Table 5.2.1-B). The two data sets have a normal-like distribution with fat tails on both sides (Figure 5.2.1-A).

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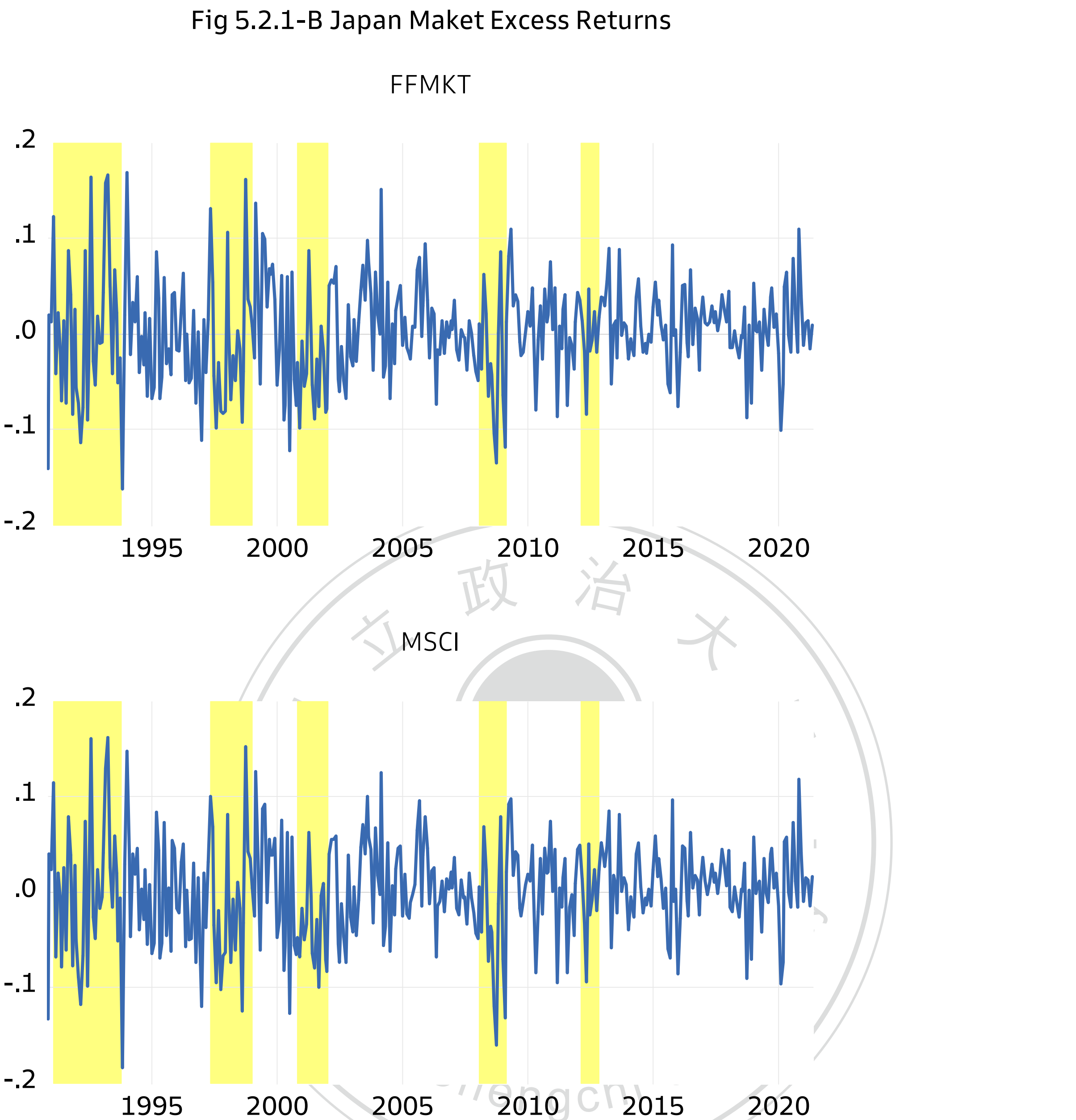

* Shaded area (light yellow or gray) are economic recession according to Japan Government

Figure 5.2.1-B Japan Market Excess Returns Proxies

Mean returns and variance are greater during an economic recession than during non-recession periods, indicating heteroscedasticity, as with the US market (Figure 5.2.1B).

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5.2.2 Simple Equality Test

The results of the simple equality test indicate that the Japanese market follows the EMH because the mean returns in the Fama and French and MSCI data are not significantly different from zero (Table 4.2.2A). This result contrasts with conventional understanding in the investment community that the stock market rewards premiums.

Table 5.2.2-A Hypothesis Testing if means are different from zero

	Fama & French	MSCI
Mean	0.5094	0.000025
ρ-value for t-statistic	0.6108	0.9929

Note: *, **, and *** denotes the rejection of the null hypothesis for 1%, 5%, and 10%, criterial levels, respectively.

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Table 5.2.2-B Equality Test for means for data sets.

Table 5.2.2-B Equality Test for means for data sets.

Method		df	Value	Probability
t-test		732	0.35509	0.72262
Satterthwaite-Welch t-test*		731.9699	0.35509	0.72262
Anova F-test		(1, 732)	0.12609	0.72262
Welch F-test*		(1, 731.97)	0.12609	0.72262
*Test allows for unequal cell variances				
Analysis of Variance				
Source of Variation		df	Sum of Sq.	Mean Sq.
Between		1	0.00036	0.00036
Within		732	2.10898	0.00288
Total		733	2.10934	0.00288
Category Statistics				
				Std. Err.
Variable	Count	Mean	Std. Dev.	of Mean
FFMKT	367	0.00143	0.05385	0.00281
MSCI	367	0.00002	0.05350	0.00279
All	734	0.00073	0.05364	0.00198

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Table 5.2.2-C Equality Test for variance for data sets

Table 5.2.2-C Equality Test for variance for data sets

Method		df	Value	Probability	
F-test		(366, 366)	1.01291	0.90243	
Siegel-Tukey			0.06093	0.95142	
Bartlett		1	0.01503	0.90243	
Levene		(1, 732)	0.00024	0.98762	
Brown-Forsythe		(1, 732)	0.00003	0.99566	
Category Statistics					
			Mean Abs.	Mean Abs.	Mean Tukey-
Variable	Count	Std. Dev.	Mean Diff.	Median Diff.	Siegel Rank
FFMKT	367	0.05385	0.04138	0.04133	367.97820
MSCI	367	0.05350	0.04142	0.04135	367.02180
All	734	0.05364	0.04140	0.04134	367.50000
Bartlett weighted standard deviation: 0.053676					

The high correlation and the mean and variance equality test (Table 5.2.2-B, and Table 5.2.2-C) demonstrate that the two data sets are not statistically different; both are excellent proxies for the Japanese stock market.

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5.2.3 Comparison with Risk Models: OLS vs. MRSR

The left side of the equation for the six-factor model, namely expected returns E(R_i), is a proxy in the Fama and French data for excess return, FFMKT. On the right side of the equation, the market risk factor βMKT is a proxy in the MSCI Japan data for excess return, MSCI.

Table 5.2.3-A Empirical Results of Risk Factor Model using OLS method

Table 5.2.3-A Empirical Results of Risk Factor Model using OLS method

	CAPM	3-Factor	4-Factor	5-Factor	6-Factor
C	0.00141 ***	0.00145 ***	0.00139 ***	0.00131 ***	0.00128 ***
β_{MKT}	0.98941 ***	0.98336 ***	0.99061 ***	0.98869 ***	0.99389 ***
β_{SMB}		0.17611 ***	0.17988 ***	-0.18195 ***	-0.18419 ***
β_{HML}		-0.03482 **	-0.01854	-0.03724 **	-0.02688
β_{CMA}				0.02604	0.01488
β_{RMW}				-0.03135 ***	-0.03059
β_{MOM}			0.03536 ***		0.03256 ***
Adj. R^2	0.96637	0.97759	0.9782	0.97772	0.9782
S.E.	0.00988	0.00806	0.00794	0.00804	0.00794
Log. Likelihood	1175.950	1250.483	1256.324	1252.502	1257.378

The results of using OLS for the different risk factor models are consistent with those in the literature. However, the results of the Japanese six-factor model differ from those of Fama and French (2015), and the loss of statistical significance for risk factors β_{HML}, β_{CMA}, and β_{RMW} has not been documented in any study but is consistent with practical experience.

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Table 5.2.3-B Empirical Results of Risk Factor Model using MRSR-2 Regimes

Table 5.2.3-B Empirical Results of Risk Factor Model using MRSR-2 Regimes

Variables	CAPM		3-Factor		4-Factor	
	Regime 1	Regime 2	Regime 1	Regime 2	Regime 1	Regime 2
C	0.00138***	0.0016*	0.0032 **	0.0008***	0.0032**	0.0008**
β_{MKT}	0.9439***	1.0110***	1.0052***	0.9690***	1.0147***	0.9733***
β_{SMB}			0.1606***	0.1983***	0.1636***	0.1984***
β_{HML}			-0.0870**	0.0146	-0.0616	0.0227*
β_{MOM}					0.0465	0.0226**
Log (SIGMA)	-5.1185	-4.4014	-4.3325	-5.3012	-4.3342	-5.3071
Exp. duration	314	322.5	14.6	49.1	3.8	12.4
S.E.	0.0098		0.00792		0.00782	
Log. Likelihood	1218.416		1318.825		1323.55	

Notes:

1. *, **, and *** denotes the rejection of the null hypothesis with the probability of ρ is less than 10%, 5%, and 1% criterial levels.

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Table 5.2.3-C Empirical Results of Risk Factor Model using MRSR-2 Regimes

Table 5.2.3-C Empirical Results of Risk Factor Model using MRSR-2 Regimes

Variables	5-Factor		6-Factor		6-Factor TVTP	
	Regime 1	Regime 2	Regime 1	Regime 2	Regime 1	Regime 2
C	0.006*	0.0024	0.00065*	0.0026	0.0018**	0.0003
β_{MKT}	0.9755***	1.012***	0.978***	1.018***	0.997***	0.9777***
β_{SMB}	0.2002***	0.1623***	0.2015***	0.1606***	0.188***	0.1824***
β_{HML}	-0.0048	-0.039	0.0033	-0.0353	-0.038	-0.003
β_{RMW}	0.0510*	-0.0472	0.041	-0.0403	-0.010	0.085***
β_{CMA}	0.0320***	-0.172*	0.0208	-0.146	-0.0051	0.0367
β_{MOM}			0.0182 **	0.0289	0.0037**	0.009
Log (SIGMA)	-5.3428	-4.364	-5.330	-4.3469	-4.605	5.865
Exp. duration	37.9	11.9	43.3	12	33.1	15.5
S.E.	0.00783		0.00779		0.00795	
Log. Likelihood	1327.422		1130.003		1318.802	

The results in Table 5.2.3-B and Table 5.2.3-C indicate heteroscedasticity in means and variance. The risk factors change negligibly, and β_{RMW}, β_{CMA}, and β_{MOM} lose statistical significance in one regime. The loss of the value premium may be due to the decrease in value premium described by Fama and French (2020).

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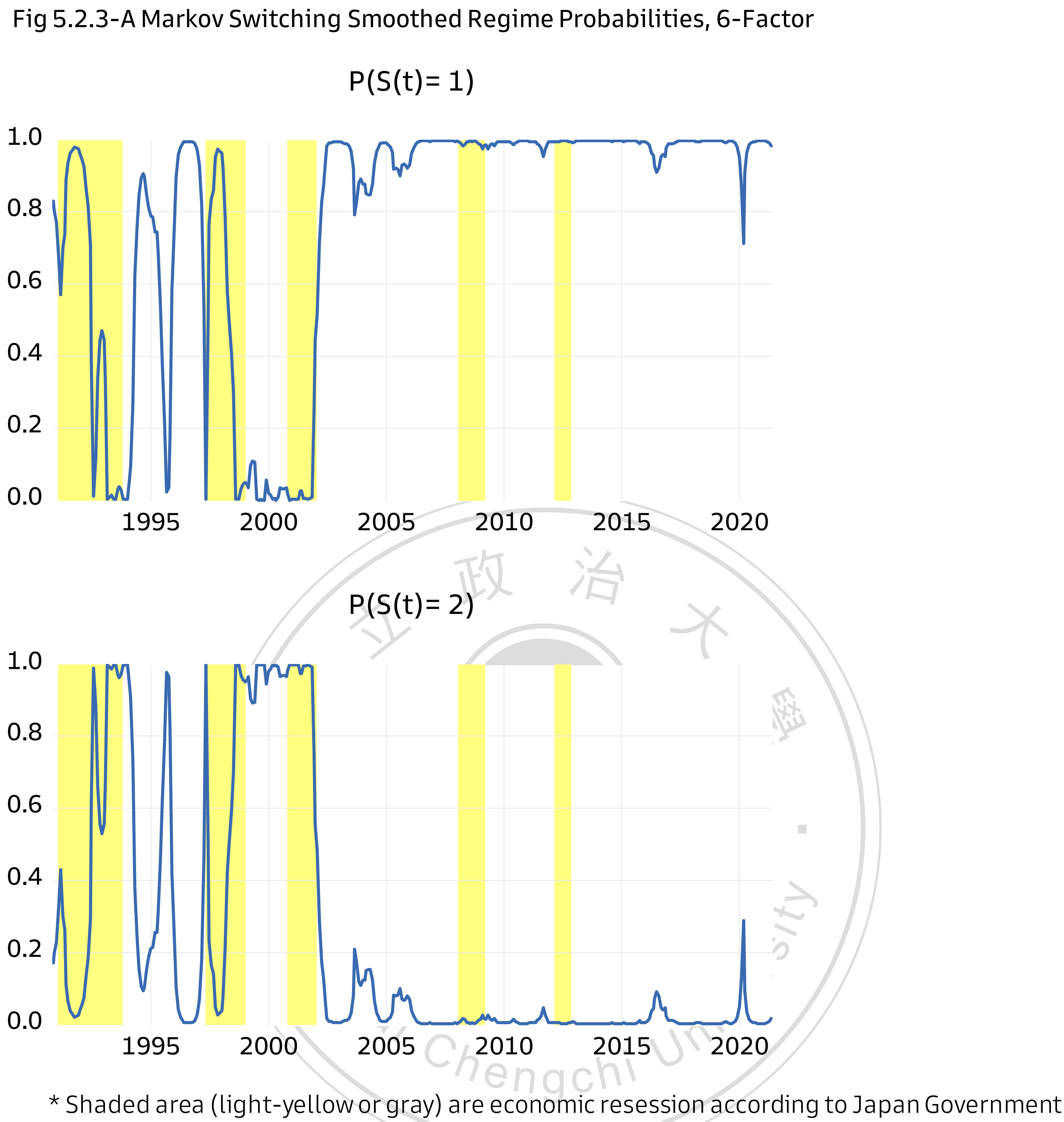

Figure 5.2.3-A 6-Factor Markov Switch Regime Probabilities for Japan

According to the six-factor model (with dynamic Markov switching regression), the Japanese stock market switches between Regime 1 and Regime 2 (Figure 5.2.3A). The economic recession in the mid-2000s is in Regime 1, whereas the recessions in the 1990s and 2000s switch between Regime 1 and Regime 2. The recession in the early 2000s is in Regime 2.

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5.3 Empirical Testing for RIs in Japan Market

This section tests for statistically significant differences between the four Japanese proxies for RI (namely the MSCI Japan ex Weapons Index, the MSCI ESG Index, the MSCI SRI Index, and the MSCI Islamic Index) and FFMKT (market proxy used by Fama and French) through the graphical approach, the simple statistical test approach, and the risk factor model (with OLS) approach. The approach using the risk factor models and MRSR is used to identify differences between the intercept and risk factors.

5.3.1 The Graphical Approach

Figure 5.3.1-A presents the proxies for the Japanese stock market's excess returns using data from October 2007 to May 2021. Although all four series have a normal-like distribution, a tail on the left side tail is present. The disparity in excess returns is wider during recessions than during other periods, especially during the 2008 financial crisis; hence, heteroscedasticity should be observed in all RI indexes (Figure 5.3.1-B).

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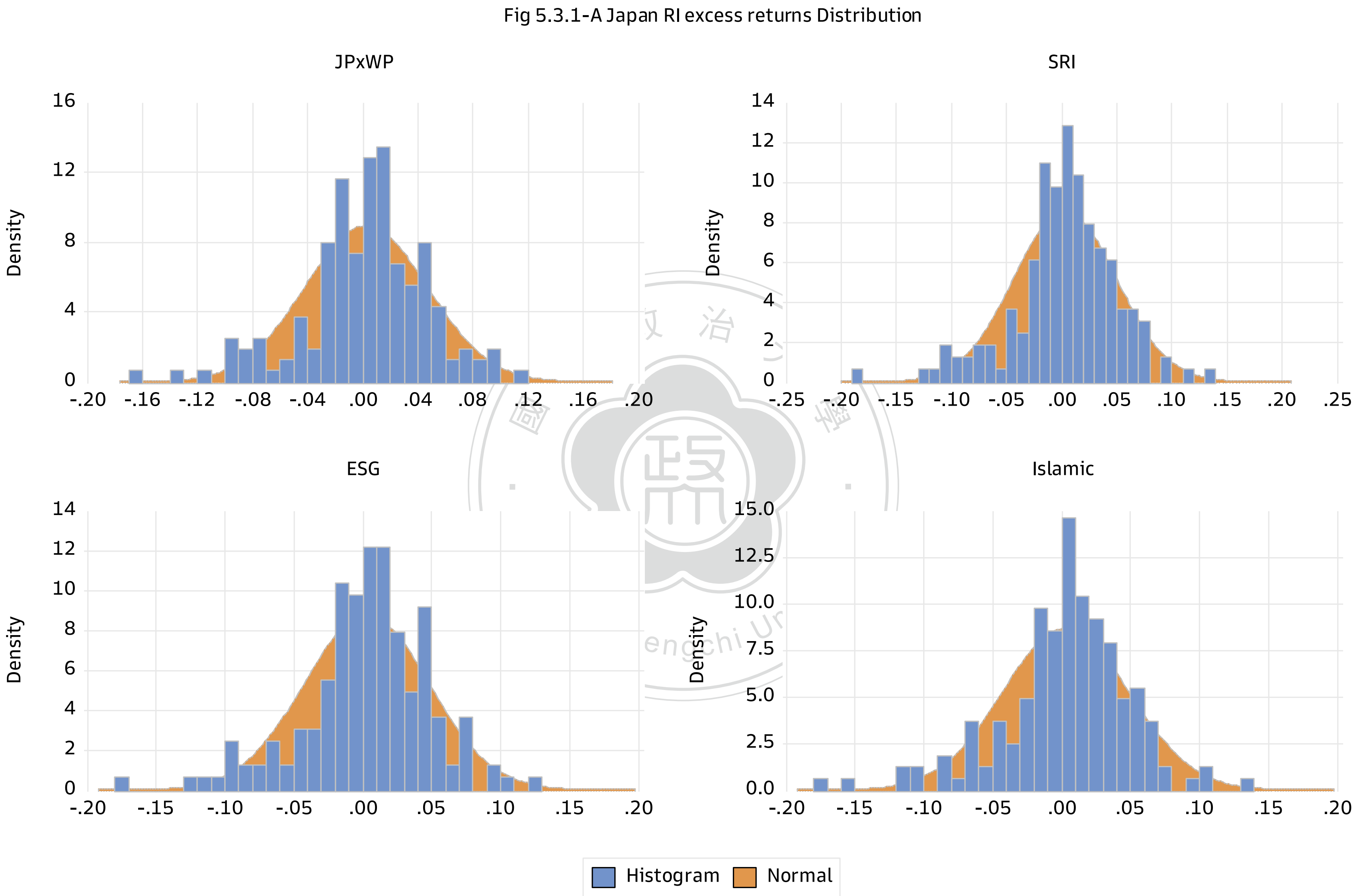

Figure 5.3.1-A Japan RI proxies' excess return Distribution

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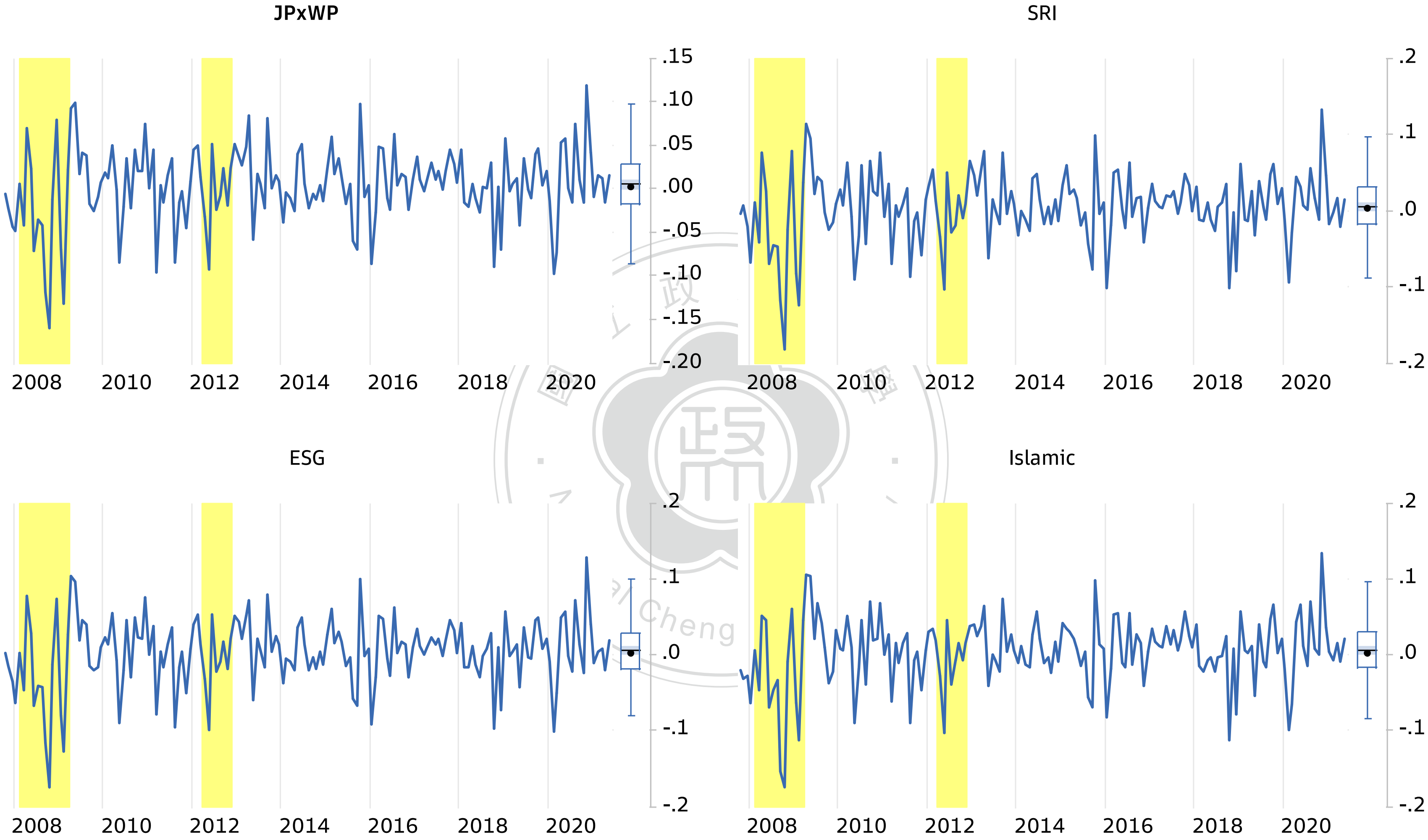
Fig 5.3.1-B Japan RI excess returns Time Series



* Shaded Area (yellow or gray) are economic recession according to Japan Government

Figure 5.3.1-B 5.3.1-A Japan RI proxies' excess returns Time Series

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5.3.2 Simple Equality Test

The results of the simple equality test indicate that the Japanese market is consistent with the EMH in that the mean returns for the RI indexes are not statistically different from zero (Table 5.3.2A). This is somewhat inconsistent with the conventional understanding in the investment community that the market rewards premiums.

Table 5.3.2-A Hypothesis Testing if means are different from zero.

Table 5.3.2-A Hypothesis Testing if means are different from zero

	JPxWP	SRI	ESG	Islamic
Data begins	2007.10	2007.10	2007.10	2007.10
Mean	0.002405	0.00304	0.00409	0.002672
ρ-value for t-statistic	0.68917	0.83756	0.1651	0.74927

Note: *, **, and *** denotes the rejection of the null hypothesis for 1%, 5%, and 10%, criteria levels, respectively.

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Table 5.3.2-B Equality Test for means for data sets.

Table 5.3.2-B Equality Test for means for data sets.

Method		df	Value	Probability
Anova F-test		(3, 652)	0.00767	0.99908
Welch F-test*		(3, 362.186)	0.00775	0.99906
*Test allows for unequal cell variances				
Analysis of Variance				
Source of Variation		df	Sum of Sq.	Mean Sq.
Between		3	0.00005	0.00002
Within		652	1.36353	0.00209
Total		655	1.36358	0.00208
Category Statistics				
				Std. Err.
Variable	Count	Mean	Std. Dev.	of Mean
JPXWP	164	0.00240	0.04469	0.00349
SRI	164	0.00304	0.04655	0.00363
ESG	164	0.00267	0.04566	0.00357
ISLAMIC	164	0.00305	0.04600	0.00359
All	656	0.00279	0.04563	0.00178

Results from Equality Test, Table 5.3.2-B, clearly suggesting that all RI indexes's means are equal.

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Table 5.3.2-C Equality Test for variance for data sets.

Table 5.3.2-C Equality Test for variance for data sets.

Method		df	Value	Probability
Bartlett		3	0.28495	0.96283
Levene		(3, 652)	0.04258	0.98830
Brown-Forsythe		(3, 652)	0.04270	0.98825
Category Statistics				
			Mean Abs.	Mean Abs.
Variable	Count	Std. Dev.	Mean Diff.	Median Diff.
JPXWP	164	0.04469	0.03282	0.03268
SRI	164	0.04655	0.03404	0.03391
ESG	164	0.04566	0.03341	0.03330
ISLAMIC	164	0.04600	0.03339	0.03314
All	656	0.04563	0.03342	0.03326
Bartlett weighted standard deviation: 0.045731				

The results of the equality test indicate that the RI indexes have the same variance (Table 5.3.2-C).

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5.3.3 Comparison with Risk Models: OLS vs. MRSR

Table 5.3.3-A CAPM model, using Fama & French as broad market proxy.

Table 5.3.3-ACAPM model, using Fama & French as broad market proxy.

	CAPM, JPxWP	CAPM, SRI	CAPM, ESG	CAPM, ISLAMIC
Data begins	2007.10	2007.10	2007.10	2007.10
C	0.000001	0.0006	0.00023	0.00066
β_{MKT}	1.00001 ***	1.0165 ***	1.01517 ***	0.9963 ***
Adj. R^2	0.9999	0.9520	0.9869	0.9360
S.E.	0.00008	0.0102	0.00523	0.01164
Log. Likelihood	1303.329	520.267	629.762	498.706

Note: *, **, and *** denotes the rejection of the null hypothesis for 1%, 5%, and 10%, criteria levels, respectively.

Table 5.3.3-B 3-Factor model, using Fama & French as broad market proxy.

Table 5.3.3-B 3-Factor model, using Fama & French as broad market proxy.

	3-Factor, JPxWP	3-Factor, SRI	3-Factor, ESG	3-Factor, ISLAMIC
Data begins	2007.10	2007.10	2007.10	2007.10
C	0.000005	0.0008	0.00035	0.0004
β_{MKT}	1.0000 ***	1.0059 ***	1.00857 ***	0.99289 ***
β_{SMB}	-0.0005	-0.08231 **	-0.0468 **	0.04163
β_{HML}	-0.00005	-0.05027	-0.0365 **	-0.00889 **
Adj. R^2	0.9999	0.9530	0.9873	0.9394
S.E.	0.00008	0.01001	0.0513	0.01133
Log. Likelihood	1304.437	523.037	633.809	504.1205

Note: *, **, and *** denotes the rejection of the null hypothesis for 1%, 5%, and 10%, criteria levels, respectively.

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Table 5.3.3-C 4-Factor model, using Fama & French as broad market proxy.

Table 5.3.3-C 4-Factor model, using Fama & French as broad market proxy.

	4-Factor, JPxWP	4-Factor, SRI	4-Factor, ESG	4-Factor, ISLAMIC
Data begins	2007.10	2007.10	2007.10	2007.10
C	-0.000005	0.0008	0.0003	0.0004
β_{MKT}	1.000072 ***	1.0089 ***	1.00738***	0.99252 ***
β_{SMB}	-0.000515	-0.08799 **	-0.0445 **	0.04225
β_{HML}	-0.0000017	-0.0458	-0.0382 **	-0.00894 **
mom	0.00017	0.0158	-0.0063	-0.0018
Adj. R^2	0.9999	0.9530	0.9873	0.9389
S.E.	0.00008	0.01001	0.0515	0.01136
Log. Likelihood	1304.790	523.267	633.944	504.126

Note: *, **, and *** denotes the rejection of the null hypothesis for 1%, 5%, and 10%, criteria levels, respectively.

Table 5.3.3-D 5-Factor model, using Fama & French as broad market proxy.

Table 5.3.3-D 5-Factor model, using Fama & French as broad market proxy.

	5-Factor, JPxWP	5-Factor, SRI	5-Factor, ESG	5-Factor, ISLAMIC
Data begins	2007.10	2007.10	2007.10	2007.10
C	-0.000005	0.0009	0.0003	-0.0004
β_{MKT}	1.000077 ***	1.0020 ***	1.0057***	1.0067 ***
β_{SMB}	-0.000471	-0.07407 **	-0.037 *	0.0825**
β_{HML}	-0.000006	-0.0284	-0.0119	0.0325*
β_{RMW}	0.00016	-0.0112	0.0121	0.03768***
β_{CMA}	0.0033	-0.04118	-0.03712	0.0260
Adj. R^2	0.9999	0.9523	0.9873	0.9389
S.E.	0.00008	0.01001	0.0515	0.01136
Log. Likelihood	1304.790	523.033	634.455	504.126

Note: *, **, and *** denotes the rejection of the null hypothesis for 1%, 5%, and 10%, criteria levels, respectively.

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Table 5.3.3-E 6-Factor model, using Fama & French as broad market proxy.

Table 5.3.3-E 6-Factor model, using Fama & French as broad market proxy.

	6-Factor, JPxWP	6-Factor, SRI	6-Factor, ESG	6-Factor, ISLAMIC
Data begins	2007.10	2007.10	2007.10	2007.10
C	-0.000005	0.001022	0.0003	-0.0006
β_{MKT}	1.000087 ***	1.0042 ***	1.0057***	1.0047 ***
β_{SMB}	-0.000514	-0.08376 **	-0.037 *	0.0914**
β_{HML}	-0.000009	-0.0150	-0.0122	0.0202
β_{RMW}	0.000008	-0.0298	0.0124	0.0394***
β_{CMA}	0.000205	-0.0698	-0.037	0.0523
mom	0.000129	0.0295	-0.0005	-0.0271
Adj. R^2	0.9999	0.9524	0.9872	0.949
S.E.	0.00008	0.01015	0.0515	0.01136
Log. Likelihood	1304.902	523.646	634.455	520.001

Note: *, **, and *** denotes the rejection of the null hypothesis for 1%, 5%, and 10%, criteria levels, respectively.

Like the US market, the Japanese market also exhibits a textbook case of the CAPM; the value of β_{MKT} in the RI indexes is higher than or close to 1. The other factor models negligibly increase explanatory power and only to a limited degree. The results of the OLS regression reveal a statistically significant absence of alpha.

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Table 5.3.3-F CAPM model with MRSR-2 Regimes, using Fama & French as broad market proxy.

Table 5.3.3-F CAPM model with MRSR-2 Regimes, using Fama & French as broad market proxy.

	CAPM, JPxWP		CAPM, SRI		CAPM, ESG		CAPM, ISLAMIC	
Data begins	2007.10		2007.10		2007.10		2007.10	
	Regime 1	Regime 2	Regime 1	Regime 2	Regime 1	Regime 2	Regime 1	Regime 2
C	0	0 **	0	0.0052 **	0.0015 *	-0.0005	0.0009	0.00113
β_{MKT}	1.0002 ***	0.9999	1.0599 ***	0.6433 ***	0.9399 ***	1.0672***	0.7989***	1.0770***
Log(SIGMA)	--8.8942	-14.1474	-4.7875	-4.717	-5.32322	--5.5638	-4.691	-4.556
Exp. duration	5.1	7.5	28.4	3.8	1.5	2.0	3.9	7.2
S.E.	0.00008		0.0103		0.00524		0.01160	
Log. Likelihood	1677.279		537.917		642.6818		505.448	

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Table 5.3.3-F 4-Factor model with MRSR-2 Regimes, using Fama & French as broad market proxy.

Table 5.3.3-G 4-Factor model with MRSR-2 Regimes, using Fama & French as broad market proxy.

	4-Factor, JPxWP		4-Factor, SRI		4-Factor, ESG		4-Factor, ISLAMIC	
Data begins	2007.10		2007.10		2007.10		2007.10	
	Regime 1	Regime 2	Regime 1	Regime 2	Regime 1	Regime 2	Regime 1	Regime 2
C	0	0	0.00009	0.0054 **	0.00004	0.0010 ***	0.00133	0.0004
β_{MKT}	1.00018 ***	0.9999 ***	1.0533 ***	0.6302 ***	1.02839 ***	0.7809 ***	1.0511 ***	0.7901 ***
β_{SMB}	-0.001	0.00005	-0.0416	-0.3892 ***	-0.0385 **	-0.0879 ***	-0.0610	0.2306 ***
β_{HML}	-0.00001	-0.00006	-0.0446	-0.01687 *	-0.0251 *	-0.2040 ***	-0.1391 ***	0.0703 *
mom	0.00003	-0.00005	-0.0059	-0.0288	-0.0026	-0.0233 ***	0.0229	-0.0352
Log(SIGMA)	--8.94922	-13.51503	-4.8043	-5.1387	-5.4628	-8.0082	-4.5509	-5.358
Exp. duration	5.9	7.6	26	3.5	13.3	1.0	3.9	7.2
S.E.	0.00008		0.0101		0.00527		0.01178	
Log. Likelihood	1637.884		543.138		660.442		518.8696	

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Table 5.3.3-G 6-Factor model with MRSR-2 Regimes, using Fama & French as broad market proxy.

Table 5.3.3-H 6-Factor model with MRSR-2 Regimes, using Fama & French as broad market proxy.

	6-Factor, JPxWP		6-Factor, SRI		6-Factor, ESG		6-Factor, ISLAMIC	
Data begins	2007.10		2007.10		2007.10		2007.10	
	Regime 1	Regime 2	Regime 1	Regime 2	Regime 1	Regime 2	Regime 1	Regime 2
C	0.00001	0	-0.00015	0.0058 *	0.00011	0.00074 ***	0.00237 *	-0.00195 *
β_{MKT}	0.99986 ***	0.10000 ***	1.0375 ***	0.7715 ***	1.02901 ***	0.7833 ***	0.8982 ***	1.0835 ***
β_{SMB}	-0.00094	0.00001	-0.0317	-0.1886	-0.03297 *	-0.0085 ***	0.1855 ***	0.0134
β_{HML}	0.00027	0.00006	0.0499	-0.2731 **	-0.00412	-0.1478 ***	0.2727 **	-0.0638
β_{RMW}	-0.00101	0.00002	0.0658	-0.3367	0.06187 *	-0.3889 ***	0.5863 ***	0.2675 **
β_{CMA}	0.00051	-0.00004	-0.1367 **	0.3244	-0.00895	-0.2717 ***	-0.2599 **	0.1893 ***
mom	0.00002	0.000004	0.0091	0.1313 *	-0.0109	-0.0549 ***	-0.0353	0.0405
Log(SIGMA)	-8.8895	-13.08264	-4.9085	-4.87765	-5.4999	-9.39336	-4.8670	-4.8158
Exp. duration	6.1	8.9	13	2.8	16.4	1.2	4.8	8.5
S.E.	0.00009		0.0103		0.005338		0.01178	
Log. Likelihood	1596.634		549.0600		674.98		518.8696	

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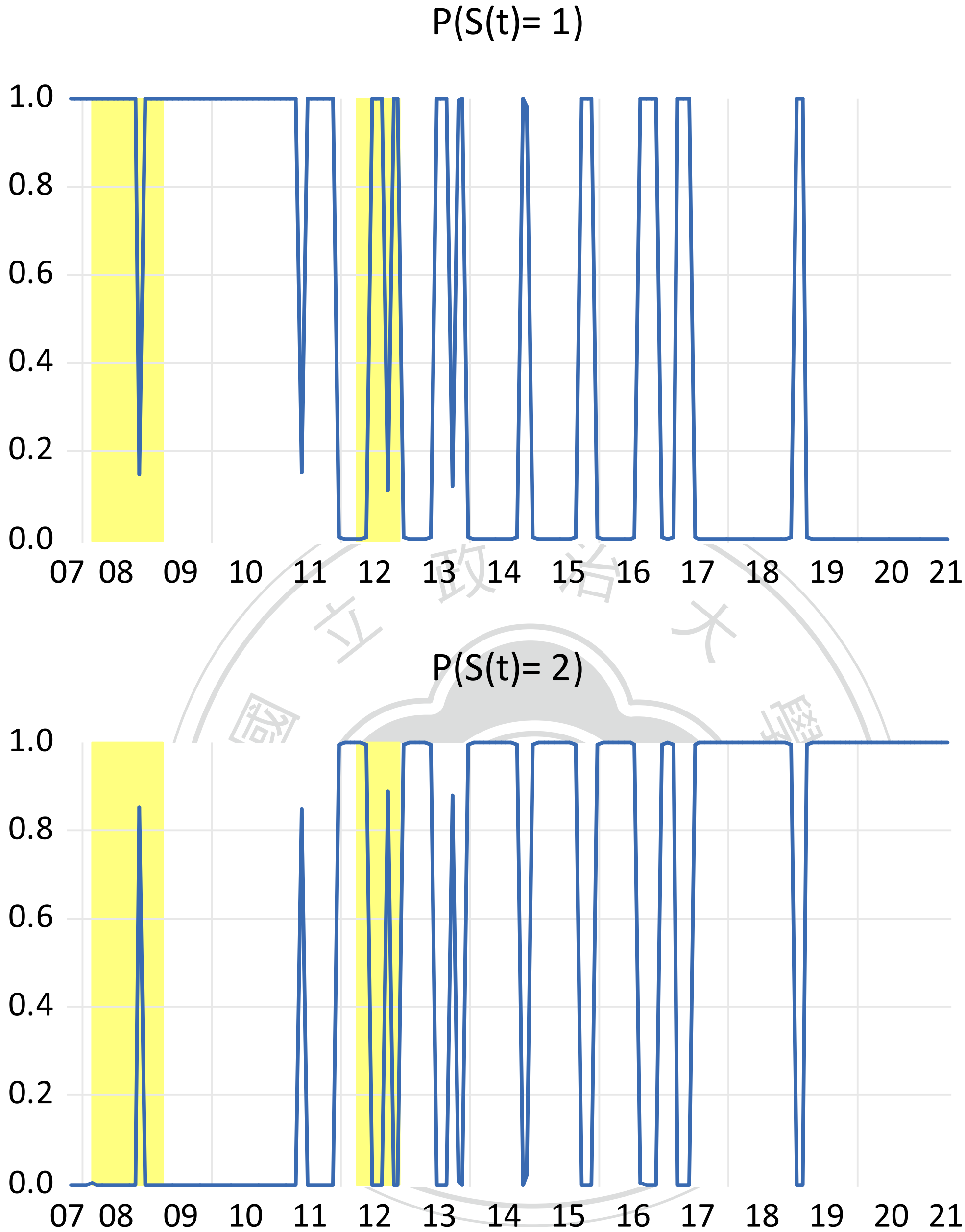
Fig 5.3.3-A Markov Switching Smoothed Regime Probabilities, CAPM for Japan ex. Weapon



* Shaded area (light yellow or gray) are economic recession according to Japan Government

Figure 5.3.3-A Japan ex. Weapon using CAPM MS-2 Probabilities

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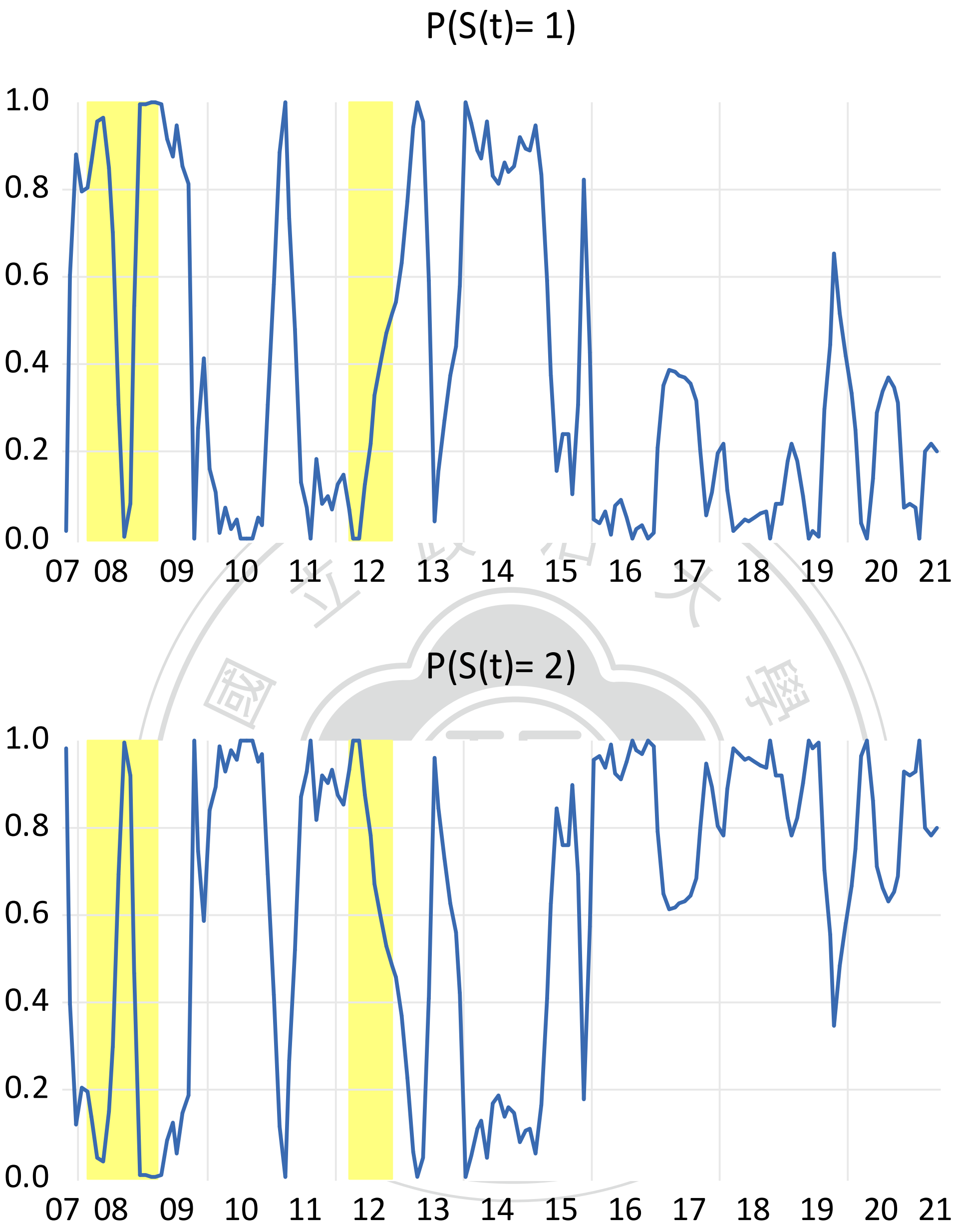
Fig 5.3.3-B Markov Switching Smoothed Regime Probabilities, 6-Factor Model with Japan Islamic



* Shaded area (light yellow or gray) are economic recession according to Japan Government

Figure 5.3.3-B Japan 6-Factor for Islamic excess return using MS-2 Probabilities

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The results in Table 5.3.3-F indicate that applying MRSR to the CAPM generates statistical significance in at least one regime. In addition, β_{MKT} is significantly different for the SRI and Islamic indexes in both regimes. This demonstrates a strong argument that heteroscedasticity exists in the mean and variance for both SRI and Islamic indexes, where both exhibit market betas (risk factor) significantly lower than one and excess returns (alpha) in the regime with the lower β_{MKT}.

The results of applying MRSR to the four-factor model indicate that the ESG Index exhibits a regime with a β_{MKT} substantially lower than one and a statistically significant alpha (Table 5.3.3F). In addition, the Islamic Index loses its alpha during the regime with a lower β_{MKT} in the four-factor model.

The six-factor model indicates that the Japanese Islamic Index has two statistically significant differences between regimes in mean returns (alpha). Furthermore, the two regimes also have statistically significant β_{MKT} values; Regime 1 is close to 0.9, whereas Regime 2 is greater than 1.

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6.0 Empirical Results from the Asia Pacific excluding Japan

This section determines whether heteroscedasticity in returns and variance exists in the Asia Pacific (excluding Japan) stock market. The methodology and workflow are the same as that of the previous sections. The objective is to determine if the model can capture the difference in mean returns and variance among regimes and identify statistically significant differences among the four proxies for RI in the Asia Pacific (namely MSCI Pacific ex. Japan and ex Weapons Index, MSCI Pacific ex. Japan SRI Index, MSCI Pacific ex. Japan ESG Index, and MSCI Pacific ex. Japan Islamic Index) and in the broad market, represented by FFMKT, through the graphical approach, the simple statistical test approach, and the risk factor model (with OLS) approach. Then, the approach using risk factor models and MRSR (Markov regime-switching regression) is used to identify differences between the intercept and risk factors.

6.1 Data for Asia Pacific (excluding Japan) Market

The data for the risk factor model are from Wharton Research Data Services and are cross-checking and referenced against the materials from the Kenneth French Data Library. In addition, the MSCI Pacific (ex. Japan) Index and MSCI Pacific (ex. Japan) IMI Index data are downloaded from the MSCI website for historical end of day data to serve as alternative proxies for the Asia Pacific (ex. Japan) broad market.

Based on Fama and French (2012) and the description of the data on French's website, the Asia Pacific (ex. Japan) region comprises stock markets in Australia, Hong Kong, New Zealand, and Singapore. The MSCI Pacific (ex. Japan) Index family is identical to that used by Fama and French. The MSCI Pacific (ex. Japan) Index has been available since January 1990 and is a few months older than the data of Fama and French.

Fama and French constructed their factor risk model using market data from the Bloomberg database for the Asia Pacific (ex. Japan) markets. Because Fama and French researched from a US perspective, the risk-free rate is the 1-month US Treasury bill rate from Ibbotson Associates. They also used the top 90% of market capitalization as the breakpoint for large companies outside the United States rather than the top and bottom 30%. This is because the bottom 10% of small-size companies, big firms in the Asia Pacific (ex. Japan),

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may only be mid-size firms in the USA.

The data became available in May 2006, and MSCI Pacific (ex. Japan) ex Controversial Weapons Index is the earliest RI-related index for the MSCI family in Japan. Like the MSCI USA ex Weapons Index, this index adopts the negative screening approach, whereby firms involving the production of bombs, landmines, chemical and biological weapons, and depleted uranium weapons are excluded from investment.

Like the MSCI KLD Index, the MSCI Pacific (ex. Japan) SRI Index applies negative screening and best-in-class approaches. Companies related to adult entertainment, alcohol, firearms, weapons (both civilian and military), gambling, genetically modified organisms (foods), nuclear power, thermal coal, and tobacco are excluded, and companies with the highest ESG scores from each sector are selected on the basis of sector weight in the Asia Pacific market.

The MSCI Pacific (ex. Japan) ESG Leader Index adopts only the best-in-class approach. Unlike its US counterpart, no sector is excluded. It only includes the top ESG companies that account for 50% of each industry; where socially acceptalbe companies are in accordance to local culture. The MSCI Pacific (ex. Japan) Islamic Index follows the same principles as its Japanese and US counterparts.

The MSCI Pacific (ex. Japan) Islamic Index is developed based on the "Sharia principles," i.e., Islamic social and moral teaching. In addition to negatively screening on: Adult Entertainment, Alcohol, Firearms and Weapons (both Civilian and Military), Gambling, Genetically Modified Organisms (foods), Nuclear Power, and Tobacco; it extension exclusion conventional financial services and "pork-related products." The threshold for the above activities is that it cannot generate more than 5% from such business activities (i.e., supermarket channel should have profit from "pork" related product less than 5%). In addition, companies cannot have "excessive leverage" according to Sharia investment principles. In general, for a company to satisfy Sharia guidelines, its financial ratio on a. total debt to total assets; b. cash investment into interest-bearing securities over total assets; and c. accounts receivables and cash equivalents over total assets; should not exceed 33.33%.

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Table 6.1-A Label Summary for Data for Asia Pacific (ex. Japan) Stocks' Market

Table 6.1-A Label Summary for Data for Asia Pacific (ex. Japan) Stocks' Market

Variables	Details	Sources
RF	Risk-Free Rate, 1-M U.S. Treasury Bill rate	Ken French Data Lib. & WRDS
FFMKT	FF Excess Return, i.e., MKT return minus RF	As above
FF3_SMB	SMB Factor from 3-Factor Model	As above
FF3_HML	HML Factor from 3-Factor Model	As above
FF5_SMB	SMB Factor from 5-Factor Model	As above
FF5_HML	HML Factor from 5-Factor Model	As above
FF5_RMW	RMW Factor from 5-Factor Model	As above
FF5_CMA	CMA Factor from 5-Factor Model	As above
FF_MOM	Momentum Factor calculated by Fama & French	As above
MSCI	MSCI Japan Index	MSCI
MSCI IMI	MSCI IMI Index (addition small cap)	MSCI
SRIxWP	MSCI Japan excluding weapon Index	MSCI
ESG	MSCI Japan ESG Lead Index	MSCI
SRI	MSCI Japan SRI Index	MSCI
Islamic	MSCI Japan Islamic Index	MSCI

* Please noted that RI-related indexes generally have a shorter data period.

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Table 6.1-B Summary Statistics for Asia Pacific (excluding Japan)

Table 6.1-B Summary Statistics for Asia Pacific (excluding Japan)

	RF	MSCIMKT	FFMKT	FF3_SMB	FF3_HML	FF5_SMB	FF5_HML	FF5_RMW	FF5_CMA	FF_MOM
Mean	0.002168	0.004532	0.006700	-0.002876	0.005721	-0.001508	0.005721	0.002931	0.003201	0.008264
Median	0.001900	0.007612	0.009900	-0.003750	0.005400	-0.002750	0.005400	0.003750	0.003750	0.011500
Maximum	0.006800	0.186368	0.205200	0.124100	0.237000	0.133000	0.237000	0.111400	0.084600	0.108800
Minimum	0.000000	-0.288503	-0.260000	-0.116900	-0.089100	-0.114300	-0.089100	-0.122000	-0.076700	-0.367700
Std. Dev.	0.001817	0.058840	0.057497	0.029238	0.029475	0.028850	0.029475	0.026478	0.023893	0.042913
Skewness	0.278466	-0.708362	-0.364943	0.280271	1.492701	0.417302	1.492701	-0.199229	0.056848	-2.925200
Kurtosis	1.782156	5.885051	5.516629	5.285203	13.87667	5.629039	13.87667	6.127150	4.812318	22.69585
Jarque-Bera	26.45143	152.3768	101.2758	81.66130	1876.414	112.2241	1876.414	146.5831	48.63701	6156.411
Probability	0.000002	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
Sum	0.767400	1.604470	2.371700	-1.018200	2.025100	-0.533900	2.025100	1.037600	1.133200	2.892500
Sum Sq. Dev.	0.001166	1.222117	1.166978	0.301773	0.306687	0.293812	0.306687	0.247491	0.201515	0.642704
Observations	354	354	354	354	354	354	354	354	354	350

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Table 6.1-C Correlation Table Table 6.1-A Correlation Table for Asia Pacific (ex. Japan) data sets

Correlation	RF	MSCIMKT	FFMKT	FF3_SMB	FF3_HML	FF5_SMB	FF5_HML	FF5_RMW	FF5_CMA	FF_MOM
RF	1.000000									
MSCIMKT	-0.051604	1.000000								
FFMKT	-0.042879	0.981514	1.000000							
FF3_SMB	-0.086182	-0.080732	-0.012474	1.000000						
FF3_HML	0.020586	0.062209	0.125530	-0.053137	1.000000					
FF5_SMB	-0.077500	-0.089566	-0.014881	0.985732	0.082932	1.000000				
FF5_HML	0.020586	0.062209	0.125530	-0.053137	1.000000	0.082932	1.000000			
FF5_RMW	0.034980	-0.312478	-0.382722	-0.172225	-0.610322	-0.220585	-0.610322	1.000000		
FF5_CMA	0.055785	-0.469086	-0.478908	-0.101091	0.177131	-0.059842	0.177131	0.170392	1.000000	
FF_MOM	0.009288	-0.209295	-0.220963	0.062466	-0.297115	0.023409	-0.297115	0.239401	0.172775	1.000000

Correlation Table is constraint availability of Fama & French momentum data which starts in November 1990 instead of earlier date with other factors.

The excess returns in the Fama and French and MSCI Pacific (ex. Japan) Index data have a high correlation of 0.98. The Fama and French excess returns have a mean of 0.0067%, whereas those of the MSCI Index have a mean of 0.004535% (Table 6.1-C).

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Table 6.1-D Summary Statistics for Asia Pacific (excluding Japan) RIs

Table 6.1-D Summary Statistics for Asia Pacific (excluding Japan) RI

	SRI_XWP	SRI	ISLAMIC	ESG
Data Begins at	2006.06	2007.10	2007.07	2007.10
Mean	0.00475	0.00244	0.00250	0.00245
Median	0.01145	0.00753	0.01042	0.00759
Maximum	0.14065	0.14284	0.15058	0.14553
Minimum	-0.28877	-0.26771	-0.32168	-0.27684
Std. Dev.	0.06019	0.06198	0.06496	0.06126
Skewness	-1.00341	-0.76253	-1.08617	-0.91165
Kurtosis	6.53122	5.14159	7.17564	5.64775
Jarque-Bera	112.04102	42.33751	139.39185	63.30185
Probability	0.00000	0.00000	0.00000	0.00000
Sum	0.77347	0.35888	0.37684	0.36052
Sum Sq. Dev.	0.58699	0.56078	0.63297	0.54790
Observations	163	147	151	147

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Table 6.1-E Unit Root Test for Intercept, Asia Pacific (ex. Japan)

Table 6.1-E Unit Root Test for Intercept, Asia Pacific (ex. Japan)

Excess Returns	Dickey-Fuller GLS	KPSS	Phillips-Perron
MSCI	-6.7690 ***	0.0465 +++	-17.0131 ***
Fama & French	-7.2155 ***	0.0383 +++	-16.6960 ***
FF-3 SMB	-3.9303 ***	0.0433 +++	-15.9472 ***
FF-3 HML	-2.6476 ***	0.2798 +++	-17.7658 ***
MOM	-13.3696 ***	0.0472 +++	-14.8112 ***
FF-5 SMB	-2.4445 **	0.0387 +++	-15.4561 ***
FF-5 HML	-2.6476 ***	0.2798 +++	-17.7658 ***
FF5-RMW	-2.3247 **	0.0678 +++	-17.4314 ***
FF5-CMA	-16.8505 ***	0.0668 +++	-17.5097 ***
EGS	-3.2220 ***	0.0711 +++	-10.7427 ***
Islamic	-9.6310 ***	0.0413 +++	-10.8094 ***
SRI	-3.1510 ***	0.0809 +++	-10.8652 ***
SRI_xWP	-10.7945 ***	0.0296 +++	-10.8387 ***

Notes:

1. *, **, and *** denotes the rejection of the null hypothesis with the probability of ρ is less than 1%, 5%, and 10% criterial levels. Both Dickey-Fuller with GLS detrending and Phillips-Perron Test have null hypotheses assuming "the time series has a unit root."
2. +, ++, +++ denotes for the "No Rejection" of the null hypothesis with the probability of ρ is less than 10%, 5%, and 1% critical value. The null hypothesis for Kwiatkowski–Phillips–Schmidt–Shin Test is assuming that time series is stationary, i.e., without a unit root.

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Table 6.1-F Unit Root Test for Intercept & Trend, Asia Pacific (ex. Japan)

Table 6.1-F Unit Root Test for Intercept & Trend, Asia Pacific (ex. Japan)

Excess Returns	Dickey-Fuller GLS	KPSS	Phillips-Perron
MSCI	-15.6539 ***	0.0425 +++	-16.9908 ***
Fama & French	-15.7169 ***	0.0379 +++	-16.6723 ***
FF-3 SMB	-14.0568 ***	0.0419 +++	-15.9238 ***
FF-3 HML	-15.9663 ***	0.0944 +++	-17.9693 ***
MOM	-14.5064 ***	0.0474 +++	-14.7887 ***
FF-5 SMB	-13.6911 ***	0.0377 +++	-15.4353 ***
FF-5 HML	-15.9663 ***	0.0944 +++	-17.9693 ***
FF5-RMW	-4.8077 ***	0.0637 +++	-16.4284 ***
FF5-CMA	-17.3560 ***	0.0348 +++	-17.5004 ***
EGS	-8.9480 ***	0.0591 +++	-10.7447 ***
Islamic	-10.3965 ***	0.0305 +++	-10.7631 ***
SRI	-8.8789 ***	0.0582 +++	-10.8818 ***
SRI_xWP	-10.7830 ***	0.0290 +++	-10.8070 ***

Notes:

1. *, **, and *** denotes the rejection of the null hypothesis with the probability of ρ is less than 1%, 5%, and 10% criterial levels. Both Dickey-Fuller with GLS detrending and Phillips-Perron Test have null hypotheses assuming "the time series has a unit root."
2. +, ++, +++ denotes for the "No Rejection" of the null hypothesis with the probability of ρ is less than 10%, 5%, and 1% critical value. The null hypothesis for Kwiatkowski–Phillips–Schmidt–Shin Test is assuming that time series is stationary, i.e., without a unit root.

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6.2 Empirical Testing for the Asia Pacific (ex. Japan) Market

This section tests for statistically significant differences between the two market proxies, FFMK and MSCI, using the graphical approach, the simple statistical test approach, and the risk factor model (with OLS) approach. Then, MRSR (dynamic Markov regimes switching regression) is applied to the risk factor models to identify differences between the intercept and risk factors.

6.2.1 The Graphical Approach

Figure 6.2.1A presents the proxies for the excess returns of the Asia Pacific (ex. Japan) stock market using data from November 1990 to December 2019.

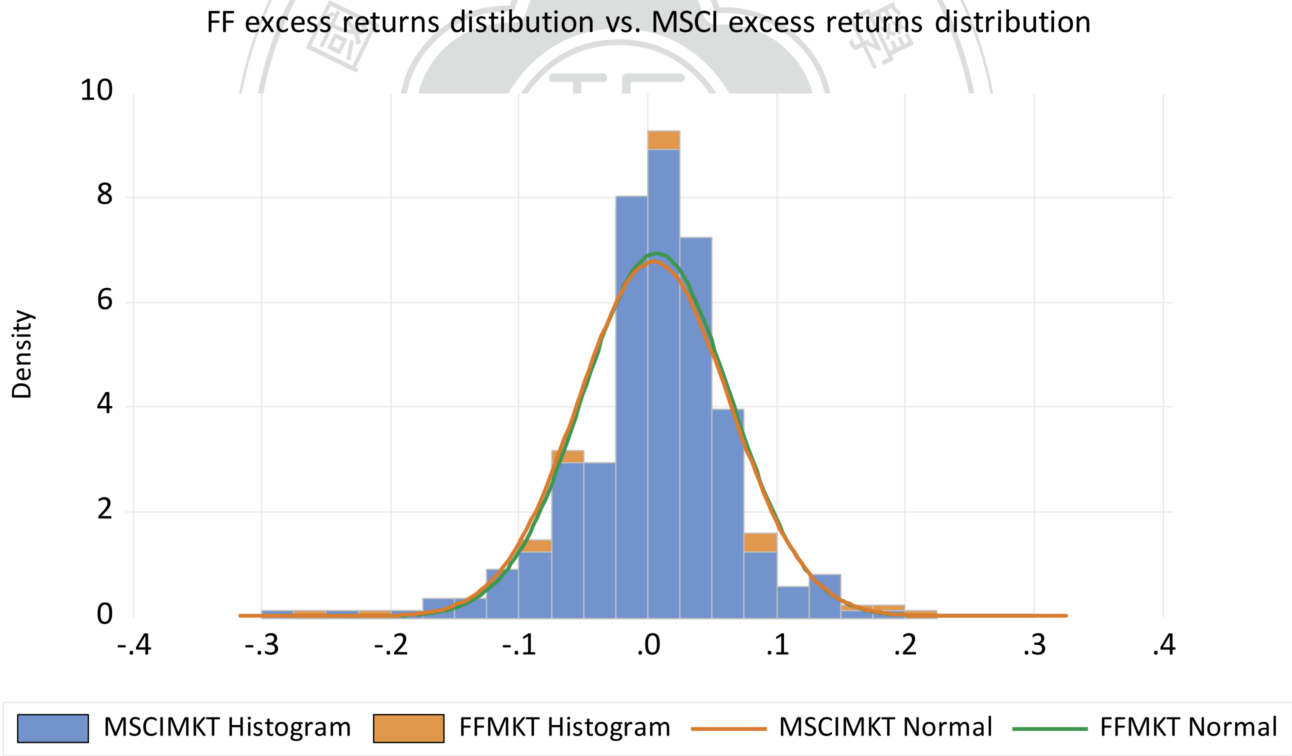

Figure 6.2.1-A Asia Pacific (ex. Japan) excess return distributions

The MSCI and Fama and French data overlap with minor differences (Figure 6.2.1A). The pattern of excess returns in the Fama and French data is remarkably similar to that of the MSCI Pacific (ex. Japan) Index data. Periods of recession in Japan are used as a proxy for the general economic environment, and the areas shaded in light gray represent economic

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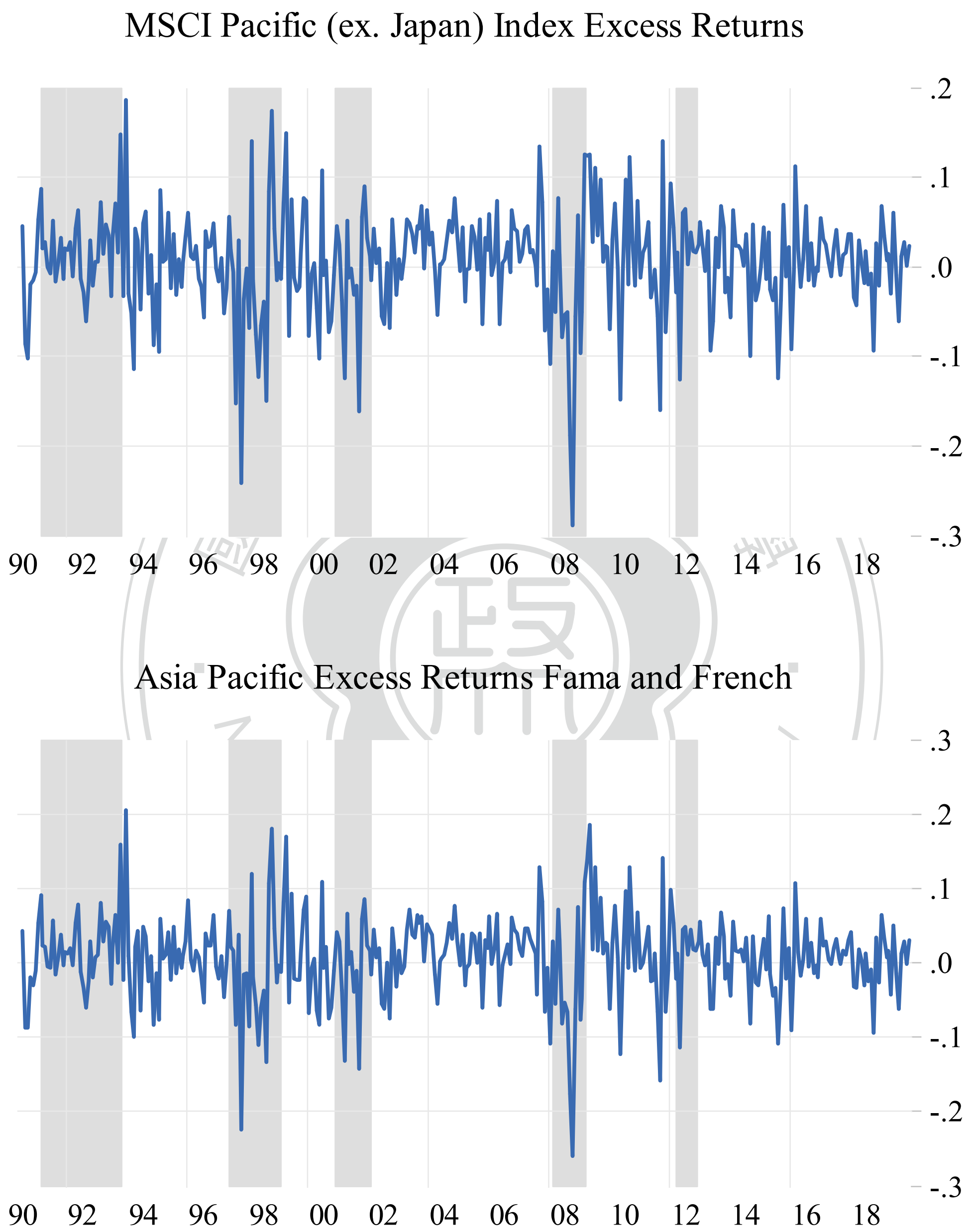
recession. After the Asian financial crisis, the stock market is associated with extremely high volatility in excess returns, although this is not always the case. In addition, excess returns from 2002 to before the financial crisis behave stably.



* Grey area are recession period defined by Japanese Government

Figure 6.2.1-B Asia Pacific (ex.Japan) Excess Returns Time Series

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6.2.2 Simple Equality Test for the Asia Pacific (ex. Japan) Market's excess return

According to the EMH, strong efficient forms of markets should not exhibit any long-term excess returns. However, the Asia Pacific (ex. Japan) stock market exhibits statistically significant mean excess returns, which contradicts the EMH.

Table 6.2.2-A Hypothesis Testing if means are statistical significance different from zero (0)

	Fama & French	MSCI Pacific (ex. JP)
Mean	0.0067 **	0.004532
ρ-value for t-statistic	0.0290	0.1481

Note: * and ** denotes the rejection of the null hypothesis for 1% and 5%, criteria levels, respectively.

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The results of the equality test for means indicate that excess returns for the MSCI and Fama and French data are not significantly different; this is an expected result because both are proxies for the Asia Pacific (ex. Japan) stock market.

Table 6.2.2-B Equality Test for Means for the Asia Pacific (ex. Japan)

Method	df	Value	Probability
t-test	706	-0.495672	0.6203
Satterthwaite-Welch t-test*	705.6241	-0.495672	0.6203
Anova F-test	(1, 706)	0.245691	0.6203
Welch F-test*	(1, 705.624)	0.245691	0.6203

*Test allows for unequal cell variances

Analysis of Variance

Source of Variation	df	Sum of Sq.	Mean Sq.
Between	1	0.000831	0.000831
Within	706	2.389096	0.003384
Total	707	2.389927	0.003380

Category Statistics

Variable	Count	Mean	Std. Dev.	Std. Err. of Mean
MSCIMKT	354	0.004532	0.058840	0.003127
FFMKT	354	0.006700	0.057497	0.003056
All	708	0.005616	0.058141	0.002185

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The results of the equality test for variance also indicate no significant difference between the MSCI and Fama and French data.

Table 6.2.2-C Equality Test for variance for Asia Pacific (ex. Japan)

Method		df	Value	Probability	
F-test		(353, 353)	1.04725	0.66474	
Siegel-Tukey			0.40885	0.68265	
Bartlett		1	0.18781	0.66474	
Levene		(1, 706)	0.09452	0.75860	
Brown-Forsythe		(1, 706)	0.10147	0.75016	
Category Statistics					
			Mean Abs.	Mean Abs.	Mean Tukey-
Variable	Count	Std. Dev.	Mean Diff.	Median Diff.	Siegel Rank
MSCIMKT	354	0.05884	0.04234	0.04228	351.35593
FFMKT	354	0.05750	0.04141	0.04131	357.64407
All	708	0.05814	0.04188	0.04179	354.50000
Bartlett weighted standard deviation:			0.058172		

However, the results of the simple hypothesis test (to determine whether the mean is statistically significantly different from zero) suggest a minor difference between the two data sets. The mean of the MSCI data is not different from zero, and that of the Fama and French excess returns for the Asia Pacific (ex. Japan) differs from zero, which indicates a positive alpha (relative to the 1-month US treasury bills). This does not imply that the EMH does not apply to the Asia Pacific because the risk-free rate is related to US investors, and a proper test for the EMH in the Asia Pacific must consider local risk-free rates rather than US risk-free rates.

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6.2.3 Comparison with Risk Models: OLS vs. MRSR

The left side of the equation for the six-factor model, namely expected returns E(R_i), is a proxy in the Fama and French excess return data, FFMKT. The right side, namely the market risk factor βMKT, is a proxy in the MSCI Pacific (ex. Japan) excess return data, MSCI.

Table 6.2.3-A Empirical Results of Risk Factor Model using OLS method

Table 6.2.3-A Empirical Results of Risk Factor Model using OLS method

	CAPM	3-Factor	4-Factor	5-Factor	6-Factor
C	0.00235 ***	0.00199 ***	0.00198 ***	0.00263 ***	0.00256 ***
β_{MKT}	0.95937 ***	0.96165 ***	0.96113 ***	0.93872 ***	0.93824 ***
β_{SMB}		0.13661 ***	0.13886 ***	0.11231 ***	-0.11319 ***
β_{HML}		0.13069 ***	0.13236 ***	0.07680 **	0.08209 ***
β_{CMA}				-0.08973 ***	-0.08892 ***
β_{RMW}				-0.05968 **	-0.06433 **
β_{MOM}			0.0009		0.007565
Adj. R^2	0.96378	0.97252	0.97215	0.97364	0.97333
S.E.	0.01094	0.0095	0.00957	0.00933	0.00936
Log. Likelihood	1097.032	1146.923	1133.152	1155.338	1141.740

The results of using OLS for different risk factor models are consistent with those in the literature. The results of the six-factor model for Asia Pacific (ex. Japan) are different from those for the United States and Japan; it does not increase explanatory power, and the five-factor model alone is sufficient. Momentum may only exist on the country level and not at the regional level because of currency exchange. Therefore, pursuing past winners is not feasible.

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Table 6.2.3-B Empirical Results of Risk Factor Model using MRSR-2 Regimes

Table 6.2.3-B Empirical Results of Risk Factor Model using MRSR-2 Regimes

Variables	CAPM		3-Factor		4-Factor	
	Regime 1	Regime 2	Regime 1	Regime 2	Regime 1	Regime 2
C	0.00075	0.0047***	0.0054 ***	0.0001***	0.00003	0.0054***
β_{MKT}	0.9543***	0.9643***	0.9510***	0.9909***	0.9912***	0.9518***
β_{SMB}			0.1518***	0.1467***	0.1512***	0.1515***
β_{HML}			0.1163***	0.1477***	0.1505***	0.1186***
β_{MOM}					-0.0008	0.03712
Log (SIGMA)	-4.9767	-4.2256	-4.2952	-5.1277	-5.1389	-4.2966
Exp. duration	21.5	13.9	10.5	23.4	22.2	10.2
S.E.	0.00109		0.009524		0.00958	
Log. Likelihood	1126.161		1186.72		1173.309	

Notes:

1. *, **, and *** denotes the rejection of the null hypothesis with the probability of ρ is less than 10%, 5%, and 1% criterial levels.

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Table 6.2.3-C Empirical Results of Risk Factor Model using MRSR-2 Regimes

Table 6.2.3-C Empirical Results of Risk Factor Model using MRSR-2 Regimes

Variables	5-Factor		6-Factor		6-Factor TVTP	
	Regime 1	Regime 2	Regime 1	Regime 2	Regime 1	Regime 2
C	0.0012*	0.0057***	0.00236***	0.00308***	0.0015***	0.00276***
β_{MKT}	0.9720***	0.9106***	0.9561***	0.9274***	0.9951***	0.9145***
β_{SMB}	0.1151***	0.1272**	0.01542***	0.04692	0.1804***	0.0507**
β_{HML}	0.0636**	0.1104*	0.06683***	0.1974***	0.0805***	0.1601***
β_{RMW}	-0.01413***	-0.0274	-0.1652***	0.1688	0.0960***	-0.0504
β_{CMA}	0.0444	0.1203**	-0.1031***	0.0657	-0.0981***	-0.0703***
β_{MOM}			-0.0542***	0.0668***	-0.0758***	0.0660***
Log (SIGMA)	-5.1382	-4.291	-5.1254	-4.4373	-5.368	-4.5606
Exp. duration	30.6	11.2	46.8	18.9	37.7	17.96
S.E.	0.0092		0.00884		0.00877	
Log. Likelihood	1204.922		1198.524		1199.560	

The results indicate heteroscedasticity in the means and variances in the Asia Pacific (ex. Japan) (Table 6.2.3-B, and Table 6.2.3-C). The value premium is statistically significant in every model regardless of regime. This suggests that it is a crucial variable for the Asia Pacific (ex. Japan). In addition, both the six-factor model with MRSR and the six-factor model with time-varying transition probability capture the momentum reversal between Regime 1 and Regime 2. This demonstrates inconsistency in momentum beta and investor caution.

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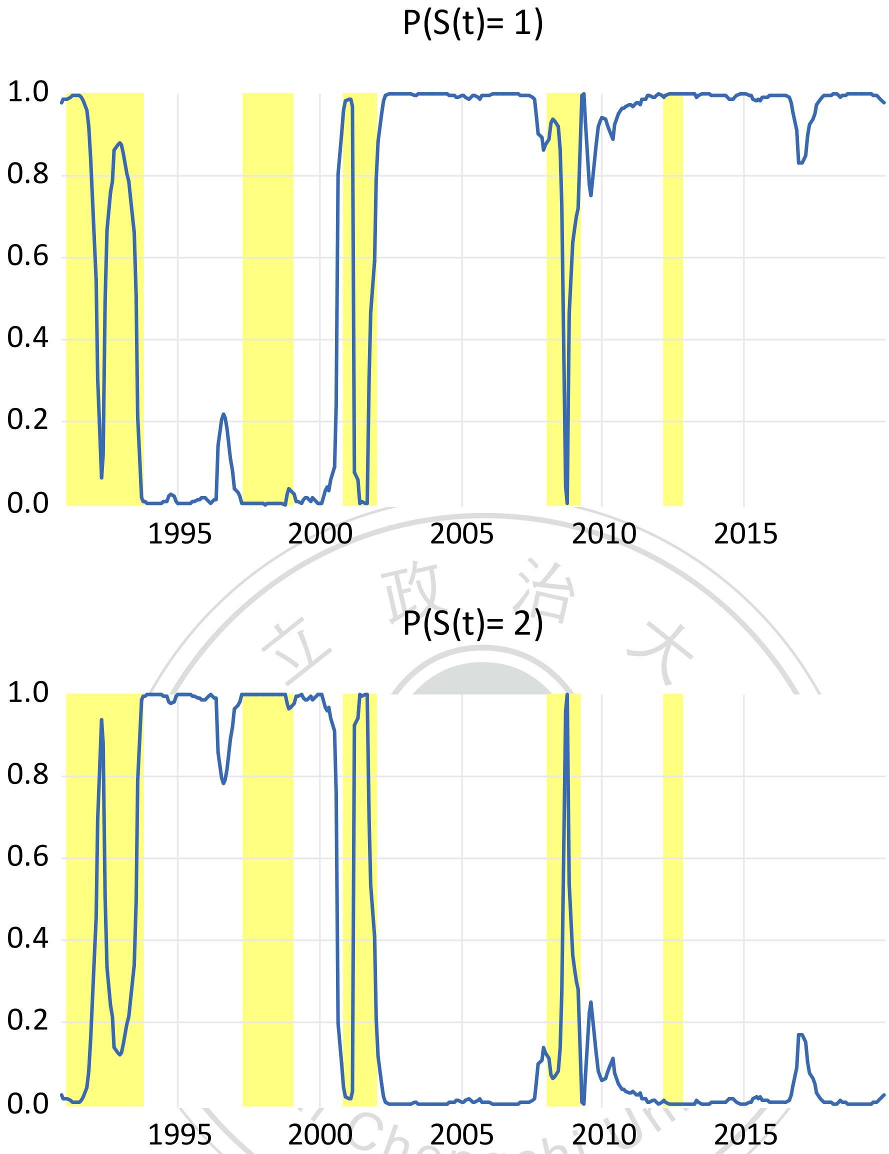
Fig 6.2.3-A Markov Switching Smoothed Regime Probabilities, 6-Factor Model in Asia Paicif (ex. Japan)



* Japanese economic recession period are shown in light yellow (or gray) areas

Figure 6.2.3-A Asia Pacific (ex. Japan) 6-Factor Model with Regime Switch Probabilities

Statistically significant heteroscedasticity exists in the means and variance of Asia Pacific (ex Japan), although it is small when compared with that of Japan and the United States.

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6.3 Empirical Testing for RIs in the Asia Pacific (ex. Japan) Market

This section tests for statistically significant differences between the four Asia Pacific (ex. Japan) proxies for RI [namely the MSCI Asia Pacific (ex. Japan) ex Weapons Index, the MSCI ESG Index, the MSCI SRI Index, and the MSCI Islamic Index] and FFMKT (market proxy used by Fama and French) using the graphical approach, the simple statistical test approach, and the risk factor model (with OLS) approach. Then, MRSR is applied to the risk factor models to identify differences between the intercept and risk factors.

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6.3.1 The Graphical Approach

Figure 6.3.1-A presents the proxies for the excess returns of the Asia Pacific (ex. Japan) stock market using data from October 2007 to May 2021. Although all four series have a normal-like distribution, a tail on the left side is evident.

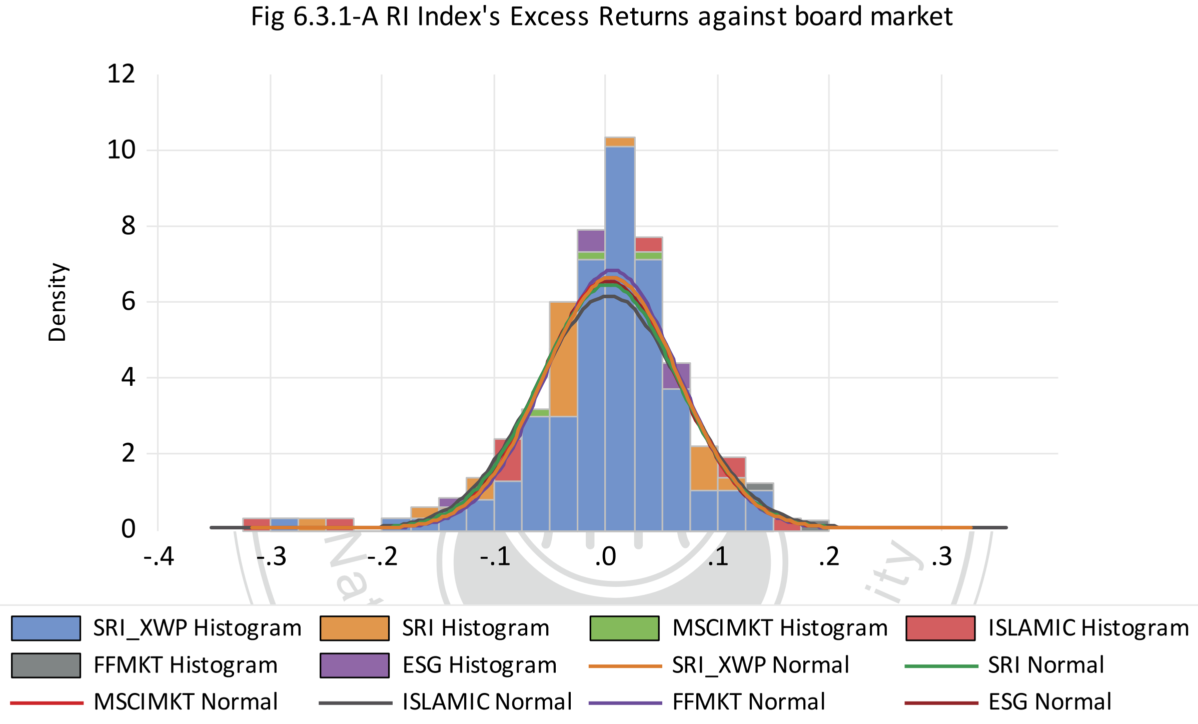

Figure 6.3.1-A RI excess returns in Asia Pacific (ex. Japan)

The disparity in excess returns is wider during recessions than during other periods, especially during the 2008 financial crisis. Therefore, heteroscedasticity should exist in the RI indexes (Figure 6.3.1-B).

DOI:10.6814/NCCU202101665

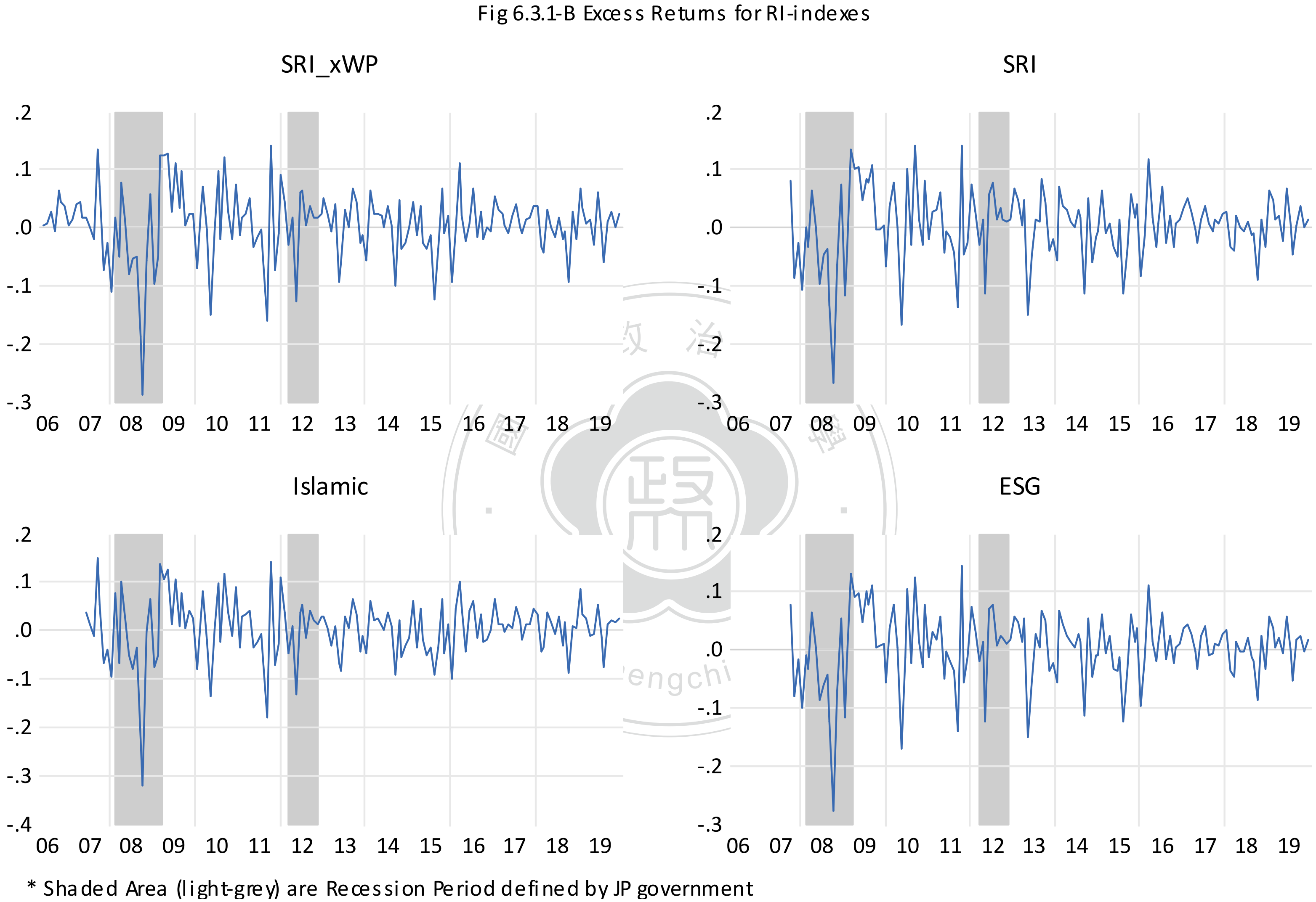

Figure 6.3.1-B Excess Return Time Series for Asia Pacific (ex. Japan) Indexes

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6.3.2 Simple Equality Test

The results of the simple equality test indicate that the Asia Pacific markets (ex. Japan) are consistent with the EMH in that the mean returns for the RI indexes are not statistically different from zero (Table 6.3.2A). This is somewhat inconsistent with the conventional understanding in the investment community that the market rewards premiums.

Table 6.3.2-A Hypothesis Testing if means are different from zero.

Table 6.3.2-A Hypothesis Testing if means are different from zero.

	JPxWP	SRI	ESG	Islamic
Data begins	2006.06	2007.10	2007.	2007.06
Mean	0.004745	0.002441	0.002452	0.002496
ρ-value for t-statistic	0.3157	0.6336	0.6281	0.6376

Note: *, **, and *** denotes the rejection of the null hypothesis for 1%, 5%, and 10%, criteria levels, respectively.

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Table 6.3.2-B Equality Test for means for data sets.

Method		df	Value	Probability
Anova F-test		(3, 604)	0.05372	0.98358
Welch F-test*		(3, 334.056)	0.05572	0.98267
*Test allows for unequal cell variances				
Analysis of Variance				
Source of Variation		df	Sum of Sq.	Mean Sq.
Between		3	0.00062	0.00021
Within		604	2.32864	0.00386
Total		607	2.32926	0.00384
Category Statistics				
				Std. Err.
Variable	Count	Mean	Std. Dev.	of Mean
ESG	147	0.00245	0.06126	0.00505
ISLAMIC	151	0.00250	0.06496	0.00529
SRI	147	0.00244	0.06198	0.00511
SRI_XWP	163	0.00475	0.06019	0.00471
All	608	0.00308	0.06195	0.00251

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Table 6.3.2-C Equality Test for variance for data sets.

Table 6.3.2-C Equality Test for variance for data sets.

Method		df	Value	Probability
Bartlett		3	0.98720	0.80435
Levene		(3, 604)	0.25894	0.85497
Brown-Forsythe		(3, 604)	0.19815	0.89766
Category Statistics				
			Mean Abs.	Mean Abs.
Variable	Count	Std. Dev.	Mean Diff.	Median Diff.
ESG	147	0.06126	0.04416	0.04393
ISLAMIC	151	0.06496	0.04677	0.04614
SRI	147	0.06198	0.04501	0.04473
SRI_XWP	163	0.06019	0.04257	0.04241
All	608	0.06195	0.04459	0.04427
Bartlett weighted standard deviation:			0.062092	

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6.3.3 Comparison with Risk Models: OLS vs. MRSR

Table 6.3.3-A 6-Factor model-OLS, using Fama & French as broad market proxy.

	6-Factor, SRIxWP	6-Factor, SRI	6-Factor, ESG	6-Factor, ISLAMIC
Data begins	2006.06	2007.10	2007.10	2007.06
C	-0.0030***	-0.0038***	-0.0041***	-0.0027
β_{MKT}	1.0560***	1.05199***	1.04882***	1.0048***
β_{SMB}	-0.1164***	-0.10554*	-0.0290	-0.1281*
β_{HML}	-0.0904***	-0.1771**	-0.1582**	-0.1968**
β_{RMW}	0.2261***	0.5544***	0.5955***	-0.0021
β_{CMA}	0.1047***	0.2486***	0.2496***	0.06989
mom	0.0478***	0.0102	0.0566	0.0596
Adj. R^2	0.9862	0.9385	0.9428	0.9189
S.E.	0.00707	0.01537	0.0146	0.0185
Log. Likelihood	579.521	408.772	415.865	391.81

Note: *, **, and *** denotes the rejection of the null hypothesis for 1%, 5%, and 10%, criteria levels, respectively.

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Table 6.3.3-B 6-Factor model with MRSR-2 Regimes, using Fama & French as broad market proxy.

Table 6.3.3-B 6-Factor model with MRSR-2 Regimes, using Fama & French as broad market proxy.

	6-Factor, SRIxWP		6-Factor, SRI		6-Factor, ESG		6-Factor, ISLAMIC	
Data begins	2006.06		2007.10		2007.10		2007.06	
	Regime 1	Regime 2	Regime 1	Regime 2	Regime 1	Regime 2	Regime 1	Regime 2
C	-0.0008	-0.0032***	-0.0021	-0.0039***	-0.0033	-0.0040***	-0.0028*	-0.01468***
β_{MKT}	0.9892***	1.1273 ***	1.0297***	1.0569	1.1025***	1.0306***	0.9963***	1.3514***
β_{SMB}	-0.1616***	-0.1022**	-0.3088***	0.0804*	-0.2237	-0.0967**	-0.1582***	0.6364***
β_{HML}	-0.1617***	0.0329	-0.32220***	-0.0488	-0.0266	-0.3258***	-0.2156***	1.8424***
β_{RMW}	0.0859*	0.2924***	0.1991	0.7942***	0.4630***	0.6641***	0.0500	0.1054
β_{CMA}	0.1352***	0.0797	0.4320***	0.0609	0.04037***	0.1399	0.0204	-0.1052
mom	0.0567***	-0.017538	-0.1475*	0.1744***	-0.1163	0.1387***	0.04475	-0.7865***
Log(SIGMA)	-5.5556	-5.0576	-4.1388	-5.632	-4.2280	-4.9535	-4.1794	-5.6855
Exp. duration	2.1	2.0	2.5	1.6	16.4	1.2	4.8	8.5
S.E.	0.00748		0.0161		0.00152		0.01746	
Log. Likelihood	598.358		420.8347		428.501		415.842	

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Fig 6.3.3-A Markov Switching Smoothed Regime Probabilities, ESG (Asia Pacific ex. Japan), 6-Factor

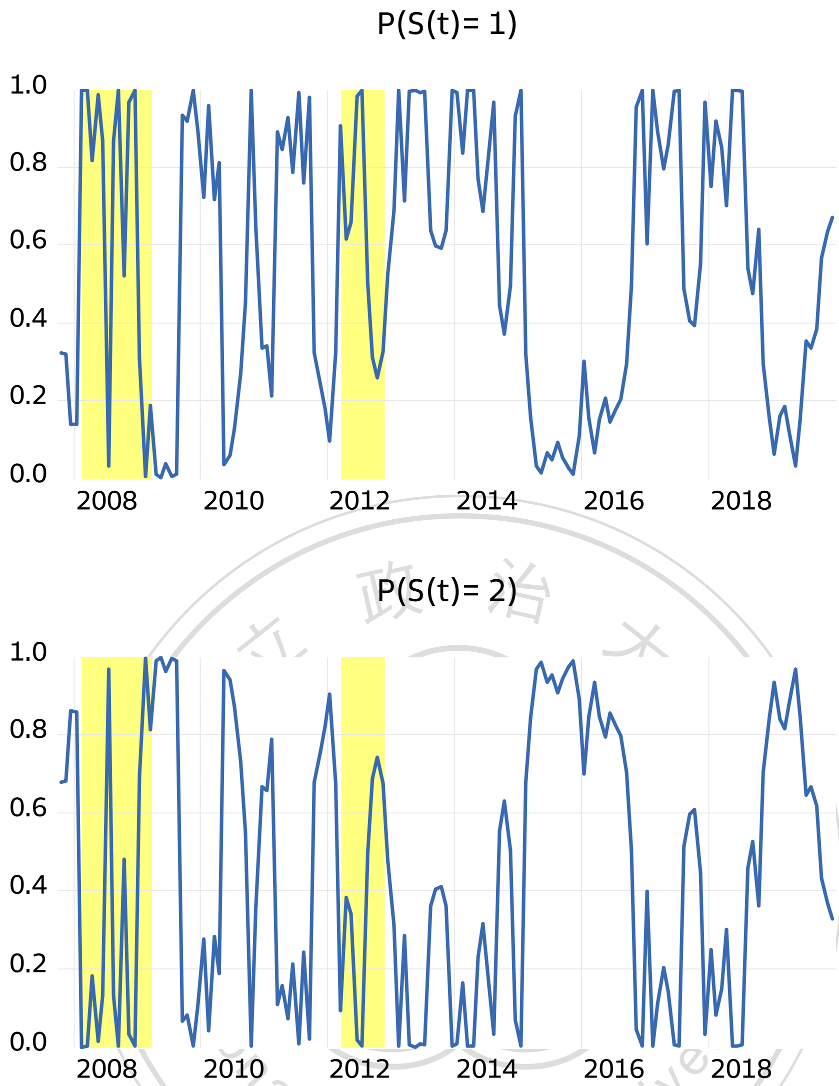

Figure 6.3.3-A 6-Facor ESG excess returns regime probabilities

RI in the Asia Pacific has a significant negative alpha. However, in a regime with a low βMKT, both SRI (ex. Weapons) and the Islamic Index have excess returns that are significantly close to zero, indicating superior performance to that in other regimes.

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7.0 Empirical Results from Europe

This section explores whether heteroscedasticity in returns and variance exists in the European stock market. The methodology and workflow are the same as in the previous sections. The objectives are to determine if the model can capture the differences in mean returns and variance among regimes and to identify statistically significant differences between the three proxies for RI in the European market (namely the MSCI Europe SRI Index, the MSCI Europe ESG Index, and the MSCI Europe Index) and the broad market, represented by FFMKT (the data used by Fama and French), through the graphical approach, the simple statistical test approach, and the risk factor model (with OLS) approach. Subsequently, MRSR (Markov dynamic regression) is applied to the risk factor models to identify the intercept and risk factors differently.

7.1 Data for Europe Market

The data for the risk factor model are from Wharton Research Data Services and are cross-checked and referenced against the monthly data from the Kenneth French Data Library. In addition, the MSCI Europe Index data are downloaded from the MSCI website for historical end-of-day data to serve as alternative proxies for the broad European market.

Based on Fama and French (2012) and the descriptions of the data on French's website, the European region comprises stock markets in Austria, Belgium, Denmark, Finland, Germany, Great Britain, Greece, Ireland, Italy, the Netherlands, Norway, Portugal, Spain, Sweden, and Switzerland. The MSCI Europe index family consists of similar countries to Fama and French, with Greece being the exception; the MSCI includes Greece in the MSCI emerging market family. However, because of Greece's capital size relative to that of other countries in the European region, the effect of its inclusion would be minimal.

Fama and French constructed their factor risk model using market data from the Bloomberg database for the European markets. The bottom 10% of small-size companies, that is, big firms in Europe, may only be mid-size firms in the USA. Like the MSCI KLD Index, the MSCI Europe SRI Index applies both negative screening and the best-in-class approach. The MSCI Europe ESG Leader Index adopts only the best-in-class approach. Unlike its US counterpart, no sector is excluded, and it only includes the top ESG companies that account for 50% of each industry. The MSCI Europe Islamic Index follows the same

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principles as its US, Japanese, and Asia Pacific counterparts.

Like the MSCI KLD index, the MSCI Europe SRI index applies negative screening and the "Best-in-Class" approach. Firstly, Adult Entertainment, Alcohol, Firearms and Weapons (both Civilian and Military), Gambling, Genetically Modified Organisms (foods), Nuclear Power, Thermal coal (and fossil fuel), and Tobacco firms are excluded from the investable universe. Secondly, companies with the best ESG scores from each sector are composed according to sector weight in the Japanese market.

The MSCI Europe, ESG Leader Index, adopted only the "Best-in-Class" approach; unlike the US counterpart, no sector is eliminated. It only includes the top ESG companies that account for 50% of each industry. Alcoholic companies, such as Asahi Breweries, are considered a socially acceptable companies to be investing in.

The MSCI Europe Islamic Index is developed based on the "Sharia principles," i.e., Islamic social and moral teaching. In addition to negatively screening on: Adult Entertainment, Alcohol, Firearms and Weapons (both Civilian and Military), Gambling, Genetically Modified Organisms (foods), Nuclear Power, and Tobacco; its extension exclusion conventional financial services and "pork-related products." The threshold for the above activities is that it cannot generate more than 5% from such business activities (i.e., supermarket channel should have profit from "pork" related product less than 5%). In addition, companies cannot have "excessive leverage" according to Sharia investment principles. In general, for a company to satisfy Sharia guidelines, its financial ratio on a. total debt to total assets; b. cash investment into interest-bearing securities over total assets; and c. accounts receivables and cash equivalents over total assets; should not exceed 33.33%.

Table 7.1-A Label Summary for Data for Europe Stocks' Market

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Table 7.1-A Label Summary for Data for Europe Stocks' Market

Variables	Details	Sources
RF	Risk-Free Rate, 1-M U.S. Treasury Bill rate	Ken French Data Lib. & WRDS
FFMKT	FF Excess Return, i.e., MKT return minus RF	As above
FF3_SMB	SMB Factor from 3-Factor Model	As above
FF3_HML	HML Factor from 3-Factor Model	As above
FF5_SMB	SMB Factor from 5-Factor Model	As above
FF5_HML	HML Factor from 5-Factor Model	As above
FF5_RMW	RMW Factor from 5-Factor Model	As above
FF5_CMA	CMA Factor from 5-Factor Model	As above
FF_MOM	Momentum Factor calculated by Fama & French	As above
MSCI	MSCI Europe Index	MSCI
ESG	MSCI Europe ESG Lead Index	MSCI
SRI	MSCI Europe SRI Index	MSCI
Islamic	MSCI Europe Islamic Index	MSCI

* Please noted that RI-related indexes generally have a shorter data period.

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Table 7.1-B Summary Statistics for Europe' Data sets

Table 7.1-B Summary Statistics for Europe' Data sets

	MSCI	FF	FF3_SMB	FF3_HML	FF5_SMB	FF5_HML	FF5_RMW	FF5_CMA	MOM
Mean	0.00444	0.00580	0.00034	0.00234	0.00089	0.00234	0.00382	0.00088	0.00884
Median	0.00833	0.00780	0.00090	0.00290	0.00150	0.00290	0.00450	-0.00010	0.01120
Maximum	0.15716	0.16620	0.09390	0.11160	0.08830	0.11160	0.06400	0.08770	0.13650
Minimum	-0.23956	-0.22020	-0.06960	-0.11300	-0.07330	-0.11300	-0.05000	-0.07300	-0.26090
Std. Dev.	0.04981	0.04887	0.02180	0.02548	0.02137	0.02548	0.01586	0.01809	0.03967
Skewness	-0.72043	-0.53917	-0.06149	0.20571	-0.06783	0.20571	-0.30434	0.35404	-1.37869
Kurtosis	5.09871	4.77807	4.08903	6.44803	3.95668	6.44803	3.91681	6.48185	10.90555
Jarque-Bera	99.09999	66.12639	18.36705	184.38985	14.27699	184.38985	18.51848	193.05194	1071.95881
Probability	0.00000	0.00000	0.00010	0.00000	0.00079	0.00000	0.00010	0.00000	0.00000
Sum	1.63032	2.13030	0.12630	0.85950	0.32600	0.85950	1.40190	0.32440	3.24610
Sum Sq. Dev.	0.90796	0.87405	0.17394	0.23757	0.16722	0.23757	0.09210	0.11974	0.57604
Observations	367	367	367	367	367	367	367	367	367

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Table 7.1-C Correlation Table for Europe' Data sets

Table 7.1-CCorrelation Table for Europe' Data sets

Correlation	MSCI	FF	FF3_SMB	FF3_HML	FF5_SMB	FF5_HML	FF5_RMW	FF5_CMA	MOM
MSCI	1.00000								
FF	0.99260	1.00000							
FF3_SMB	-0.17866	-0.10677	1.00000						
FF3_HML	0.23588	0.23764	-0.07489	1.00000					
FF5_SMB	-0.17558	-0.10289	0.99373	0.00628	1.00000				
FF5_HML	0.23588	0.23764	-0.07489	1.00000	0.00628	1.00000			
FF5_RMW	-0.29589	-0.30424	0.01680	-0.56586	-0.00433	-0.56586	1.00000		
FF5_CMA	-0.25325	-0.25565	-0.07329	0.57342	-0.02172	0.57342	-0.21174	1.00000	
MOM	-0.35386	-0.34910	0.08172	-0.35422	0.06180	-0.35422	0.44000	-0.01682	1.00000

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Table 7.1-D Summary Statistics for Europe RI's Data Sets

	ESG	SRI	ISLAMIC
Stating Date	2007.10	2007.10	2007.10
Mean	0.00266	0.00379	0.00352
Median	0.00640	0.00754	0.00840
Maximum	0.15139	0.14770	0.13714
Minimum	-0.22864	-0.26403	-0.18952
Std. Dev.	0.05678	0.05708	0.05380
Skewness	-0.69395	-0.81115	-0.66216
Kurtosis	4.58731	5.57525	4.19138
Jarque-Bera	30.37975	63.30227	21.68362
Probability	0.00000	0.00000	0.00002
Sum	0.43702	0.62185	0.57769
Sum Sq. Dev.	0.52542	0.53103	0.47182
Observations	164	164	164

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Table 7.1-E Unit Root Test for Intercept, Europe Data Sets

Table 7.1-E Unit Root Test for Intercept, Europe Data Sets

Excess Returns	Dickey-Fuller GLS	KPSS	Phillips-Perron
MSCI	-6.7690 ***	0.0465 +++	-17.0131 ***
Fama & French	-7.2155 ***	0.0383 +++	-16.6960 ***
FF-3 SMB	-3.9303 ***	0.0433 +++	-15.9472 ***
FF-3 HML	-2.6476 ***	0.2798 +++	-17.7658 ***
MOM	-13.3696 ***	0.0472 +++	-14.8112 ***
FF-5 SMB	-2.4445 **	0.0387 +++	-15.4561 ***
FF-5 HML	-2.6476 ***	0.2798 +++	-17.7658 ***
FF5-RMW	-2.3247 **	0.0678 +++	-17.4314 ***
FF5-CMA	-16.8505 ***	0.0668 +++	-17.5097 ***
EGS	-3.2220 ***	0.0711 +++	-10.7427 ***
Islamic	-9.6310 ***	0.0413 +++	-10.8094 ***
SRI	-3.1510 ***	0.0809 +++	-10.8652 ***

Notes:

1. *, **, and *** denotes the rejection of the null hypothesis with the probability of ρ is less than 1%, 5%, and 10% criterial levels. Both Dickey-Fuller with GLS detrending and Phillips-Perron Test have null hypotheses assuming "the time series has a unit root."
2. +, ++, +++ denotes for the "No Rejection" of the null hypothesis with the probability of ρ is less than 10%, 5%, and 1% critical value. The null hypothesis for Kwiatkowski–Phillips–Schmidt–Shin Test is assuming that time series is stationary, i.e., without a unit root.

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Table 7.1-F Unit Root Test for Intercept & Trend, Europe Data Sets

Table 7.1-F Unit Root Test for Intercept & Trend, Europe Data Sets

Excess Returns	Dickey-Fuller GLS	KPSS	Phillips-Perron
MSCI	-15.6539 ***	0.0425 +++	-16.9908 ***
Fama & French	-15.7169 ***	0.0379 +++	-16.6723 ***
FF-3 SMB	-14.0568 ***	0.0419 +++	-15.9238 ***
FF-3 HML	-15.9663 ***	0.0944 +++	-17.9693 ***
MOM	-14.5064 ***	0.0474 +++	-14.7887 ***
FF-5 SMB	-13.6911 ***	0.0377 +++	-15.4353 ***
FF-5 HML	-15.9663 ***	0.0944 +++	-17.9693 ***
FF5-RMW	-4.8077 ***	0.0637 +++	-16.4284 ***
FF5-CMA	-17.3560 ***	0.0348 +++	-17.5004 ***
EGS	-8.9480 ***	0.0591 +++	-10.7447 ***
Islamic	-10.3965 ***	0.0305 +++	-10.7631 ***
SRI	-8.8789 ***	0.0582 +++	-10.8818 ***

Notes:

1. *, **, and *** denotes the rejection of the null hypothesis with the probability of ρ is less than 1%, 5%, and 10% criterial levels. Both Dickey-Fuller with GLS detrending and Phillips-Perron Test have null hypotheses assuming "the time series has a unit root."
2. +, ++, +++ denotes for the "No Rejection" of the null hypothesis with the probability of ρ is less than 10%, 5%, and 1% critical value. The null hypothesis for Kwiatkowski–Phillips–Schmidt–Shin Test is assuming that time series is stationary, i.e., without a unit root.

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7.2 Empirical Testing for the Europe Market

This section tests for statistically significant differences between the two market proxies, FFMK and MSCI, through the graphical approach, the simple statistical test approach, and the risk factor model (with OLS) approach. Subsequently, MRSR (dynamic Markov regimes switching regression) is applied to the risk factors models to identify differences between the intercept and risk factors.

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7.2.1 The Graphical Approach

Figure 7.2.1-A presents the proxies for the excess returns of the European broad stock market using data from November 1990 to May 2021.

Fig 7.2.1-A Europe Excess Return Distributions, MSCI vs. FF

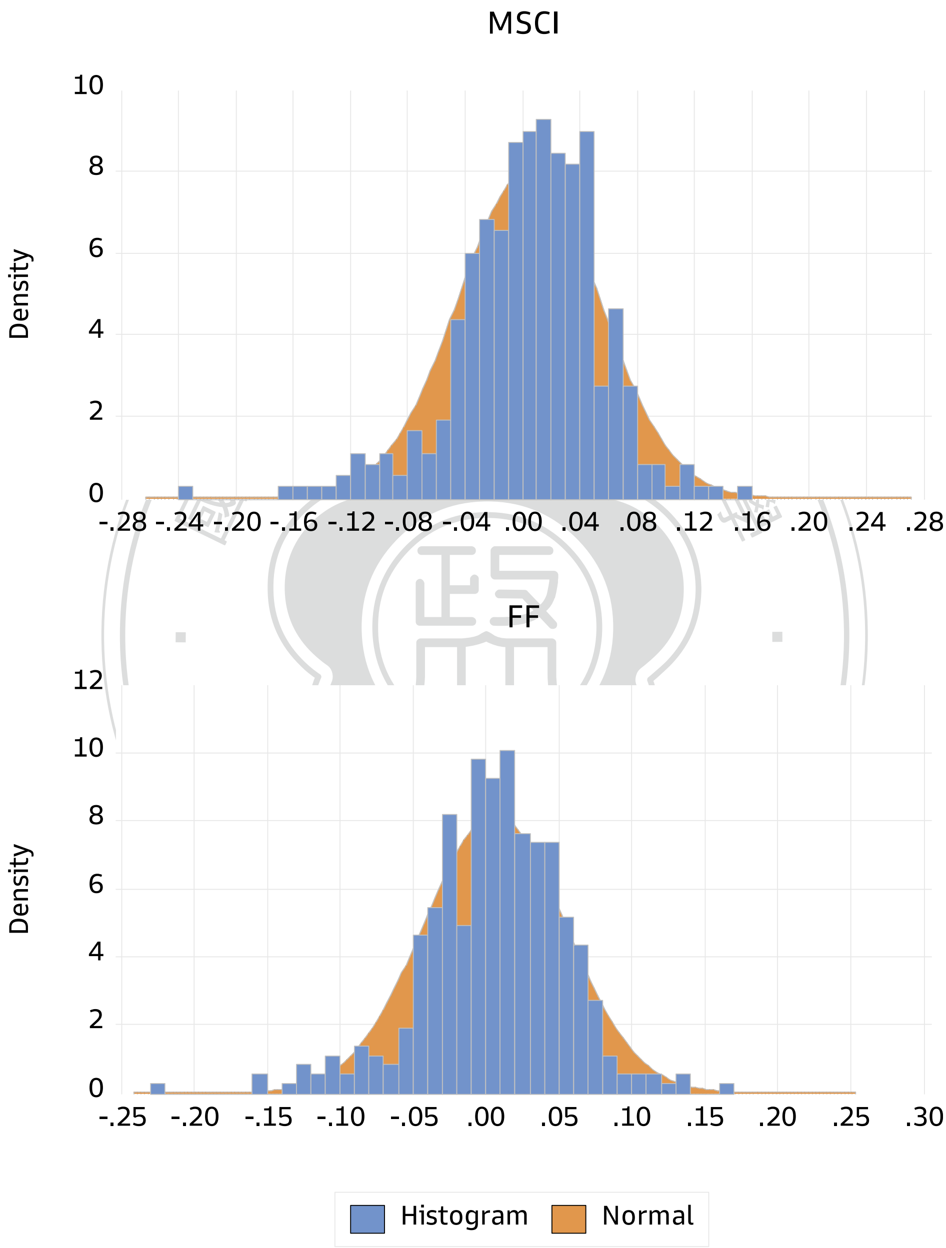

Figure 7.2.1-A Excess Return distribution for Europe

Although histogram distributions are similar between MSCI Europe and FF Europe, the distributions are not normal-like, as in the United States, Japan, and the Asia Pacific. Instead, the distribution exhibits a fat tail on the left and a small fat tail on the right. The central mass

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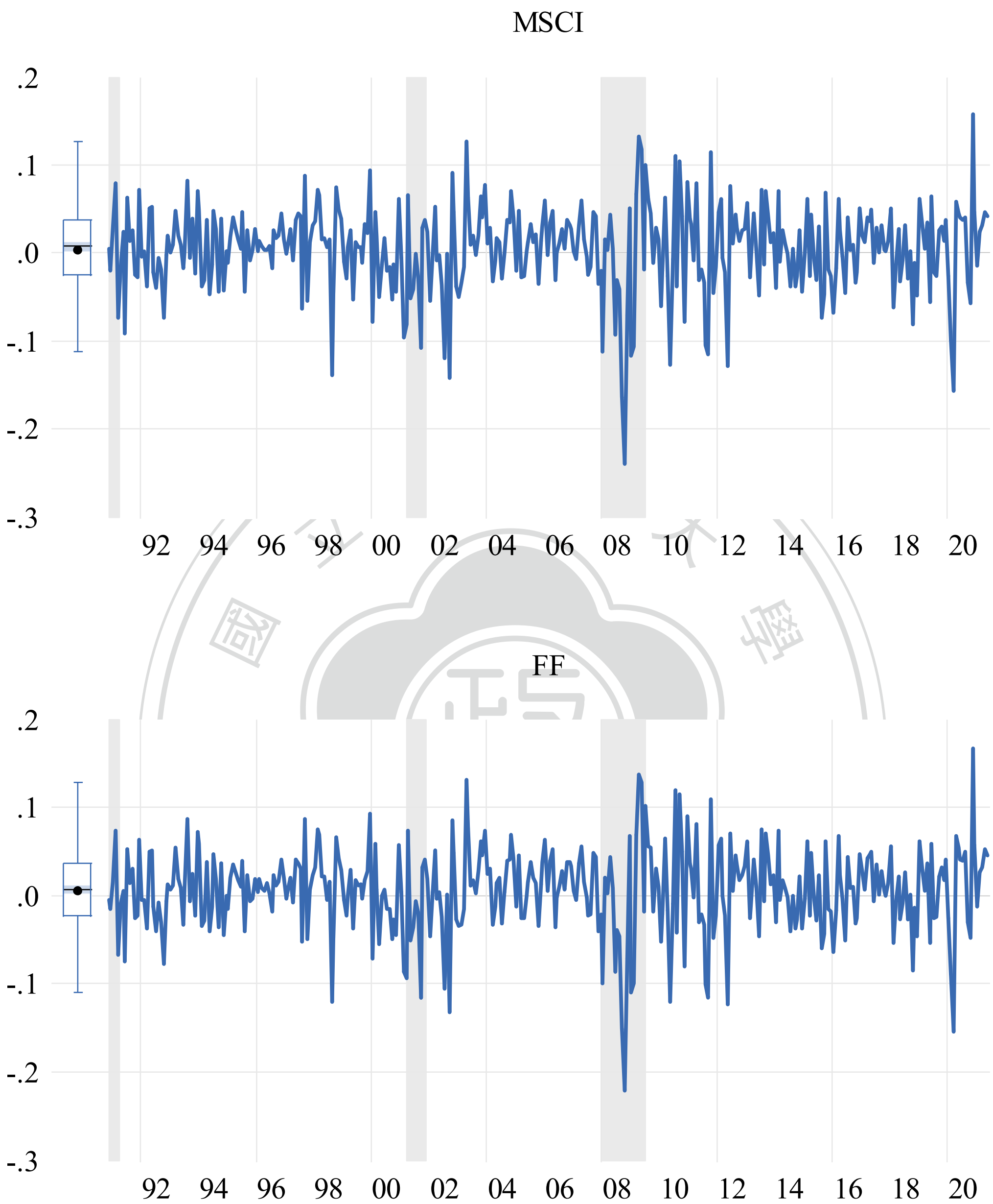
of the distributions is dense between −0.05 and 0.10.

Fig 7.2.1-B Europe Excess Returns, MSCI vs. FF



Shaded Area are economic recession period according to NBER

Figure 7.2.1-B Excess Returns Time Series for Europe

Periods of recession in the United States are used as a proxy for the general economic environment, and the parts shaded in light gray represent economic recession. As with Asia and Japan, the stock market exhibits a strong association with extremely high volatility in excess returns during economic downturns, although this is not always the case; this is especially visible in the 2008 financial crisis. Excess returns from 2002 to before the financial

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crisis behave stably.

7.2.2 Simple Equality Test for Europe Market's excess return

According to the EMH, strong efficient forms of markets should not exhibit any long-term excess returns. However, the European stock market exhibits statistically significant mean excess returns, which contradicts the EMH.

Table 7.2.2-A Hypothesis Testing if means are statistical significance different from zero (0)

	Fama & French	MSCI Europe
Mean	0.0058 **	0.0044 *
ρ-value for t-statistic	0.0235	0.0.884

Note: * and ** denotes the rejection of the null hypothesis for 1% and 5%, criteria levels, respectively.

The results of the equality test for means indicate that excess returns for the MSCI and Fama and French data are not significantly different; this is an expected result because both are proxies for the European stock market.

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Table 7.2.2-B Equality for Means, between MSCI Europe and FF Europe

Method		df	Value	Probability
t-test		732	-0.37403	0.70849
Satterthwaite-Welch t-test*		731.73501	-0.37403	0.70849
Anova F-test		(1, 732)	0.13990	0.70849
Welch F-test*		(1, 731.735)	0.13990	0.70849
*Test allows for unequal cell variances				
Analysis of Variance				
Source of Variation		df	Sum of Sq.	Mean Sq.
Between		1	0.00034	0.00034
Within		732	1.78201	0.00243
Total		733	1.78235	0.00243
Category Statistics				
				Std. Err.
Variable	Count	Mean	Std. Dev.	of Mean
MSCI	367	0.00444	0.04981	0.00260
FF	367	0.00580	0.04887	0.00255
All	734	0.00512	0.04931	0.00182

The results of the equality test for variance between the MSCI and Fama and French data also indicate no significant difference and confirm that both are similar proxies for the European market.

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Table 7.2.1-C Equality for variances, between MSCI Europe and FF Europe

Table 7.2.2-CEquality for variances, between MSCI Europe and FF Europe

Method		df	Value	Probability	
F-test		(366, 366)	1.03880	0.71597	
Siegel-Tukey			0.25381	0.79964	
Bartlett		1	0.13239	0.71597	
Levene		(1, 732)	0.08172	0.77506	
Brown-Forsythe		(1, 732)	0.07471	0.78468	
Category Statistics					
			Mean Abs.	Mean Abs.	Mean Tukey-
Variable	Count	Std. Dev.	Mean Diff.	Median Diff.	Siegel Rank
MSCI	367	0.04981	0.03735	0.03726	365.51226
FF	367	0.04887	0.03666	0.03660	369.48774
All	734	0.04931	0.03700	0.03693	367.50000
Bartlett weighted standard deviation: 0.049340					

The results suggest a minor nonsignificant difference between the MSCI and FF data sets for the European market. Although the MSCI and FF data exhibit statistically significant mean excess returns, this does not indicate alpha in the European market; it might be due to the risk-free rate being relative to US investors, and the proper test for the EMH in the European market must consider local risk-free rates rather than US risk-free rates alone.

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7.2.3 Comparison with Risk Models: OLS vs. MRSR

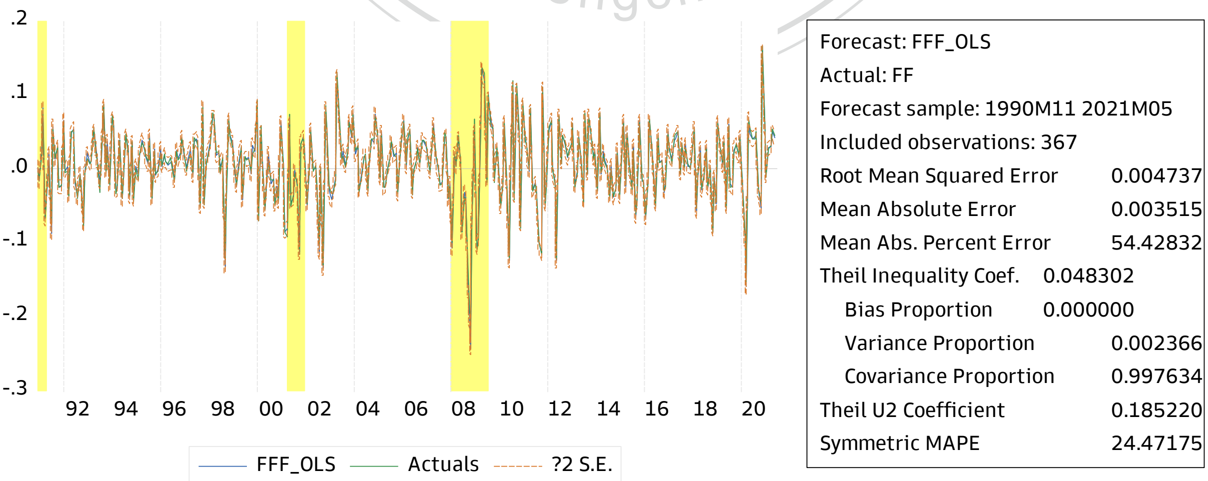
The left side of the equation for the six-factor model, namely expected returns E(R_i), is the proxy for excess return in Fama and French, FFMKT. The right side, namely the market risk factor βMKT, is the proxy for excess return in MSCI Europe, MSCI.

Table 7.2.3-A Empirical Results of Risk Factor Model using OLS method

Table 7.2.3-A Empirical Results of Risk Factor Model using OLS method

	CAPM	3-Factor	4-Factor	5-Factor	6-Factor
C	0.00148 ***	0.00134 ***	0.0013 ***	0.00142***	0.00137 ***
MKT	0.97389 ***	0.98526 ***	0.98613 ***	0.98571***	0.9866 ***
β_{SMB}		0.16389 ***	0.16382 ***	0.1682***	0.1677 ***
β_{HML}		0.01198	0.1369	-0.0127	-0.01039
β_{CMA}				-0.0307	-0.0355 *
β_{RMW}				-0.0056	0.0037
β_{MOM}			0.0038		0.0066
Adj. R^2	0.98521	0.99036	0.99033	0.99904	0.9904
S.E.	0.005942	0.004799	0.0048	0.004776	0.0048
Log. Likelihood	1361.389	1440.837	1440.985	1443.595	1444.007

Fig 7.2.3-A Europe 5-Factor Model (OLS) Forecast



8Shaded Area (light-yellow or gray) are economic recession according to NBER

Figure 7.2.3-A Europe 5-Factor (OLS) Forecast

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Table 7.2.3-B Empirical Results of Risk Factor Model using MRSR-2 Regimes

Table 7.2.3-B Empirical Results of Risk Factor Model using MRSR-2 Regimes

Variables	5-Factor		6-Factor		6-Factor TVTP	
	Regime 1	Regime 2	Regime 1	Regime 2	Regime 1	Regime 2
C	0.0023***	0.0008***	0.0025***	0.0005***	0.0005	0.0019***
β_{MKT}	0.9829***	0.9908***	0.9829***	0.9915***	1.0056***	0.9720***
β_{SMB}	0.1232***	0.2075***	0.01223***	0.2073***	0.1807***	0.1673***
β_{HML}	-0.0439	0.0347	-0.0506	0.0441**	0.0405**	-0.0615*
β_{RMW}	-0.0375	0.0060	-0.0341	-0.0011	0.0361	0.0898**
β_{CMA}	0.0245	-0.0278	0.0315	-0.0409**	-0.0681***	0.1013**
β_{MOM}			-0.0115	0.0246***	0.0253***	0.0235
Log (SIGMA)	-4.9579	-5.7606	-4.943	-5.7793	-5.9535	-5.1631
Exp. duration	8.6	22.6	7.1	20.3	2.2	2.0
S.E.	0.00479		0.00481		0.00485	
Log. Likelihood	1481.776		1486.298		1471.145	

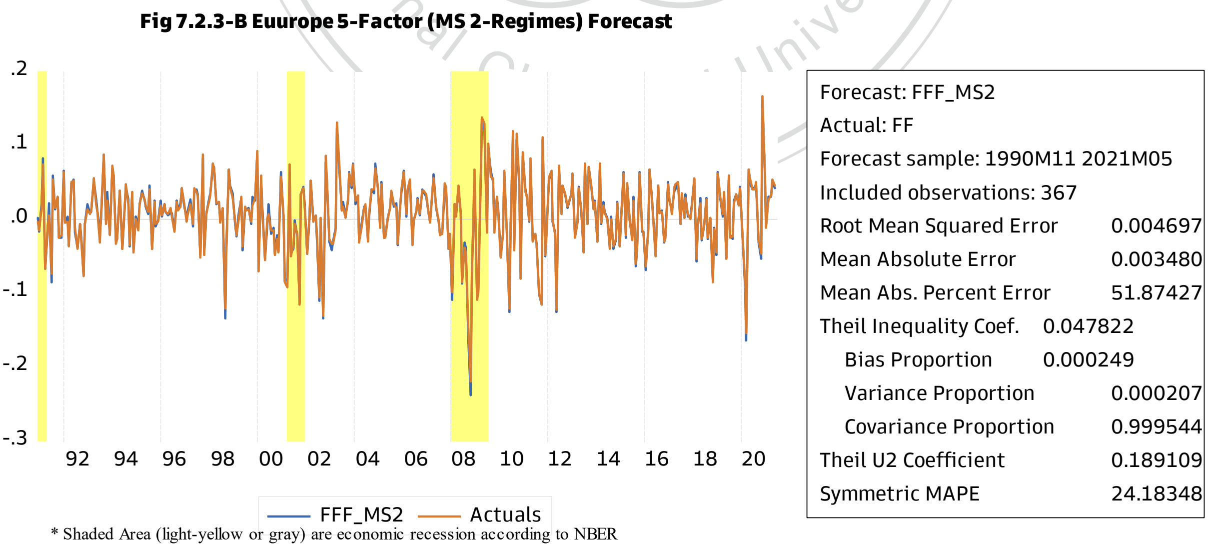

Figure 7.2.3-B Europe 5-Factor (MS-2Regimes) Forecast

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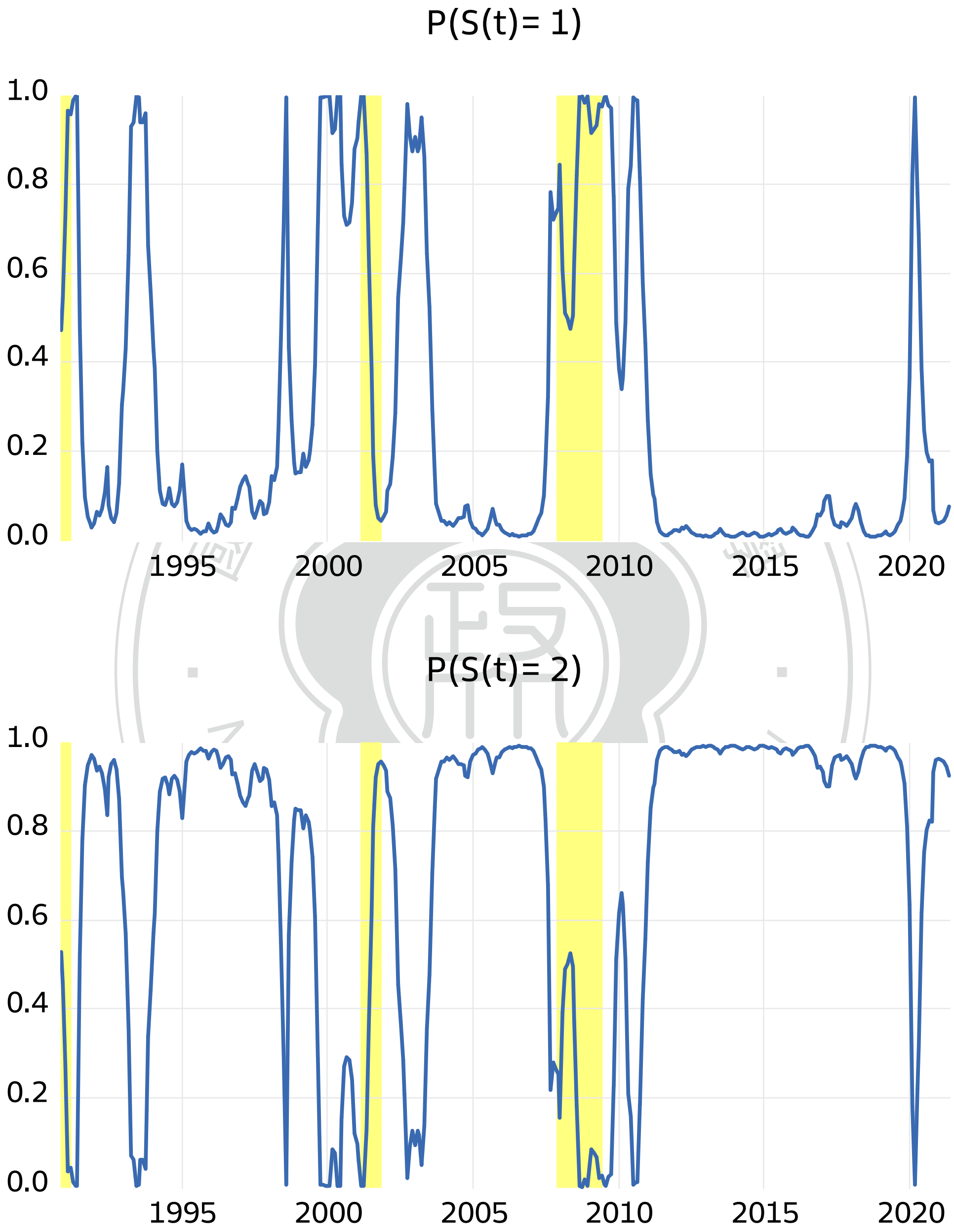
The five-factor model with dynamic MRSR exhibits a lower mean absolute percent error (54.43% versus 51.87%) compared with the actual forecast. This suggests that the MRSR method is superior to the OLS method for the European market.

Fig 7.2.3-C Markov Switching Smoothed Regime Probabilities



* Shaded area (light yellow/Gray) are economic recession according to NBER

Figure 7.2.3-C Markov Switching Regime Probabilities for Europe, 5-Factor

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Economic recession in Europe mainly occurs during Regime 1, and Regime 1 and Regime 2 exhibit significant differences in means and risk factors (Figure 7.2.3C). The size factor in Regime 2 is considerably higher than that in Regime 1. In the six-factor model, certain risk factors, such as momentum, are only statistically significant under certain regimes.

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7.3 Empirical Testing for RIs in Europe Market

This section tests for statistically significant differences between the three proxies for RI in the European market (namely the MSCI Europe ESG Index, the MSCI Europe SRI Index, and the MSCI Europe Islamic Index) and FFMKT (market proxy used by Fama and French) through the graphical approach, the simple statistical test approach, and the risk factor model (with OLS) approach. Subsequently, MRSR is applied to the risk factor models to identify differences between the intercept and risk factors.

7.3.1 The Graphical Approach

Figure 7.3.1-A presents the proxies for the excess returns of the European stock market using data from October 2007 to May 2021. All four series exhibit a normal-like distribution skewed toward the right with a tail on the left.

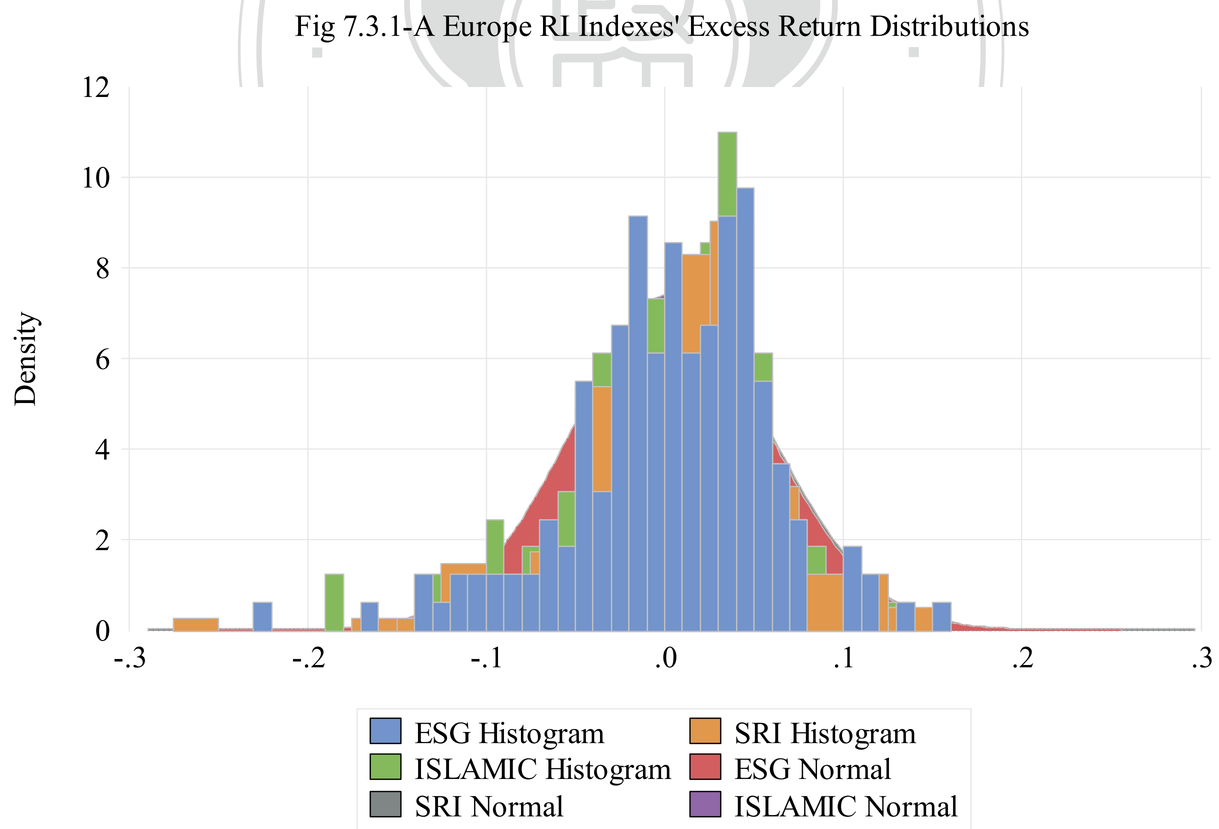

Figure 7.3.1-A Europe RI's excess returns distribution

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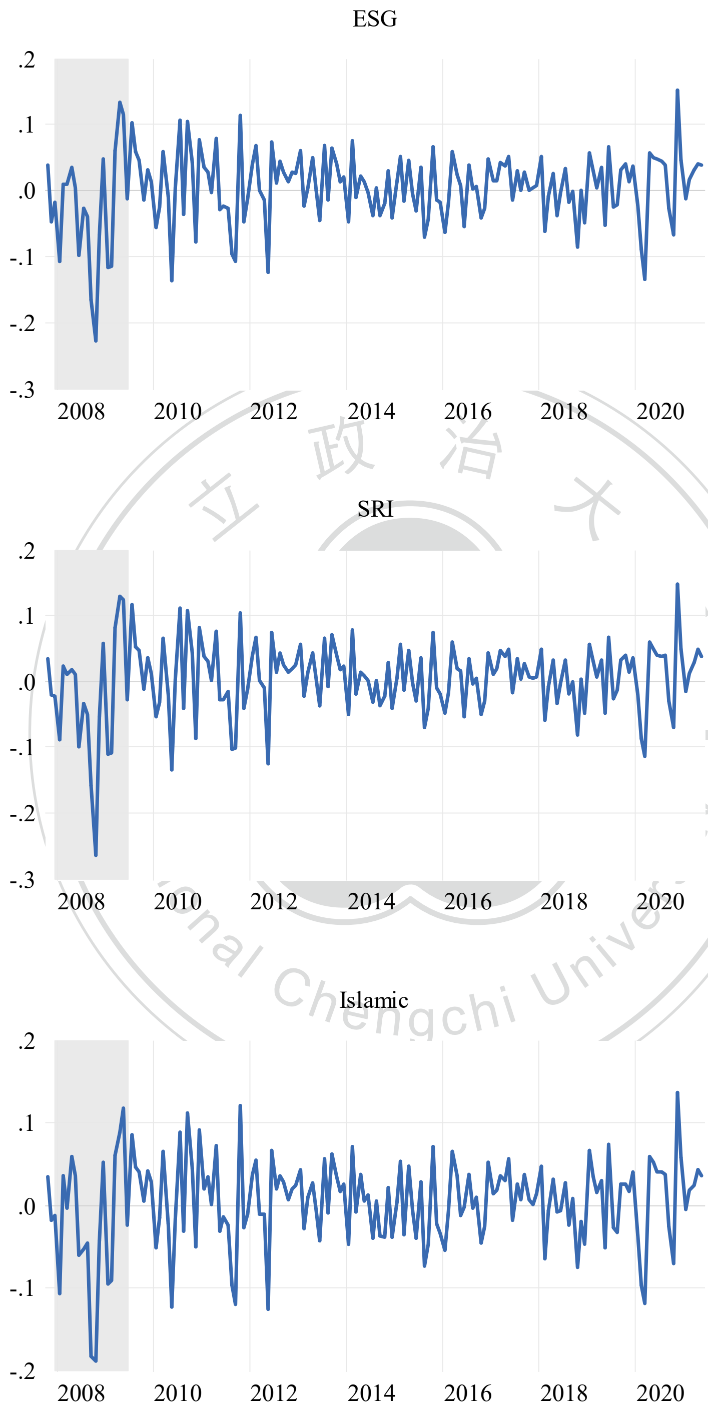
The disparity in excess returns is wider during recessions than during other periods, especially during the 2008 financial crisis, and minor differences among the three RI indexes are noted (Figure 7.3.1B). Therefore, heteroscedasticity should exist in all RI indexes.

Fig 7.3.1-B Excess Returns for Europe's RIs



* Shaded area (light yellow or gray) are economic recession according to NBER

Figure 7.3.1-B Europe RI excess return Time Series

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7.3.2 Simple Hypothesis Testing

Simple hypothesis testing is performed to determine if the RI indexes' mean returns are different from zero. The results indicate that European RI is consistent with the EMH in that the mean returns for the RI indexes are not statistically different from zero. The European market also has no excess returns in the period specified below. However, this contradicts the conventional understanding in the investment community that the stock market rewards premiums.

Table 7.3.2-A Hypothesis Testing if means are different from zero.

Table 7.3.2-A Hypothesis Testing if means are different from zero.

	SRI	ESG	Islamic	MSCI
Data begins	2007.10	2007.10	2007.10	2007.10
Mean	0.003792	0.002665	0.00352	0.022
ρ-value for t-statistic	0.3962	0.5486	0.4030	0.6283

Note: *, **, and *** denotes the rejection of the null hypothesis for 1%, 5%, and 10%, criteria levels, respectively.

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7.3.3 Comparison with Risk Models: OLS vs. MRSR

Table 7.3.3-A 6-Factor model-OLS, using Fama & French as a broad market proxy.

Table 7.3.3-A 6-Factor model-OLS, using Fama & French as a broad market proxy.

	6-Factor, SRI	6-Factor, ESG	6-Factor, ISLAMIC
Data begins	2007.10	2007.10	2007.10
C	-0.0002	-0.0015***	-0.0019**
β_{MKT}	1.0114***	0.9936***	0.9913***
β_{SMB}	-0.1722***	-0.1534***	-0.1589***
β_{HML}	-0.2292***	-0.07488*	-0.1301**
β_{RMW}	-0.1069	0.0026	0.1838**
β_{CMA}	0.0029	-0.0467	0.0944
mom	0.040*	-0.0137	0.0578**
Adj. R^2	0.9775	0.9869	0.9653
S.E.	0.0085	0.0065	0.010
Log. Likelihood	551.775	596.867	526.661

Note: *, **, and *** denotes the rejection of the null hypothesis for 1%, 5%, and 10%, criteria levels, respectively.

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Table 7.3.3-B 6-Factor model with MRSR-2 Regimes, using Fama & French as broad market proxy.

	6-Factor, SRI		6-Factor, ESG		6-Factor, ISLAMIC	
Data begins	2007.10		2007.10		2007.06	
	Regime 1	Regime 2	Regime 1	Regime 2	Regime 1	Regime 2
C	-0.00223	0.0014*	-0.0015*	0.0007	0.0034**	-0.01468
β_{MKT}	1.0666***	0.9633***	0.9999***	0.9756***	1.0209***	0.9925***
β_{SMB}	-0.0843	-0.1739***	-0.1379***	-0.2828***	-0.0585	-0.1626***
β_{HML}	-0.0805	-0.2939***	-0.0744	-0.1674***	-0.1568	-0.1647**
β_{RMW}	-0.0245	-0.0836	0.0038	-0.0436	0.1320	0.1777**
β_{CMA}	-0.1529	0.2569***	-0.1224*	0.2458***	-0.5061***	0.2698***
mom	0.0257	-0.0420	-0.0248	0.03604	-0.0819*	0.0536*
Log(SIGMA)	-4.6300	-5.4649	-5.009	-6.2122	5.7377	-4.6855
Exp. duration	3.6	6.3	2.6	1.3	3.3	16.9
S.E.	0.0083		0.00688		0.0106	
Log. Likelihood	582.918		614.599		540.245	

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Fig 7.3.3-A Markov Switching Filtered Regime Probabilities, 6-Factor SRI Europe

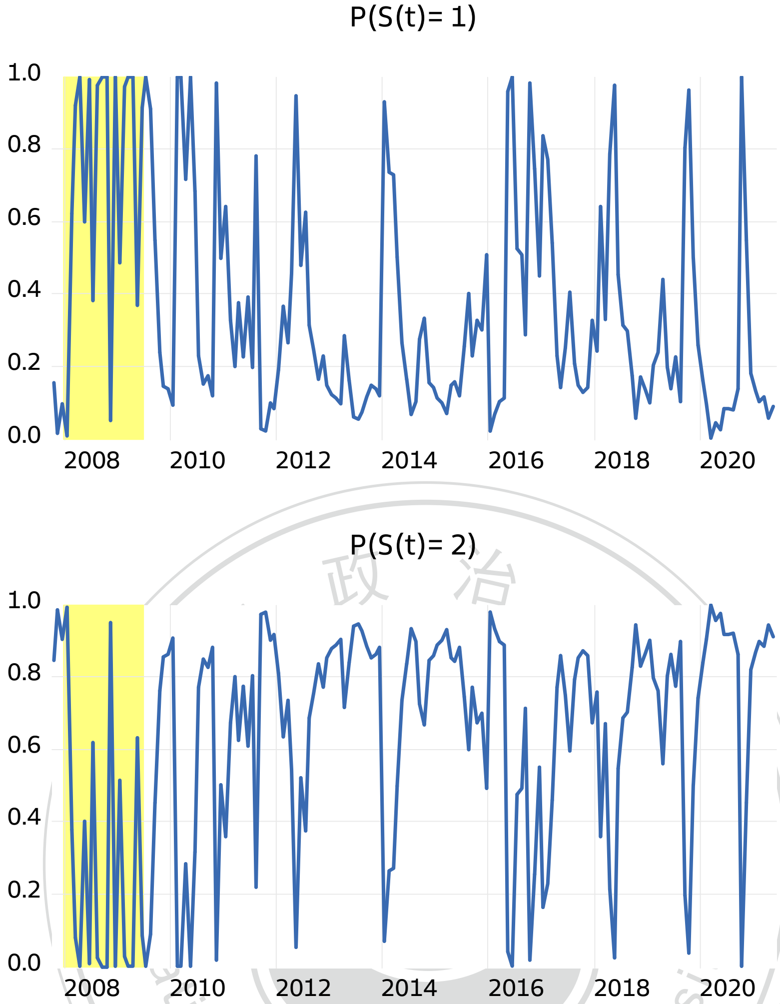

Figure 7.3.3-A Markov Switching Filtered Regime Probabilities, 6-Factor SRI Europe

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Fig 7.3.3- B Markov Switching Smoothed Regime Probabilities, 6-Factor, Islamic

Figure 7.3.3-B Markov Switching Smoothed Regime Probabilities, 6-Factor, Islamic

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Both the ESG and Islamic indexes exhibit significant negative excess return, and only the performance of the SRI Index is similar to that of the broad market in Europe (Table 7.3.3A). When the six-factor is expanded using MRSR, SRI minorly outperforms the market (Regime 2) and occasionally (Regime 1) does not outperform the market. Islamic investment in Europe is not significantly different from the market but occasionally significantly outperforms the market, as does ESG investment in Europe.

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8.0 Conclusions and Implications

This paper explores heteroscedasticity in the global stock market and the benefits of RI for shareholders. Heteroscedasticity in the stock market's mean returns under different market regimes should not be interpreted as a market bubble or a failure of the EMH. Instead, this study should be viewed as an empirical demonstration of investors' overreaction (or underreaction) during a specific market condition. The results indicate that both market excess returns and the risk factor (beta) are regime-dependent worldwide, meaning that both change during the switch between regimes.

The bandwagon effect, a phenomenon whereby investors chase stock prices as the market goes up, has long been a critical concern that contradicts the EMH. In this study, the trend of investors chasing past winners in finance is a proxy for the momentum factor. Mark Carhart, an investment practitioner, was the first to demonstrate the statistical significance of the US market's momentum factor. Shiller (2003) supported this finding with empirical evidence and explained the bandwagon effect from the perspective of behavioral finance. Finally, Shiller (2005) emphasized the role of irrational exuberance, coined by Alan Greenspan in 1996, in the mechanism of market bubbles.

Fama and French's data on the US market have three indicators of the momentum effect: a short-term reversal (1 month), a long-term reversal (5 years), and mid-term momentum (1 year). By using data from November 1971 to the end of December 2019, this study demonstrates that the four-factor OLS model resulted in statistically significant mid-term and long-term momentum. In addition, the six-factor OLS model reveals that only the long-term momentum factor is statistically significant, indicating that investors may learn from past mistakes (i.e., not to chase short-term returns).

However, dynamic MRSR yields contrasting results. The four-factor model indicates that long-term momentum is only statistically significant in a short regime (one that lasts for less than four months). In more extended regimes, short-term and mid-term momentum are statistically significant but with different signs (i.e., mid-term momentum is negative, whereas short-term momentum is positive). Moreover, the expected duration of short regimes is less than four months, whereas long regimes are one year. This implies that investors neglect this fact and chase past winners (stocks) despite the clear and statistically significant impact on excess returns in the US market.

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The findings from the six-factor model expanded with the three-regime dynamic MRSR confirm this notion; long-term momentum has no statistical significance in every regime. The results also indicate that mid-term momentum alternates between negative and positive regimes; this partially explains the bandwagon effect. As the empirical results demonstrate, mid-term momentum is statistically significant in one of the three regimes. Therefore, investors should check for alpha and betas during different regimes to avoid being misled by various market risk factors, particularly the momentum factor.

These results also should encourage caution toward the momentum factor in the Japanese market. The risk factor models with OLS using data from November 1990 to May 2021 indicate that momentum positively affects excess returns. However, the results of the two-regime dynamic MRSR indicate that momentum (1 year) is only statistically significant during one regime. The momentum effect on excess returns is considerably weaker than that generated by the OLS models and dynamic MRSR. For example, in the six-factor model, momentum in Japan has a beta of 0.0326, and momentum in the six-factor dynamic MRSR has a beta of only 0.0182 in Regime 1 and does not have a statistically significant beta in Regime 2.

In European and Asia Pacific (ex. Japan) markets, although the risk factor models with OLS do not indicate a statistically significant momentum factor, this does not imply that the Asia Pacific and European markets are superior to those of the US or Japan. The results of extending the two-regime dynamic MRSR to a six-factor model indicate a momentum reversal in the Asia Pacific market (ex. Japan), whereby the beta of momentum switches from −0.0542 in Regime 1 to 0.0668 in Regime 2; both are statistically significant. The findings for the European market suggest a similar trend.

In a nutshell, the outcomes from the USA, Japan, Europe, and the Asia Pacific hinted that the momentum factor could be a misleading indicator for long-term investment and that investors should exercise caution when chasing past winners in the stock market.

Second, on diminishing the value premium's issue that Fama and French (2020) actively defend, the disappearance of the risk factor premium can be attributed to the risk factor variable losing its statistical significance and becoming negative. The loss of statistical significance for β_{HML} indicates that both value and growth premium is irrelevant to the model. The risk factor variable becoming negative can be interpreted as the growth factor outperforming the value factor; the growth factor has a premium rather than a value premium. The results of the four-factor OLS

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model using data from 1970 to 2019 indicate premium growth in the United States and not in the value premium. The other OLS models suggest no statistically significant results for β_{HML}. The results of the five-factor model with three-regime dynamic MRSR indicate a small yet statistically significant regime switch in which β_{HML} changes from −0.0126 in Regime 1 to 0.0103 in Regime 3. Because the expected durations of Regime 1 and Regime 3 are 1.6 and 1.7 months, respectively (Regime 2 has an expected duration of 4.6 months), and in consideration of the conclusions of Fama and French (2020), investors in the United States may have learned from Fama and French (1993) and do not excessively overreact (or underreact) to the information flow related to the book value of firms in the United States.

The results indicate that the Japanese and European markets exhibit similar trends in βHML to that of the US market in that it is only statistically significant in one regime. However, the results differ for Asia Pacific (ex. Japan). The risk models with OLS indicate a statistically significant positive value premium, and two-regime dynamic MRSR allows the risk models to confirm the presence of a statistically significant and positive βHML in both regimes, with one regime having a lower value than the other. Therefore, the value premium is vital in the Asia Pacific (ex. Japan).

Lins et al. (2017) summarized the academic theory on CSR. This study supplements their findings by using the intangible valuation approach in which MSCI is adopted to evaluate ESG. The investment community has accepted the best-in-class approach as a standard method for portfolio construction in RI and is used by most MSCI indexes related to RI. The approach involves selecting the companies with the highest ESG scores from different sectors. Assessing companies from different sectors is a crucial ESG criterion. For example, ESG researchers in the field of business rely on a detailed understanding of externality in a sector, such as new environmental (or social) standards for carbon emissions, and anticipate the challenge for firms within the industry to internalize the costs.

Lins, Servaes, and Tamayo's (2017) have summarized the most up-to-date academic theory for CSR, and this research would like to supplement with the intangible valuation approach where MSCI adopted in its ESG valuation. The investment community has accepted the "Best-in-Class" approach as the portfolio construction for RIs and is used by most MSCI RI-related indexes. The approach involves selecting the "best" ESG score companies with different sectors; thus, assessing companies within different sectors becomes the key for ESG criteria. Practically, ESG researcher from business field relies on particular

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understanding externality within a sector, new environmental (or social) standard on carbon emission for example and anticipate the costs for those firms within the industry to internalize the challenge.

The findings from other RI proxies have yielded results comparable to those of the KLD for the US market. Most of the risk factor models indicate no statistically significant alpha or negative excess returns despite OLS use. Most of the RI-related indexes can divide data into low-beta and high–excess return regimes, regimes with market-like betas, and regimes with zero alpha, suggesting the benefits of RI in Japan and the Asia Pacific. The results indicate that in Europe, excess returns for RI indexes are negative and statistically significant for both OLS and two-regime dynamic MRSR. This might be because European firms are more invested in ESG than in European companies from other parts of the world.

Based on Lins et al. (2017) and other academic studies, this research proposes that the outperformance of the MSCI KLD may be a United States–specific trend and not applicable to other parts of the world. Firms in the United States have more freedom in determining when to address issues related to ESG and may take actions such as internalizing costs. Therefore, firms with high ESG scores in the US market are more likely than firms that already meet future standards, although firms with low ESG scores would incur additional costs and expenses. However, this is likely not the case for European firms; central regulatory agencies and local governments usually have more active roles in requiring companies to meet specific ESG standards.

This dissertation provides two directions for further research. First, a study can be conducted to refine the technique of diminishing value premiums. This can be achieved by applying dynamic MRSR to the value premium across all sizes of portfolios using Fama and French's data to identify regime probability changes over time and a statistically significant value premium in a certain period. Second, subsequent studies on ESG should perform industry-specific and firm-level comparisons between firms in Europe and those in the United States to determine the time required for firms from different regions to internalize ESG costs.

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